A MODEL FOR AN ENVIRONMENTALLY DIRECTED TEACHING APPROACH

by

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DECLARATION

I declare that *A model for an environmentally directed teaching approach* is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

DEDICATION

In honour of my late father, **Simon Mpatlanyane Lebeloane**, and my mother, **Euodia Nobesuthu Lebeloane** - themselves sources of inspiration.

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Bommeko 'a kobuwe makgotla diala
mabolawa a ipolaela.
Bomaila go tshwarwa ka molala
mafiri makgaola tlhogo matlogela sebelebele se phela.

Ke batho ba ba tshabileng 'hututu ba re ke tau ya ngwaneng.
Ba tshaba, ba tshaba lerole lona ba re ke dira.
Ke bana ba Tlhokotsi a malobitsane a Kgabo a tona.

Ba re re romile monna ra roma khunou,
ra roma sekgobadi sa marumo a tswelela pele.
Ba re ke gona go tla tswa e khunwana
ra re re boditse bosweu ba re ke yona setswa ka 'ngope.

Ba re se teng sediba gare ga thota
ba re monwi 'a sona o nwa maswe,
mokgela huba o a kgela.
Diphala di etla Bakgatla, diphalana di di setse morago.
Madilotsana a kgaka e tona
Kwa 'tsatsi la tlhaba la nthwesa
la nthwesa mmamorapolosa' kgosi.

Asiao, Kgabo!

SUMMARY

The purpose of this study was to develop and test a model which could be used to interpret and assist teaching in an environmentally directed way. Its principal aim was to establish the extent to which elements from a variety of paradigms and teaching methods could be used simultaneously when teaching in an environmentally directed way, depending on the topic and the context within which is taught.

An in-depth literature review on theoretical perspectives on environmental education, paradigms relating to environmental education and teaching methods appropriate for environmental education indicated that these partially addressed the problem of the study, namely to determine how elements from a variety of paradigms and teaching methods could be used simultaneously to teach in an environmentally directed way.

The theory developed from the literature review facilitated the development of the model mentioned above. An amoeba was used as a metaphor to develop a model which can help facilitate the process of teaching in an environmentally directed way. In developing the model, some examples of influential paradigms and teaching methods were used. None of the examples used for the study converged. Each contributed to the research in its own way. Some teaching methods showed common features of conversion and also addressed the problem of the study in

their own ways. The amoeba model was developed from this theory.

Qualitative research was further conducted to test the amoeba model. People who are knowledgeable in environmental education were selected to participate in the research.

It emerged, from the findings of the research, that the amoeba model concurs positively with the hypothesis that no specific paradigm and teaching method(s) could be regarded as exclusively ideal for teaching in an environmentally directed way. Elements from a variety of paradigms and teaching methods could be used simultaneously for teaching in an environmentally directed way, depending on the topic and the context within which a topic is taught. The amoeba model thus serves as a solution to the problem of the study. Respondents further suggested that the amoeba model should be adopted for use in the South African education system. That is, the thesis should be put in the form of a workbook and teachers should be trained to teach in an environmentally directed way by using this model.

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CHAPTER ONE

ORIENTATION

1.1 INTRODUCTION

1.1.1 Environmental crises

a) The global environmental crisis

The world is experiencing environmental crises on a global scale (Huntley, Siegfield & Sunter 1989; Tolba 1992; Salvador, Schmidt & Miller 1993). A day rarely goes by without news of some environmental crisis somewhere around the world, either pending or already upon people (Hopkins 1990-1991:3). These environmental crises include natural and non-natural crises such as polluted air, rivers and water, disappearing species on land and in water, chemical spills, depleted resources and human intrusion into the remaining wilderness frontiers, et cetera (Hopkins 1990-1991:3). Social problems such as those caused by war and urbanisation (Tolba 1992) may be added to these problems. Clarke (1993:54) adds that there is a worrying increase in global environmental changes within the atmosphere, biosphere, geosphere and hydrosphere which are associated with a series of major

ecological crises such as ozone depletion, global warming, rising sea-levels, air pollution, soil erosion, desertification, deforestation, water shortages and toxic wastes.

Various factors such as the cultural, economic, demographic, social, political, technological and other related factors contribute towards the environmental crises in developed and developing countries respectively (Clarke 1993:54). This assertion can be explained through examples of what happened in other countries in the world, as well as in South Africa.

In the Soviet Union, for example, the environmental threats had a negative impact on the people living there when the Chernobyl nuclear power plant disaster of 1986 occurred (Winfrey 1992:46). It released radiation which spread throughout most residential parts of Russia and since then has led to an increase in the incidence of leukaemia and thyroid and kidney disease (Winfrey 1992:46).

Between 1960 and 1990, earthquakes contributed to environmental crises in some parts of the world, killing an estimated 439 000 people and causing, among others, economic losses (Tolba 1992:88). In some of these earthquakes, violent ground motions led to the collapse of some buildings, bridges, tunnels and many other rigid structures. Earthquakes also caused

fires, landslides and floods in some areas (Tolba 1992:88). Other factors such as turmoil in countries also contributed to environmental crises in various parts of the world. According to Timberlake (1988:162) many states in Africa were in turmoil from the early 1970s. Many people were fleeing their homes, some into famine centres, some into cities and many others into neighbouring countries. Many of these people were "environmental refugees" - fleeing land(s) which could no longer feed them, governmental repressions or civil wars (Timberlake 1988:162).

People's misuse of nature and its resources, the use of harmful substances and degradation of nature in many parts of the world are evident in the industrial use of forests and the expansion of pasture or agrarian areas with the repercussions of erosion and desertification (Schleicher 1989:258). The above interventions and misuse of nature often yield unexpected, tragic economic and social consequences (Schleicher 1989:258). After years of spraying pesticides to kill insects, for example, it was discovered that people came close to wiping out the bald eagle, peregrine falcon and other birds in the USA. Concentrated through the food chain, pesticides accumulate in the bird's body tissues, resulting in a myriad reproductive and other problems (Schleicher 1989:258). Further evidence of the degradation of nature and resources through harmful substances is to be found in the piling up of hazardous wastes (poisonous substances) which are stored

universally, especially in industrial countries in ways which threaten the environment (Woischnik 1993:5).

Deforestation, which is the elimination of billions of acres of trees (Woishnik 1993:6) to clear the land for agricultural purposes, human settlement, freshwater pollution such as contamination of rivers and lakes by municipal sewerage, some members of society and industrial processes that release oil, chemicals and other hazardous wastes, also add to environmental problems (Woischnik 1993:5). These environmental problems also contribute to people's ill-health which is worsened by more than 25 000 harmful chemical substances used universally (Woischnik 1993:5). To make matters worse, environmental crises are likely to escalate, since the population figure may reach 2,5 billion by the middle of the next century (Schleicher 1989:258).

b) Environmental crises in South Africa

South Africa, like the rest of the world, is also experiencing environmental crises. Environmentalists in South Africa have, since the 1960s, concentrated primarily on the non-urban natural and physical environment, marginalising the cultural, economic, ethical, social and urban environments (Baskin 1991:22).

In South Africa, for example, millions of urban people do not have shelter. Some have no choice but to use polluted water for cooking and drinking purposes. Many are unemployed (Baskin 1991:22). In many cities around South Africa, traffic-related pollution does not only contaminate the air people breathe but also damages the buildings and plant life (Baskin 1991:24). The dependence on certain types of fuels such as coal and paraffin for cooking, heating and lighting, further exacerbates air pollution, especially in informal settlement areas (Baskin 1991:24).

Environmental crises are further worsened by the fact that South Africa's facilities for disposing of waste are not developing fast enough to deal with the increasing amount of new and more dangerous wastes being produced, especially in some industrial areas and institutions (Coetzee 1991:11). Along the Elsburgspruit in Germiston, Gauteng, for example, an unknown company was reported to be dumping toxic wastes on the river banks (Coetzee 1991:11). On the East Rand, both Earthlife (a concerned environmental group of people) and the Katlehong Civic Association found contaminated sweets dumped by a Wadeville company in an unused site on the East Rand, Gauteng (Coetzee 1991:11). They further found used bandages, syringes, medical drips and needles from a local hospital illegally dumped on the aforementioned site (Coetzee 1991:11).

The Pietermaritzburg Earthlife branch also uncovered a toxic waste dump in an area on the outskirts of the town. The local people were taking the toxic waste containers from that area and using these for collecting drinking water. In each of the above cases, no one was prosecuted, let alone traced (Coetzee 1991:11). These examples of environmental problems in South Africa explicitly show that focus has for a long time been on the non-urban natural and physical environment only and not on the economic, social and urban environment.

Despite all efforts to improve the problems manifesting in the non-urban natural and physical environment, environmental crises have intensified in these very areas (Baskin 1991:22). Soil erosion, for example, has been one of the major problems in these environments for some time, because many farmers "mined" the land in order to discover minerals such as diamond and gold instead of only ploughing and/or farming on the land (Hurry s.a:4). Due to this resource mismanagement, some 12 million hectares of marginal grassland were transformed into a false karoo (a place in which small patches of grass but very few trees grow because of lack of rain, especially during dry seasons). The latter (false karoo) further deteriorated, due to overstocking - especially in the wool boom years of the 1950s. Efforts at Parliamentary level to conserve the soil through legislation

bore little or no fruit, due to the disrespect for the latter by members of society (Hurry s.a:4). In 1966, the Veld Reclamation Scheme was introduced in an effort to reduce livestock and overgrazing in some of the areas referred to. By 1969, most farmers had not responded to the scheme, probably because they had not understood the problem (Hurry s.a:4).

During the 1980s, some alien and indigenous invasive plants further added to the existing environmental crisis in South Africa. These invasive plants included plants such as the jointed cactus - a spiny cactus which often injures the feet and mouth of sheep and goats, the woody acacias, pines, and hakeas of the south-western and south-eastern Cape Province, which collectively spread rapidly through both the lowland and mountain fynbos areas, shading out many sensitive erica, protea, gladiolus and similar species. These invasive plants thus threatened to invade and outgrow South Africa's wildflowers (Huntley, Siegfried & Sunter 1989:36).

The examples of environmental crises in South Africa cited above, clearly indicate that not much success was achieved to combat the environmental crises in the natural, non-natural, urban and non-urban environments respectively. In addition to warnings issued by the authorities on environmental crises, efforts were made to make South Africans aware of these crises and to educate them by instilling in them knowledge, skills and a sense of responsibility towards the environment. However, these efforts

did not reach many people at that stage, especially those in the formal education system. Only some people outside the formal education system became involved (Van Wijk 1995:11). Yet, many people perceive the solution of environmental problems as lying in environmental education in formal education (South Africa. Reconstruction and Development Programme 1994:40; South Africa. White Paper on Education and Training 1995:18).

c) Efforts to introduce environmental education in formal education

In 1991, discussions between the Department of Environmental Affairs and Tourism (DEA&T) and various education departments indicated that few departments had formally incorporated environmental education into their school curricula (Van Wijk 1995:10). The DEA&T initiated a project that would fulfil a need for a formally worked out environmental education policy in formal education.

Consultations were engaged in with bodies such as the Environmental Education Association of Southern Africa (EEASA), a broadly representative body of environmental educationists, non-governmental organisations (NGOs), colleges, schools, universities, environmental conservation departments, nature conservationists, private agencies and individuals.

These consultations led to the formation of a committee which later produced a document representing central issues and principles in environmental education, as well as their implications in formal education. The initiative came to be known as the Environmental Education Policy Initiative (EEPI). One of its primary tasks was to promote policy change and develop a policy options document which would stipulate what should be incorporated into the Department of National Education's new policy with regard to environmental education.

This effort proved successful because after the new government had come into power, the Department of National Education developed and released a policy document on 15 March 1995 (South Africa. White Paper on Education and Training 1995:18) which incorporated environmental education. Environmental education was now accepted as a necessary part of the formal education at all levels in formal schools as well as at colleges of education.

However, the problem has not yet been overcome. Environmental education is accepted on paper (South Africa. White Paper on Education and Training 1995) but still has to be implemented in practice. The Environmental Education Curriculum Initiative (EECI) is currently investigating the various

possibilities of implementing environmental education in formal education. The National Department of Education has indicated that the general curriculum has to start in 1998 (South Africa. National Department of Education 1997:1; 14). The environment has been accepted as one of the phase organisers. The process of implementing the environment as one of the phase organisers has not been completed. Meetings are still going on wherein it is being planned on how that process is going to be implemented. While that is the position, very few teachers have been educated about environmental education (as will be indicated later in this study). What this will necessitate is that many teachers will have to be educated to use this "new" approach by, among others, indicating which teaching methods may be necessary. This study will attempt to address the issue and to show which paradigm influences teaching about, in and for the environment.

1.1.2 The need to teach in an environmentally directed way

It was shown in the introduction that the world is threatened by environmental crises. Therefore, learners in formal and non-formal education need to acquire an awareness and knowledge about these crises in order to take action against environmental problems. Kastenholz and Edmann (1992:181) supported this need by stating that most of today's

environmental crises deal with highly complex phenomena found at global and local levels, and that it is increasingly necessary to achieve global change of attitudes towards the environment, by thinking globally and acting locally. In order to develop and consolidate such a change so that it has long-term effects, there is a need for environmental education at all levels of education (Kastenholz & Edmann 1992:181).

Leketi (1992), adding to this, declares that teaching about and for the environment can act as a vehicle for the development of environmental **awareness** and **consciousness**. He further maintains that it is necessary to follow an environmental approach in teaching about and for the environment in formal schools, because it may develop learners into critical thinkers, social inquirers and problem-solvers. It may further develop them into active participants in environmental, political or even educational decision-making processes (Leketi 1992:8).

By teaching in an environmentally directed way, teachers may also

- facilitate new patterns of behaviour in learners which include personal lifestyles and informed social actions in order to harmonise with the environment; and
- show the links between elements of the biophysical and socio-

political environment and awareness of and concern for the total health of the planet and its people (Council for Environmental Education 1993:6).

From the above discussion it is obvious that if teaching occurs in an environmentally directed way, acquisition of environmental **knowledge** and **awareness** may be developed in learners. Learners may further be in a position to **acquire skills** which could enable them to take action against environmental problems and **value** them by exercising **responsibility** through adopting new patterns of behaviour, lifestyle and social action towards the environment.

The term teaching in an environmentally directed way, in the context of the study, therefore refers to a process of teaching knowledge, skills and helping to change values during which the teacher uses, and refers to, the environment as one of her or his primary focal points.

1.2 FACTORS LEADING TO THE PROBLEM AND PROBLEM FORMULATION

1.2.1 Factors leading to the problem

A number of factors have led to the main problem of the study as described

in paragraph 1.2.2.

a) Initial lack of environmental education in the curriculum of formal education in South Africa

In general, environmental education was not catered for in the curricula of the different education departments during the apartheid government in South Africa. However, a few institutions of learning attempted to introduce the teaching of environmental education in the past. Examples of institutions of learning where environmental education was taught in the past include

- some schools such as Treverton preparatory school in Natal (Richards 1982:2) and some schools in the former Bophuthatswana (Irwin 1992:16); and
- some tertiary institutions such as a few colleges of education and a few universities such as the University of North West (former University of Bophuthatswana) in the former homeland of Bophuthatswana, Rhodes University (Irwin 1992:16-17) and the University of Cape Town (Clacherty 1988:1). Other tertiary institutions such as the University of Stellenbosch, University of South Africa, Rand Afrikaans University and Potchefstroom University have recently joined the list of the pioneer institutions

mentioned above.

b) Lack of qualified teachers in environmental education

Because so few institutions of learning did offer environmental education in the past (refer to the preceding paragraph 1.2.1.a), not many teachers were qualified in environmental education. Problems of underqualfied teachers were aggrevated by

- the lack of training programmes for teachers in environmental education (Ballantyne & Oelofse 1989:7-12; Loubser 1991: 19; Braus 1995:46);
- the fact that many teachers did not have any background and experience to teach environmental education, let alone teach this approach (Blignaut 1992:254); and
- the inherent conservatism of many school teachers (Irwin 1992:20) and their resitance to change (Schreuder 1995:2). Many teachers were worried about interrupting the fixed school timetable because that could cause their learners to fail in their examinations.

c) Ineffective teaching methods and materials (resources)

The rote-learning methods of teaching which were emphasised in the past,

also contributed to the problem because they were directed by the compartmentalised school subjects, which never, in any way, overtly catered for environmental education (South Africa. National Department of Education 1997:6). The rote-learning methods of teaching were to some extend influenced by textbooks which were of poor quality, not reader-friendly and rigidly adhered to the prescriptions set out in the syllabus. Teachers felt safer when working in prescribed ways as they could not be held responsible if anything went wrong.

d) An emphasis on environmental awareness

In contrast to many countries, such as the Federal Republic of Germany (Lob 1989:90), USA (Engleson & Yockers 1994:40), England (Palmer & Neal 1994:26) and the Netherlands (Woischnik 1993:60), where environmental education was promoted through movements and actions taken in schools, the focus in South Africa was, for a long time, on environmental awareness only - not environmental education (Irwin 1992:15). The public was made aware of environmental problems through the various media such as television and newspapers, and some school subjects such as Biology and Geography included topics about the environment, such as ecology and population dynamics, in their syllabi. However, general environmental education was not part of these syllabi. Bodies such as the Wilderness Leadership School and the then Wildlife Society of Southern Africa also

played a prominent role in environmental awareness (Irwin 1992:16). However, environmental education as an approach through which the environment can benefit by teaching for the environment did not really receive enough attention in formal education in the past.

e) A slow growing interest in environmental education

South Africa started showing an interest in environmental education in the modern and international sense in the early 1970s (Irwin 1992:16). More people who were interested in environmental education were gradually becoming more concerned about better teaching and more effective learning about the environment. The first international conference on environmental education in South Africa was held in 1982 at the Treverton College in Mooi River, KwaZulu-Natal (Irwin 1992:16). That conference saw the formation of the Environmental Education Association of South Africa (EEASA) which, together with other non-governmental organisations, some state agencies and individuals, have since developed and coordinated environmental education (Irwin 1992:16).

More people, such as formal educators, some people in the private sector who are interested in environmental education and independent bodies became interested and played pioneering roles in the development and operationàlisation of environmental education in South Africa (Irwin

1992:17). This led to the formation of environmental centres by concerned individuals and movements, such as the Wildlife Society's Umgeni Valley project in Natal (which was established in 1973), the National Environmental Awareness Council (NEAC) in Soweto (which was established in 1974) (Irwin 1992:17), the South African Nature Conservation Centre (SANCC) which has since changed its name to Delta Environmental Centre in Victory Park, Johannesburg (which was formed in 1978), the Environmental Education Policy Initiative (EEPI) movement (EEPI 1994:1), Environmental Education Curriculum Initiative (EECI) and many others.

Most of these movements have recently started taking action on environmental issues. Some of the institutions, such as the Wildlife Society's Umgeni Valley Project, which were previously only concerned with environmental awareness, also changed their focus. Yet, environmental education did not find an official niche in the education system. Consequently, not many teachers were exposed to and learned environmental education.

f) Confusing paradigms in environmental education

Different views are held on environmental education (O'Donoghue & Ashwell 1994; Janse van Rensburg 1995; Schulze 1991-92). These different views probably emanate from different paradigms - some of which

discussed in chapter 3. Because environmental education is d and interpreted from different points of departure (paradigms), these will probably influence teaching methods, that is, the way in which teaching is facilitated. For this reason, both paradigms and teaching methods and their relationship need to be researched.

The above-mentioned factors have led to the main problem of the study, which is stated in the next paragraph.

1.2.2. The main problem

In the past, environmental education was neither taught as a separate learning area nor as an approach in the general curriculum of the South African education system (see paragraph 1.2.1). Consequently, many teachers in formal education in South Africa lack knowledge about

(1) paradigms through which environmental education is taught; and

(2) ideas about the appropriate teaching method(s) which can be used to teach in an environmentally directed way (also see paragraph 1.2.1).

This lack of knowledge contradicts the aims with the statement in section 20 of the White Paper on Education and Training (1995:18):

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.

Because there is growing interest in environmental education (see paragraphs 1.1.1 and 1.1.2) and environmental education is included in the White Paper on Education and Training (1995:18) - as part of formal education - while it is not formally provided for in the majority of South African schools and tertiary institutions as yet (see paragraph 1.1.1), this process also constitutes to the main problem of the stdy.

The main problem of the study is to determine how elements from a variety of paradigms and teaching method(s) can be used by teachers and environmental educators simultaneously for teaching in an environmentally directed way.

1.3 HYPOTHESIS

No specific paradigm and teaching method(s) can be regarded exclusively ideal for teaching in an environmentally directed way, that is, elements from

a variety of paradigms influence teaching in an environmentally directed way and a variety of teaching methods could be used simultaneously for teaching in this way, depending on the topic and the context within which a topic is taught.

1.4 AIM OF THE STUDY

The main aim of the study is to establish to what extent elements from a variety of paradigms influence teaching in an environmentally directed way and a variety of teaching methods could be used simultaneously to teach in this way, depending on the topic of the lesson and the context within which a topic is taught. In order to do that, relevant literature will be used to develop an appropriate model for teaching in an environmentally directed way.

1.5 RESEARCH METHOD

While research is defined differently in many sources (Mouly 1978:53; Hopkins 1980:25; Gay 1990:549; Aray, Jacobs & Razavieh 1990:23) it is defined in this study as a well-structured and exploratory study which uses systematic means (methods) to solve an identified issue which warrants inquiry, and to recommend new ideas. This study is exploratory because it is aimed at establishing how a variety of paradigms and teaching methods

sed to teach in an environmentally directed way, depending on f the lesson and the context within which a topic is taught.

On the basis of the above outline, this study will be concerned with a collection of data because it is aimed at

- gaining holistic insight into the questions "how" and "why" rather than "who", "what" and "where" only (Thomas 1989-1990:4) regarding the relationship between paradigms, teaching methods and environmental education;
- responding to the questions "how" and "why" by describing those methods of teaching which would be most appropriate for teaching in an environmentally directed way in a given place and at a given time (Van Maanen, Dabbs & Faulkner 1982:16); and
- focusing on the essential character(s) of the paradigms and teaching methods referred to in the preceding assertions because these may facilitate the acquisition of knowledge and help to indicate priorities for future research in environmental education.

The study will also be descriptive (Loubser 1991:9) because it draws on

- literature on environmental education (theoretical perspectives of environmental education) in chapter 2; and
- literature on paradigms and teaching methods in chapters 3 and 4

respectively.

Lastly, qualitative research will be conducted in this study to

- evaluate the acceptance and feasibility of the model and
- gain reactions of how this model might operate in practise

A description of the exact programme of the study follows.

1.6 PROGRAMME OF THE STUDY

Chapter 2 will focus on the theoretical perspectives in environmental education. Reference will be made to the analysis, definition, nature, aims, goals and objectives of environmental education and how they address the problem of the study - teaching in an environmentally directed way.

Paradigms relating to environmental education will be discussed in chapter 3. The way in which this description of the paradigms address the problem of the study will also be discussed.

Chapter 4 will be a discussion of the role of teaching methods appropriate for environmental education. In this chapter, the focus will firstly be on didactics and subsequently on teaching methods. These will be identified,

classified and described in terms of implications for environmental education and how they address the problem of the study.

The structure of a model for teaching in an environmentally directed way will be described and discussed in chapter 5. That discussion will be followed by a report of qualitative research conducted on the developed model in chapter 6. A summary and recommendations of the entire study regarding the model will be made in chapter 7. The hypothesis will also be tested in chapter 7.

CHAPTER TWO

THEORETICAL PERSPECTIVES ON ENVIRONMENTAL EDUCATION

2.1 INTRODUCTION

Theoretical debates on certain concepts in environmental education are common in literature. Various issues and concepts such as a definition of environmental education (Disinger 1983), appropriate aims and objectives of environmental education and environmental values are contentious issues in environmental education about which researchers often do not agree. On the other hand, a sound knowledge of the theoretical perspectives of environmental education is necessary for any person who wishes to teach in an environmentally directed way. A lack of a formal environmental education curriculum in an educational system, and a lack of knowledge and understanding of environmental education by many people thus preclude the possibility for any of them to teach in an environmentally directed way. While that is the position, environmental education is gaining popularity in South Africa (refer to chapter 1) but is also hampered by other factors such as those mentioned earlier in this paragraph, as well as by the incorrect understanding that people have of the concept of *environmental education,* and a lack of agreement about its place in the formal school curriculum.

This chapter will endeavour to clarify certain concepts and define their meaning in the context of this study, but will also attempt to place environmental education into the context of educational theory. It will describe some of the theoretical perspectives on environmental education by highlighting the contributions of various authors, educationists and environmentalists with a view to applying some of the insights in subsequent chapters and the development of the interpreted model. In describing some theoretical perspectives, that is, the nature of environmental education, the analysis and definition as well as its aims and objectives, it will also be pointed out whether they address the problem of the study (refer to chapter 1) - how to teach in an environmentally directed way and if that is the case, how they address it.

Since the ultimate aim of this study is to design a model (refer to chapter 5) to clarify the theory underlying the usage of teaching methods and paradigms that direct teaching in an environmentally directed way, it is believed at this stage in the research that differences in positions about the theory of environmental education are the result of support given to different paradigms (refer to chapter 3), and that this leads to environmental educators using different teaching methods or even ignoring the use of certain teaching methods.

2.2 THE NATURE OF ENVIRONMENTAL EDUCATION

Many authors believe that every field of study, for example, natural and social

sciences, has its own nature (Papenfus 1977:59-61; Degenaar 1985:25). Degenaar (1985:25) also maintains that the content of a field of study is linked to its nature. The question now arises whether environmental education should be regarded as a field of study or whether it should be considered an approach to learning.

Although the view is held that environmental education could be a separate subject (Joubert & Steenkamp 1995:43), there appears to be wide support for the view that environmental education is not an independent field of study. That implies that it should rather be regarded as an interdisciplinary approach which, one could add, should be integrated into other school subjects or fields of study (Wolsk 1977:56; South Africa. White Paper on Environmental Education 1989:6; Joubert & Steenkamp 1995:43). Okot-Uma and Wereko-Brobby (1985:4) also maintain that environmental education in its formal pedagogical sense implies an integrated approach cutting across the traditional subject areas in order to enhance in the learner an awareness and understanding of and concern for the environment and its associated problems. This could be achieved through disseminating information through human activities. This means that the content of and skills developed through environmental education should be merged into existing school subjects or courses in such a manner that they are compatible with the nature of the school subject(s) or courses and do not dominate their content or jeopardise the integrity of the courses themselves (UNESCO 1989:57).

The point of departure of this thesis is also that environmental education

(1) should not be regarded as a separate school subject or viewed as an add-on to other school subjects as proposed by some authors (Joubert & Steenkamp 1995:43); and

(2) is an approach which emphasises learning through direct experience, leading to knowledge acquisition, development of skills and understanding of how to care for the whole environment and all those who share it (Scottish Environmental Education Council 1993:52).

This point of departure is developed and presented in chapter 5.

A survey of literature on environmental education indicates that environmental education has its roots way back during the era of Comenius, Rousseau, Pestalozzi and Froebel (Disinger 1983:3). The focus was then placed on outdoor education; not on environmental education. Interest in environmental education and the need for an educational approach to the environment gained momentum in the 1940s. This interest waned in the 1950s because of the demographic changes that had taken place in many countries of the world (Disinger 1983:3). In the 1960s, interest in environmental education was revived. By 1969, sufficient interest in environmental education had been aroused to occasion the development of definitional statements in environmental education (Disinger 1983:3; UNESCO 1985:1).

The global concern about environmental education got under way at the 1972 United Nations Conference on the Human Environment in Stockholm. Recommendation 96 of that conference called for the development of environmental education programmes as one of the most critical elements of an all-out attack on the world's environmental crisis (Disinger 1983:6; Engleson & Yockers 1994:10). That contributed, among others, to promoting interest in the nature of environmental education, the production of printed educational materials and the development of facilitating strategies for implementing environmental education in the formal and non-formal educational systems (UNESCO 1985:1).

Blignaut (1991:2) concurs with these views from the literature and adds that internationally, perceptions of and interest in environmental education have changed and expanded over the past few decades. This was due to sustained global inputs. In 1975, for example, the United Nations Environmental Education Programme (UNEEP) was launched by the United Nations Educational, Scientific and Cultural Organization (UNESCO) at its Belgrade workshop. This workshop led to the adoption of the Belgrade Charter which outlines the aims, objectives and principles of environmental education, some of which will be discussed in paragraph 2.4, whilst others will be discussed in some sections of chapter 3. The Tiblisi Declaration of 1977 emanated from and followed the Belgrade Charter and provided a rationale, goals, objective categories and twelve principles for environmental education programmes (Disinger 1983:7; Blignaut 1991:2).

In June 1992, the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro, Brazil (Engleson & Yockers 1994:10). By consensus, the conference adopted Agenda 21, an 800-page action plan document on the global environment for the twenty-first century. This document contains the following recommendations:

- Reorientating education towards sustainable development
- Striving to achieve increased public awareness in environmental education
- Integrating environmental education in all educational programs (Engleson & Yockers 1994:10)

In the course of time, other global inputs, especially from third world countries, contributed to a better understanding of the nature of environmental education. The following are examples of viewpoints often expressed, as summarised by Blignaut (1991:2):

(1) Environmental education is regarded as an integrated lifelong process which should occur at all levels of education, that is, from the pre-school years to adulthood, through formal and non-formal education.

(2) It is a process of education which occurs through dialogue, reflection and interaction in natural, man-made (rural and urban) and social environment. It should lead to the understanding of, for example

- human interactions with a country's political processes;
- the nature of socio-economic and scientific issues;
- social processes of change; and
- the effect of all these on environmental degradation or enhancement.

3) It encourages the development of attitudes and value systems which may lead to a sustainable quality of life for all (through positive social interactions and the maintenance and improvement of natural and built environments).

(4) It wishes to develop an individual's critical thinking skills, as well as creative, communicative, aesthetic, practical and other skills which may contribute to active environmental problem-solving.

(5) It provides opportunities to develop feelings of empowerment, empathy and belonging to the environment, which are necessary for a positive behaviour towards the biophysical and social environment in everyday life. It also provides for active participation in group efforts to find optimal solutions to environmental problems.

(6) It requires a holistic, integrated, participatory or interdisciplinary approach to teaching with opportunities for diverse learning experiences and particular emphasis on direct experiential learning in natural, built and social environments.

From the preceding examples it could be noted that environmental education as

an approach should not only be infused into different fields of study and school subjects, but may also facilitate improved lifelong learning processes. In the context of this study, environmental education will be considered an approach through which all human beings, especially in formal education, could acquire more knowledge of and skills in caring for the biosphere and all its living and non-living components, valuing it and working towards its maintenance and development.

Having discussed the nature of environmental education and having considered it as an approach, it is also important to understand the concept *environmental education* better by analysing and defining it.

2.3 ANALYSIS AND DEFINITION OF THE CONCEPT *ENVIRONMENTAL EDUCATION*

The concept *environmental education* will be analysed, after which it will be defined. This analysis will be made to facilitate the development of the definition of environmental education for the study.

The concept *environmental education* entails two basic terms, namely environment and education. These two concepts will be analysed separately in the subsequent paragraphs.

2.3.1 The concept *environment*

Many authors perceive and analyse the concept *environment* from a specific point of view. Examples of these definitions include the following:

The Verklarende Afrikaanse Woordeboek (Kritzinger, Labuschagne & Pienaar 1965: 749) as quoted by Loubser (1991:19) uses four other words to explain the word *environment,* namely "kring" (circle or area in which people communicate); "milieu" (background, area where something is happening); "nabyheid" (proximity, neighbourhood) and "streek" (region, area or zone).

In the Concise Oxford Dictionary (1983:323) the word *environment* is described as "surrounding; surrounding object(s), region or conditions, especially circumstances of life of a person or society". The Collins Dictionary of the English Language (1979:489) describes environment as "surroundings especially those in which people, plants or animals live which tend to influence their development or behaviour".

The more technical literature elaborates on the above explanations. According to UNESCO (1985:7) *environment* is considered to be "the world around people" or "that sector of the outside world which has a direct impact on man". Included in the meaning are the biophysical natural and the person-made physical environment, as well as the aesthetic, cultural, economic, political, social and

technological environments. It is also an aggregate of external (biological, cultural, physical and social) conditions that influence life on this planet. *Environment* is perceived as a dynamic system in which the sub-systems are in constant interaction with each other and undergoing continuous change.

According to Baskin (1991:22), *environment* does not only refer to nature (nature conservation) but to society and economy as well. *Environment* is any space where people live, work or play, whether it is a river bank or a patch of concrete. In the Dictionary of Environmental Science and Technology (1992:137) the word *environment* is defined as referring to all surroundings of an organism, including aspects such as the climate and soil. The environment is thus as much a matter of economic policy and social process as it is a matter of natural systems and resources (EEPI 1994:1).

Although the meaning of the concept *environment* will be described comprehensively in the subsequent section when the concept *environmental education* is defined, it is imperative to note that, for the purposes of this study, the concept *environment* is used, not in the narrow sense of the natural environment only, but to refer to the universe with all its components - the natural and non-natural (person-made), biotic (live) as well as the abiotic (non-living) components.

2.3.2 The concept *education*

The concept *education* has often been used in the social sciences and may be interpreted in many different ways. Two main views of education, namely the conservative view and the liberal view, will be described here. This description will be followed by an explanation of what education means in this study.

2.3.2.1 A conservative view of *education*

Some conservative views limit the use of the term *education* to an adult-child relationship. Some South African educators, for example, refer to education as the intervention of an educator (who is normally an adult) in the life of a child to guide him or her on the way to adulthood (Van Rensburg, Kilian & Landman 1981:257). It is the conscious, purposive intervention of an adult with a not-yet-adult to lead him or her to spiritual independence (Van Rensburg et al. 1981:257). Kemmis, Cole and Suggett (1983:9) define education as a personal value rather than an instrumental means to a vocational end because it must develop a sense of the good, true and beautiful in every child, and it can do this by recognising virtues in children and enhancing them through creative and engaging tasks. They therefore take an individualist perspective on social philosophy and view the development of autonomous persons as its aim.

Still on the conservative view of the term education, Fraser, Loubser and Van Rooy (1993:210) describe education as "the activity engaged in when an adult who has superior knowledge and insight purposefully teaches a child, adolescent or adult who has inferior knowledge and insight in order to help him or her to become intellectually independent and socially responsible (i.e. a mature adult)". In this definition education is not only confined to an adult-child relationship but could also refer to an adult-adult relationship. While this is the position, Lofberg (1994:2) also notes that education has been defined in a conservative way as (the ideal process of) promoting learning by passing on information to learners or by transmitting knowledge as a basic concept to learners in settings specifically designed for that purpose.

2.3.2.2 A liberal view of education

Contrary to the conservative definition of education, the liberal view regards education as the ideal process of enhancing the possibilities for knowledge to be built or constructed rather than for knowledge to be transmitted to learners (Lofberg 1994:2). Martin (1993:23) describes education as a process which empowers people and gives them insight to explore, participate in and understand their environment and to decide about the way they should relate to and use their environment.

Education may be defined as an intentional process that teaches people in a respectful manner so that they can change in a worthwhile way. It further changes the way in which people think (Natal College of Education 1994:10). Education is a deliberate process by which learners are helped and guided to make the most of their abilities, to understand what is happening in the world around them, and to make sensible choices, so that they can lead meaningful, worthwhile lives (Lofberg 1994:12).

For the purposes of this study, education may be defined as a facilitating process on account of which learners are empowered to construct their own knowledge and develop their own potential through discovering, exploring, interpreting and understanding information. An issue which needs to be addressed now is how this view of education is actualised in environmental education.

2.3.3 Definitions of environmental education

In this section, definitions of environmental education by various authors, educationists and environmentalists will be presented and interpreted in two broad categories, namely environmental education as a process and environmental education as a holistic and interdisciplinary approach. These will be followed by a working definition derived from these views, which will be used in this study.

2.3.3.1 Environmental education as a process

Although various authors such as Hurry (1980) and Irwin (1992) perceive and interpret environmental education differently, they concur with the following definition of the International Union for the Conservation of Nature (IUCN):

> *Environmental education is a process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among people, their cultures, and their biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of code of behaviour about issues concerning environmental quality (IUCN 1971:2).*

This definition and other international definitions also accept the notion of environmental education as a process which

- involves both training and education that enable people to solve local and global environmental problems (such as health problems, sanitation, pollution and soil erosion);
- encourages people to be more environmentally responsible (in the context of the areas within which they live); and

- is directed at environmental sustainability (Hurry 1992:31).

Nightingale (1987:16) quotes the USA Act of 1970 as accepting and defining environmental education as

> *... an integrated process dealing with man's interrelationship with his natural and man-made surroundings, including the relationship of population growth, population resource allocation and depletion, conservation, technology, urban and rural planning, to the total human environment.*

Environmental education is the study of factors including the ecosystem, mental and physical health, cities and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it and the concern and responsible action necessary to assure our survival and to improve the quality of life.

Zoller (1986:26) describes environmental education as exposing learners to actual existing environmental problems in their immediate environments; learning about these problems occurs by self-experience via the enquiry method - a direct interaction between students' cognitive system, which in turn entails a change in the teacher's role and a change in a traditionally accepted role of the subject matter that the latter should be, in many cases, the servant and not the master in

the process of learning. Opie's view (1989:5) is much broader than the concern with teaching learners about the environment or how to conserve it. He regards it as a method of teaching and learning which is stimulating and enriching.

A deduction which may be made from the preceding paragraphs is that environmental education is a process. As a process, it is also holistic. That implies that it can facilitate the exploration and acquisition of knowledge, skills and values which are relevant to environmental education. That could occur through accepting, clarifying and recognising the interrelationship of people who live in a particular environment with both natural and human-made surroundings. This means that the process of facilitating the exploration and acquisition of knowledge, skills and values which are relevant to environmental education, can occur through educating and training people, thus enabling them to be environmentally responsible in the context of the areas within which they live. This deduction leads to the discussion of environmental education in formal education.

2.3.3.2 Environmental education as an interdisciplinary and a holistic approach in formal education

Irwin (1991:4) describes environmental education as a world-wide socio-ecological phenomenon of many dimensions, as a sophisticated holistic concept which embraces ecological knowledge and understanding, the entire population

and its environmental relationships, ethics, politics, psychology, sociology and public participation in decision-making. In addition, environmental education could also be described as learning how to care for the earth, other people and ourselves (South Africa. Department of Education 1993:3). On the other hand, the Council for the Environment (1993:5) maintains that environmental education is education

- about the total environment (knowledge);
- through the total environment (activity method);
- for the total environment (leading to positive behaviour);
- for sustainable living;
- which seeks to create responsible behaviour patterns and attitudes towards the environment;
- which aims to influence personal lifestyles choices and social responsibility for living conditions;
- aimed at knowledge, values and skills culminating in appropriate environmental behaviour;
- aimed at self-enlightenment and empowerment of individuals, groups and communities for joint environmental commitment;
- aimed at group and community participation in the decision-making process and beneficial policy outcomes;
- of people for environmental awareness and caring actions; and
- for an interaction process between people and the environment.

2.3.3.3 Definition of environmental education for the purposes of this study

The above definitions have features in common, which include the recognition that environmental education

- is a continuous process;
- could provide skills through learning; and
- could provide the recognition of the interrelatedness of environmental education with other learning areas.

On the grounds of these common features, the following working definition of environmental education will be used for this study:

> *Environmental education is an approach of lifelong learning which empowers people to discover, interpret and understand their environment such as artificial, built, natural, rural and urban environment, and thus to develop knowledge of, skills in and techniques of valuing the environment locally, regionally, nationally and globally. It further recognises the value of the environment and clarifies concepts thereof through discussions and other methods or techniques of critical thinking which may develop in learners skills, positive attitudes and understanding of the inter-relatedness among*

the learners and the planet's naturally living and non-living components and other artificial components.

Having analysed and defined environmental education in the preceding paragraphs, it is also important to discuss some aims, goals and objectives of environmental education as these also form part of the theoretical perspective of environmental education in this study.

2.4 AIMS, GOALS AND OBJECTIVES OF ENVIRONMENTAL EDUCATION

2.4.1 Introduction

Returning to some common features in the foregoing definitions that recognise that environmental education is a process which takes into cognisance knowledge, skills and values, it is important to note that as an approach which relates to education and which also has paradigms relating to it, it also has its own aims, goals and objectives.

In the Webster's Comprehensive Reference Dictionary and Encyclopedia (1954:21) the term *aim* refers to a purpose, an endeavour (to strive for the attainment of something tangible or intellectual), intention to do something whereas the term

goal refers to the end aimed at (1954:221). The term *objective*, on the other hand, refers to something external to the mind which is aimed at or something strived for, something which has to be attained, an end sought of something.

According to the International Dictionary of Education (1978:16) *aim* refers to a perspective goal, a purpose for which something exists whereas *goal* refers to an end to something. *Objective*, on the other hand, describes what the learner is intended to do at the end of a process (1978:247).

The Concise Oxford Dictionary (1984:20) defines the term *aim* as a purpose which seeks to attain something and *goal* as the end of something (1984:424). *Objective* is used to describe something which is external to the mind and which a person may wish to attain (1984:699).

Curzon (1985:88) states that *aim* is a general word which represents ideals or aspirations. In contrast, *goals and objectives* refer to statements which are often quantifiable and further operational in nature, indicating events from which the mastery of desired activities may be correctly inferred. Curzon further supports the view that an objective is an intent communicated by a statement which describes a proposed change in a learner - a statement of what the learner is to be like when he or she has successfully completed a learning experience.

From the above definitions, the main difference between aims, goals and

objectives would appear to be that the term *aim* is considered a more general term (and perhaps more of a context) than *goal* and *objective*, which are more closely related in terms of meaning. The latter two are considered to refer more to specifics. For the purposes of this study, the term *aim* refers to a general ideal which may be achieved in the long term, *goals* and *objectives* refer to specific ideals which are quantifiable and can be put into practice in the short term. It is for this reason that they are closely related in terms of meaning. These two terms can further be linked to the practical teaching and learning situation, among others, in terms of time and space in didactics more than the term *aim*. In some quarters in South Africa, for example, the aim of environmental education will be general in that it will attempt to make people environmentally literate, whereas its objective, which will be more specific, will be to have people carry out the activities of the environment so that they can acquire specific knowledge and skills, and change their attitudes towards the environment for specified reasons.

2.4.2 Aims of environmental education

An author such as Tyldesley (1990:22) concurs with the notion that environmental education wishes to reconcile people, the "world " and all its participants. This also implies the aim of helping learners to become environmentally literate. That implies that environmental education endeavours to enable learners to become aware, knowledgeable, skilled and dedicated citizens who are committed to work, individually and collectively, towards achieving and maintaining a dynamic

equilibrium between the quality of life and the quality of the environment (Hopkins 1990-1991:8).

UNESCO (1989:14) states that environmental education seeks to develop human beings who can become effective citizens in the world community and who will be able to contribute towards the solution of environmental problems through action. Hurry (s.a:7) adds that environmental education also wishes to develop a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively towards the solution of current environmental problems and the prevention of new ones.

In short, a deduction which is made from the aims of environmental education in the preceding paragraphs is that environmental education aims to develop an environmentally literate society through actions. It is for the preceding reasons that the concept of environmental literacy will also be discussed. This concept is important in the context of the study because it highlights the characteristics of an environmentally literate person in a society.

2.4.2.1 Environmental literacy

(a) Definitions

Many authors, educators and environmental educators attribute environmental literacy to people. According to Harvey (1976:76), for example, an environmentally literate person is one who possesses basic skills, understanding and sensitivity to the man-environment relationship. To Hurry (1982:44) an environmentally literate person has a critical awareness of social, economic and political forces in society as these relate to environmental quality and the quality of life. On the other hand, Rockcastle (1989:8) defines environmental literacy as a basic understanding of the interactions between humans and their natural environment with regard to both living and non-living components (air, rocks, soil and water). This implies, according to Rockcastle, an awareness and understanding of the basic relationships in an environmental interaction (1989:8). This interaction refers not only to what people do, that is, taking from and putting into, but also what plant and animal life does in response to human intervention (Rockcastle 1989:8).

According to Roth (1992:1), environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and take

appropriate action to maintain, restore, or improve the health of those systems. Environmental literacy thus involves more of a human discourse about the interrelationship with the environment (Roth 1992:4). It is on the basis of this notion that environmental literacy is described as referring to the acknowledgement of being in the world (the environment) and making meaning with and around the environment, that is, thinking and talking about, interacting with and valuing the environment and other people (Roth 1992:4).

In the discussion document, *The integration of environmental education into formal education* (Joubert & Steenkamp 1995:5), environmental literacy is defined as the capacity of people to perceive and interpret the state of the environment and its systems and take appropriate action to improve, maintain, and restore that state.

A deduction which can be made from the preceding information on environmental literacy is that, for a person to be regarded as environmentally literate, he or she has to have a sound knowledge of, skills in and values about, for and in the environment. These should be based on a commitment to shape the world in which we live through thoughtful and active participation. It is on the basis of the preceding deduction and definitions that a definition of environmental literacy will be developed for this study.

For purposes of this study, environmental literacy will therefore be defined as the ability of people to acknowledge their existence in an environment and to understand, interpret and provide meaning to this environment with regard to all living and non-living things to facilitate constant physical improvement and maintenance of it.

It is clear from the preceding paragraphs that different definitions of environmental literacy are available. Still, there are some common features which could characterise it - as will be discussed in the subsequent section.

(b) Characteristics

Characteristics of environmental literacy are characteristics with which an environmentally literate person could be identified. Such a person could be referred to as someone who

- is aware of and sensitive to the entire environment;
- has a variety of experiences in and a basic understanding of environmentally associated problems and concepts;
- has the ability to seek opportunities to be involved at all levels in working towards resolutions of environmental problems; and

- has a basic understanding of decision-making processes of governments, business and other social, political and economic institutions impinging upon environmental issues (Joubert & Steenkamp 1995:5).

In interpreting these characteristics in the context of the study, it is vital to indicate that a person who is environmentally literate, should have knowledge of and skills in the environment and value the environment (refer to goals and objectives in paragraph 2.5.3). That implies that such a person

- is in a position to move from environmental awareness to knowledge and action on the environment;
- has developed a set of values and feelings of concern for the environment and the motivation for active participation in improving, protecting and leading a lifestyle which is not detrimental to the environment;
- has the knowledge and skills for identifying and solving environmental problems such as
  - using critical and creative methods of thinking;
  - seeking and organising information;
  - proactive thinking and planning;
  - constantly seeking connections and interconnections between objects and events;

- routinely seeking for seeds of change;
- routinely evaluating the consequences of potential individual and group actions;
- regularly examining alternatives and making choices;
- constantly making choices among alternatives that have minimum negative impact on the environment; and
- acting responsibly (Joubert & Steenkamp 1995:5).

These features will enable such a person to recognise an environmental problem or problems when they arise. Such a person thinks before acting, that is, examines the short-term as well as the long-term results of a problem before taking action to correct the environmental imbalance in various ways, that is, depending on the nature of the environmental problem. A person of that nature is always willing to learn about environmental issues and developments throughout his or her life. He or she recognises the need to use the environment to the full but also acknowledges the value of preserving and passing the environment for generations to come with as little damage as possible done to it. In addition, such a person is aware of and recognises other environmental aims or action aims, some of which will now be discussed.

2.4.2.2 Action aims

Another assertion derived from the preceding notions is that environmental education has aims which are action-driven. Leketi (1992:8), for example, maintains that environmental education aims at fostering teamwork and cooperation among the learners through action. Teamwork and cooperation among learners could be effected through processes such as enabling learners to be empowered in knowledge, skills and values by using various methods of teaching. Environmental education also aims at defending, improving and sustaining the quality of the environment on behalf of the present and future generations of all living organisms through action (Engleson & Yockers 1994:14). In line with the preceding assertions, Palmer and Neal (1994:28) also note that environmental education aims at encouraging learners to take action in examining and interpreting the environment from a variety of perspectives such as the economic and social so as to improve it. They further state (1994:28) that environmental education aims at arousing learners' awareness of and curiosity about the environment and at encouraging active participation in resolving environmental problems.

Prominent types of aims of environmental education which may be identified from the above discussion are focused on learners achieving the following goals and objectives (knowledge, skills and values) (Queensland Department of Education

93:6; Hopkins 1990-1991:9; Engleson & Yockers 1994:14; Joubert & ɜenkamp 1995:32-35). These goals and objectives will be discussed comprehensively in the paragraphs that follow.

2.4.3 Goals and objectives of environmental education

Although there is a school of thought that does not support the view that goals and objectives should be stated as part of any research study, in this study, goals and objectives will be discussed as they will provide a clear direction for the research and contribute to the development of a model for teaching in an environmentally directed way.

An overall view of goals and objectives in environmental education will be discussed. In chapter 3, their interpretation and practical application will be focused on. In discussing these views, knowledge, skills and values will be the focal point as the three dimensions of the learning process referred to and articulated in a variety of sources which attempt to define aims, goals and objectives of environmental education (see Palmer & Neal 1994:21; Engleson 1991:5).

2.4.3.1 Goals and objectives focusing on knowledge

The goals and objectives of environmental education help learners to acquire knowledge of the environment.

Learners who wish to acquire an understanding of environmental education first have to acquire a basic knowledge of what environmental education is, that is, how environmental education functions, how people interact with the environment, how issues and problems dealing with the environment arise, and how they can be solved and improved (Hopkins 1990-1991:9; Engleson 1991:5).

To foster a greater understanding of environmental education, learners have to be empowered with more knowledge of the issues related to it (Hopkins 1990-1991:9). The Queensland Department of Education (1993:6) suggests that teachers should provide knowledge and opportunities for all learners to learn or learn more about environmental education issues by introducing concepts such as the following:

Natural systems	concepts which are complex, self-regulating and interconnected
Social systems	concepts which have cultural, economic, political and religious aspects connected to natural systems
Personal ecology	concepts which are inter-related and encompass a sense of self, that of place, that is, the way in which we see ourselves and the world and what our attitudes are towards our environment
Ecologically sustainable development	concepts focused on meeting the needs of the present without compromising the ability of future generations to meet their needs
Citizenship	to teach all people to be responsible for their actions and work together in their local, national and global communities to make the world a better place to live in.

Teaching these concepts may contribute to a better understanding of environmental education, as this will facilitate learners' acquisition of a basic understanding of how the environment functions, how its functioning is affected by human activity and how harmony may be achieved between human activity and the environment (Joubert & Steenkamp 1995:33). More information in this regard will be provided in paragraphs 2.4.3 and 2.4.4 respectively.

The above concepts point to the inter-relatedness of the cosmos (the universe and all its living and non-living components) and may create a sense of pride and security because learners acquire knowledge and skills (see paragraph 2.4.3). In this process, teachers always need to take the learners' level or levels of development into cognisance in order to progressively build on previous knowledge.

2.4.3.2 Goals and objectives focusing on skills

Environmental education also has goals and objectives of helping learners to acquire skills to identify and investigate environmental problems and to contribute towards their resolution (Hopkins 1990-1991:9). This also implies the facilitation of acquiring skills to examine more critically environmental phenomena and their relationships and to develop a spirit and ability to inquire about specific and

general environmental implications of human activities (Hopkins 1990-1991:9; Joubert & Steenkamp 1995:35).

In order to ensure that the goals and objectives of environmental education are realised, teachers should help to develop in learners critical thinking skills and critical action in favour of the environment by developing skills which will enable them to

- use their senses to explore different environments;
- evaluate and reflect on these explorations;
- observe and record information, ideas and opinions;
- investigate and communicate concern about environmental matters;
- gather, analyse and synthesise information logically;
- present information in oral, written and in graphic forms;
- develop divergent pilot study skills and other thinking skills which could facilitate and necessitate active citizenship;
- view environmental matters from different perspectives;
- discuss and debate alternative viewpoints on environmental issues;
- identify, clarify and express value judgements that relate to the environment;
- identify, consider, select, design and implement action on any environmental matters embarked on so as to facilitate predicted results; and

- cooperate and negotiate with others to resolve problems arising on environmental issues (Queensland Department of Education 1993:6).

In short, the goals and objectives which are cited in the preceding paragraphs primarily focus on facilitating the acquisition of critical thinking skills on how to work collectively or individually in identifying, investigating, evaluating, and contributing towards the improvement of the environment and the solution of environmental problems.

The skills which learners acquire through the environmental education approach are also important for reflecting on their underlying values regarding the environment and for understanding ethics and norms.

2.4.3.3 Goals and objectives focusing on values

In developing skills in learners such as those noted in the preceding paragraph in learners, teachers could also help learners to develop environmental ethics (relating to teaching moral questions on the environment) which are based on values of social justice and ecological sustainability (Council for the Environment 1993:9). Not only environmental ethics but also environmental norms or standards, or both, could be developed through the acquisition of certain skills.

Hopkins (1990-1991:9) considers the acquisition of a set of values and a feeling

of concern for the environment as part of the goals and objectives of environmental education. That implies helping learners to develop a sense of civil responsibility and the awareness that their actions affect others just as the actions of others affect them. It also includes the clarification of values relating to the environment which learners may have, and changing them for the purpose of environmental activities and decisions. The Queensland Department of Education (1993:6) is of the opinion that values can be developed by empowering learners to develop a sense of

- enthusiasm, joy and respect for nature;
- appreciation and concern for a particular environment;
- recognition of indigenous people's cultural knowledge and experience of the environment;
- appreciation of preparedness to examine and change personal lifestyles, to become informed and participate in decision-making on the environment; and
- working individually and with others to improve the environment and the willingness to be open-minded.

In addition to the above list, the Council for the Environment (1993:9) also mentions the following goals and objectives, namely to promote

- personal exploration, inquiry and valuing of the environment; and

- a pattern of holism (holistic thinking), that is, thinking globally and acting locally.

In summarising this section on goals and objectives which focus on values, it is important to note that these have two dimensions. On the one hand, they are related to the acquisition of a feeling of concern for the natural and artificial or non-natural environment but, on the other hand, there is also the motivation for the awareness and understanding of the environment as well as the active participation in the protection and improvement of the environment. These two types of goals and objectives could be realised through providing learners with the knowledge and skills on how to identify and explore an environmental problem and how to take physical action towards its solution.

While bearing this summary on goals and objectives in mind, it is also important to indicate on aims, goals and objectives with regard to outcomes-based education (OBE), a new approach to the South African education system which is envisaged to be in place from 1998, and the relationship of the two.

2.5 OUTCOMES-BASED EDUCATION (OBE)

The aims, goals and objectives regarding environmental education have been

widely discussed (refer to 2.4). The focus will, however, for now be shifted towards a discussion on outcomes-based education which forms the basis of the new education dispensation in South Africa, and its relationship with aims, goals and objectives regarding environmental education. The new curriculum, Curriculum 2005, will effect a shift from the old content-based curriculum to the new one, which is based on outcomes (South Africa. Department of National Education 1997:1). These outcomes include the specific knowledge, skills and values learners are expected to acquire during a lesson and to display at the end of their school careers. Learners will therefore be equipped throughout their schooling with the knowledge, competencies and orientations they will need for successfully entering the labour market after completing a certain level of formal schooling. The new curriculum will begin to integrate education and training by incorporating a view which rejects rigid divisions between academic and applied knowledge, theory and practice and knowledge, skills and values (South Africa. Department of National Education 1997:1). The differences between the 'old' and 'new' approaches in the South African education system and the shift may be represented as follows:

DIFFERENCES BETWEEN THE "OLD" AND "NEW" APPROACHES TO EDUCATION IN SA

OLD APPROACH	NEW APPROACH
1. Learners are passive participants in the process of learning	1. Learners are active participants in the process of learning
2. Examination-driven	2. Learners are assessed on an ongoing basis
3. Rote-learning is emphasised	3. Critical thinking, reasoning, reflection and action are emphasised
4. The syllabus is content-based and is broken down into subjects	4. There is an integration of knowledge; learning is relevant and connected to real-life situations
5. Teaching is textbook or worksheet bound and teacher-centred	5. Teaching is learner-centred; the teacher acts as a facilitator and constantly uses groupwork and teamwork to consolidate the new approach
6. The syllabus is seen as rigid and non-negotiable	6. Learning programmes are seen as guides that allow teachers to be innovative and creative in designing programmes
7. Teachers are responsible for facilitating the learning process; the motivation of learners depends on the personality of teachers	7. Learners take the responsibility for their learning; learners are motivated by constant feedback and affirmation of their worth.
8. Emphasis on teaching is based on what the teacher hopes to achieve	8. Emphasis on teaching is based on outcomes - what the learner becomes and understands
9. The content is placed into rigid time-frames	9. There are flexible time-frames which allow learners to work at their own pace
10. The curriculum development process is not open to public comment	10. Comment and input from the wider community is encouraged in the process of developing the curriculum

(South Africa. Department of National Education 1997:6-7)

Having discussed aims, goals and objectives and outcomes-based education in the preceding paragraphs, it is important to make deductions regarding their relationships with each other. Aims, as noted in the preceding sections, are general. Goals and objectives, like outcomes, are specific and as such, the difference between the two, in the context of this study, is negligible. Goals and objectives, for example, refer to such matters as knowledge, skills and attitudes which a teacher expects learners to acquire in a given short period of time. On the other hand, outcomes are also expectations a teacher has of learners to do within a given short period of time.

The sentiments expressed by different authors regarding aims, goals and objectives about, for and in environmental education correlate very well with the new approach of outcomes-based education. Active participation of learners, for example, is crucial for learning in the process of learning in, for and about environmental education, as much as it is also crucial for facilitating learning through the use of outcomes-based education strategies. In outcomes-based education, knowledge, skills and values are the primary expected results from a learning area. That correlates well with environmental education because, for example, a person who is regarded as environmentally literate in environmental education, has to be able to display characteristics of acquired knowledge, skills and values relating to the environment. This relationship does not only apply to the noted examples but to all characteristics of the 'new' approach to teaching - as outlined in the table in the preceding paragraph. On the basis of these deductions

it could be stated that environmental education correlates well with outcomes-based education and, on these grounds, has to form part of the 'new' curriculum.

2.6 CONCLUSION

In this chapter, an attempt was made to describe some theoretical perspectives on environmental education. It was indicated how, to some extent, they address the problem of the study, namely to determine how elements from a variety of paradigms and teaching methods can be used simultaneously for teaching in an environmentally directed way. It was shown in the theoretical perspectives, for example, that environmental education arouses awareness of and curiosity about the environment. Environmental education was also defined as a lifelong learning process which empowers people to acquire knowldge, skills and value artificial or non-natural and natural environment locally and globally. This encourages active participation in resolving environmental problems. It was also pointed out that an environmentally literate person can recognise an environmental problem, critically reflect on it by interpreting it from various perspectives, and act in accordance with the nature of that environmental problem. Goals and objectives were also discussed. In addition, their relationship to outcomes-based education was highlighted. Deductions made in that regard indicated clearly that environmental education correlates well with outcomes-based education.

The theoretical perspectives on environmental education in this chapter generated ideas towards the use of different paradigms or frames of reference by environmentalists to view and interpret environmental education and further relate to it while using environmental education as an approach. These paradigms will be discussed in chapter 3.

CHAPTER THREE

PARADIGMS RELATING TO ENVIRONMENTAL EDUCATION

3.1. INTRODUCTION

Paradigms form pillars on which people that interact with fields of study, learning areas and approaches to learning and teaching respectively and or collectively in education base their ways in which they view, interpret and relate to things. Similar to other concepts such as definitions, aims and objectives of environmental education (refer to chapter 2), paradigms are also contentious concepts in environmental education because not much research has been done to establish which paradigms influences teaching in an environmentally directed way and how paradigms in environmental education relate to teaching methods. For this reason paradigms will be discussed in this study. It has been proposed that environmental education should form part of the curriculum of the South African education system (refer to the Reconstruction and Development Programme [RDP] document of 1993, White Paper on Education of 1995 and South African Schools Act of 1996), but there is uncertainty about which paradigm or paradigms relate to environmental education. This uncertainty is probably exacerbated by lack of understanding of the concept environmental education and lack of agreement about its place in the curriculum (refer to chapters 1 and 2).

In this chapter, some paradigms will described and discussed as viewed by various authors. First the concept paradigm is considered to bring about a better understanding of the concept in the context of the study. From the different paradigms which exist, such as critical rationalism, ecocentricism, ecosocialism, gaianism, hermeneutics, holism, logical empiricism, and technocentrism, categories of paradigms have been developed to bring about consistency with regard to the term paradigm in the study. Characteristics of each of the identified categories of paradigms and the way in which they relate to environmental education and teaching methods respectively will be discussed. In conclusion, case studies will be discussed with the view to indicating how the identified paradigms address the problem of the study (refer to chapter 1), namely to determine how elements from a variety of paradigms and teaching method(s) can be used by teachers and environmental educators simultaneoulsly for teaching in an environmentally directed way.

3.2. THE CONCEPT PARADIGM

The increase in popularity of environmental education throughout the world can be related to some of the dominant western paradigms such as those of Robottom and Hart (1993) and Higgs (1990). This increase in popularity of environmental education is rooted in the philosophical and technological developments of the twentieth century which include new ways of thinking on the environment (Clacherty 1988: 2). African paradigms do not, however, enjoy the same increase

in popularity, because very little is mentioned is mentioned about these paradigms in sources on environmental education.

Different interpretations of environmental education are underpinned by different theoretical assumptions, ontologies and epistemologies (Robottom and Hart 1993: 12). Ritzer (1975: 7), for instance, defines a paradigm as a fundamental reflection or interpretation of the subject matter within a science. He adds that a paradigm serves to define what should be studied, what questions should be asked, how they should be asked, and what rules should be followed in interpreting the answers obtained. A paradigm is the broadest unit of consensus within a science and serves to differentiate one scientific community from another. It also subsumes, defines and interrelates the exemplars, theories, methods and instruments that exist within it (Ritzer 1975: 7). In interpreting Ritzer's definition of a paradigm (1975) to environmental education, it could be mentioned that environmental education should be studied in a particular context. A specific topic of environmental education should in other words, be studied in a particular context at a specific time. In studying that specific topic at a particular time, a decision should also be made as to the types of questions that should be asked with reference to that topic, how they should be asked and the rules which should be followed in interpreting the answers to those questions.

Patton (1975: 15) defines a paradigm as a world view, a general perspective, a way of breaking down complexity of the real world. According to him paradigms

are deeply embedded in the way in which proponents and practitioners conform to them and as telling what is important, what is legitimate, what is reasonable and what to do without necessarily considering its implications. In interpreting Patton's definition of a paradigm to environmental education, it could be noted that environmental education could also be regarded as a way of breaking the complexity of the real world, by studying the real world as components with a view to indicating what is important, legitimate, reasonable and what to do without necessarily considering the implications of such a study. To Robottom and Hart (1993: 15) a paradigm is a way of seeing or knowing, a perceptual organiser, the broadest unit of consensus among researchers. In interpreting this definition in terms of environmental education, it could be mentioned that environmental education should be regarded as a way of perceiving and organising acquired knowledge, which is the broadest unit of consensus among researchers.

The impression created in the above cited definitions is that paradigms reflect meaning and or interpretation of what is legitimate, reasonable and what should be studied in a community, that is, what questions should be asked, how and why they should be asked. Based on this impression, a paradigm is defined in this study as a systematic way of identifying, perceiving and interpreting the world view in terms of what should be studied, how this should be studied, when and why that should be studied.

3.3. CATEGORIES OF PARADIGMS

There are a variety of paradigms (refer to section 3.1.) which could influence people's way of teaching. Although there are a variety of paradigms which could be discussed for different purposes in any study, three paradigms - positivism, social critical theory and constructivism - were selected from the pool of many other paradigms for this study. These will be discussed because they are the most common and are used in many sources or learning areas which are used for educational purposes (Anderson 1968; Higgs 1990; Robottom and Hart 1993). The three paradigms which were selected, namely, positivism, social critical theory and constructivism will be discussed according to their:-

- main characteristics (to clarify their meaning),
- implications for environmental education (to clarify the implication they have for environmental education), and
- implications for teaching methods (because the main focus of the study is on teaching methods).

This discussion will be followed by an outline of the paradigm which underlies this study.

3.3.1. Positivism

Positivism is, according to Sztompka (1979: 30) a paradigm which focuses on scientific methodology. That implies the use of scientific methods which are based on the exact sciences for experimenting, observing and testing the soundness of conclusions. It is aimed at shaping human behaviour in a particular, desirable way through natural scientific method(s) (Hungerford and Volk 1990: 12).

(a) Characteristics

- Positivism is characterised by the belief of the natural sciences, and concentrates on objective testable observations of the physical world. That implies that, in positivism only positive, observable and testable phenomena are acceptable (Robottom and Hart 1993: 21).
- Positivism generates theory and assesses data with theory which is based on empirical merits (Seidman and Wagner 1992: 159).
- Data is researched, developed, disseminated and adopted. That implies that the Research, Development, Dissemination and Adoption (RDDA) model is used in positivism (Robottom and Hart 1993: 21).

(b) Implications for environmental education

- Environmental education should, in the context of positivism, provide

observable and measurable knowledge, skills, et cetera (Engleson and Yocker 1994: 14). For example, environmental education should provide learners with the following:

1. knowledge to acquire a basic understanding of how the natural environment functions, how its functions are affected by human activity and how the harmony can be achieved between human activity and the natural environment,
2. citizen action skills to help learners to develop skills needed to identify, investigate and take action towards the prevention and resolution of environmental issues,
3. citizen action experiences to help learners gain experience in applying acquired perceptual awareness, knowledge and skills in working towards the prevention of and resolution of environmental issues at all levels, starting from local through to global level (Engleson and Yockers 1994:14). all of which should be observable and measurable.

- Environmental education should provide learners with observable, measurable and testable knowledge, skills and experiences they need to understand regarding the environment (Robottom and Hart 1993: 21).

(c) Implications for teaching methods

- Environmental educationists who use a positivistic approach to research often use the RDDA model (a research model) to facilitate teaching. These include:
  - the measuring and reviewing of teaching and learning material for environmental education;
  - the usability and transferability of environmental education resources such as environmental education centres, people, reading or writing materials and schools; and
  - pre- and post-tests of the application of environmental education resources,

- In the context of positivism, the RDDA model could be used as an efficient way to facilitate change through teaching, as it provides a neutral administrative process for dealing with situations that might otherwise involve social, political and ethical problems (Robottom and Hart 1993: 21). Environmental educationist using a positivist approach will ask questions which are explicitly formulated from theory which is in turn based on empirical merits (Seiman and Wegner 1992: 159; Robottom and Hart 1993: 21).

A case study will be used to indicate how positivism addresses the problem of the study

(d) Using an environmentally related case study to teach from a positivist view

The following newspaper article titled: *Pupils smoked out despite attempt to douse burning tyres - from The Star (Thursday, August 21, 1997)* will be used as a case study to show how positivism can be used to teach about an environmental issue.

"Tyres were still burning near Duzenendlela Primary School in Grasmere, south of Johannesburg, yesterday, disrupting classes and enveloping the area in a wall of black smoke. Nearly everyday, a company that retrieves metals to sell as scrap burns more than 100 tyres on property adjoining the school....

The pupils are the victims of the pollution the fire causes: "The kids are coughing and sneezing and are now complaining that they have headaches. They don't learn freely because the smoke interrupts their classes..." said an asthmatic principal, Olga Hlubi, struggling to breathe.

Yesterday a strong wind of about 30km/h pushed the dark smoke clouds towards neighbouring farms, and the smoke billowed over the road, making visibility difficult for passing motorists.

Greater Johannesburg deputy chief operations spokesperson Brian Hogan said firefighters had been on the scene to douse flames from 08h50 yesterday. He said the fire department had investigated these matters, but he believed the case would not make it in court and the guilty party would get off with a spot fine. Hogan added that the only legal fires in Greater Johannesburg were those for cooking and heating..." *(The Star, Thursday August 21, 1997).*

Using the above case study to teach grade twelve learners pollution from a positivistic point of view, the following procedure would be followed:-

Learners will be given the opportunity, by their teacher, to read the case study carefully in order to acquire understanding of how human activity, such as polluting the environment, affects the natural environment and people within a specific environment. The teacher will further explain the case study to the learners. Once that has been done, learners will be engaged into the following activities:-

1. to identify and test the type of pollution noted in the case study
2. to identify and note the pollutants and how many of these are burned at a time
3. to identify, observe and measure the extent of smoke caused by pollution
4. to observe and identify the harm the pollution causes to the children in the case study
5. to identify and measure the speed at which the wind blows to exacerbate and spread pollution
6. to identify and measure the time at which the fire was doused off in the case study.

The following deductions could be made from the above case study with reference to the problem of the study:

- Using the positivistic approach to teach a topic, only that which is measurable, observable and testable is acceptable. For example, in the case of the utilisation of the above case study, pollution and the nature of this problem were identified by learners.

The extent of pollution and the speed at which it spreads were measured. In measuring its extent for example, it was noted in the case study that the smoke was "enveloping the area in a wall of black smoke". In other words, the scope of the smoke was equated to the size of a wall. Regarding the speed at which the pollution spreads, it was noted in the case study that "a strong wind of about 30Km/h pushed the dark smoke clouds..."

- Data was researched, developed, disseminated and adopted in the utilisation of the case study. Information on what pollutes the atmosphere was thus discovered through research. For example, the cause(s) of pollution were discovered.

Observable, measurable and testable facts were developed from the information which was researched. For example, facts about what the colour of the smoke is, its extent and the speed at which the smoke was pushed in a certain direction were obtained from the information generated from the research done.

- Data was disseminated in the use of the above case concerned. For

example, the children complained to their principal about headaches caused by the pollution in the area. The school principal, Olga Hlubi, also expressed her complains regarding the pollution to the reporters who visited the school. Data was also disseminated to the firefighters who started to douse the flames from 08h50 of the previous day.

- Data was lastly adopted in the utilisation of the case study in that it was noted to be true that there was indeed pollution in the area. In adopting the data, the firefighters came to douse the flames from 08h50. The spokesman for the Greater Johannesburg deputy chief operations, Brian Hogan, further noted that the school had a case against the person who is responsible for the pollution although he expressed the view that the person responsible for the fire would only be expected to pay a fine as an admission of guilt in the court of law.

There is little evidence of the characteristics of other paradigms such as constructivism and social critical theory in the preceding examples. For example, nothing is said about the history of pollution which is discussed in the case study and how the situation can be changed in order to improve it for future purposes. Furthemore, there is no inquiry which focuses on uncovering the contextual meaning and causes of contradictions which operate behind unquestioned interactions of people's daily lives and the pollution.

While positivism is frequently adopted as the only paradigm by empiricists (those people who rely solely on experiments and or that which can be observed and measured), there are critics and competitors such as those who are in accord either with constructivism or the social critical theory - which will be discussed in the paragraphs that follow. Some of the critics base their arguments on facts which will be noted in the following paragraphs.

3.3.2. Social critical theory

To be critical means to expose one's ideological bases, penetrating one's ideological assumptions, through critique (Green 1990: 4). To Popkewitz (1990: 80) it also means developing a conception of reality that ties ideas, thought and language to social and historical conditions which are based on criticism, on notions of power and control. From the preceding descriptions,becoming critical seems to be developing an analytical posture towards argument, procedures and developing an action-orientated commitment to change.

(a) Characteristics of social critical theory

- Social critical theory has an emancipatory action-constitutive interest on improving the quality of human existence for future purposes. That is, social critical theory has an interest in improving the quality of human existence by setting human beings free from their way of thinking and

replacing that with an 'improved' way of thinking of a particular community and or society.

- It attempts to relativise issues of methodology by embedding these in their history, that is, their past thereby refering to the present and focusing on how these could be improved for future purposes.
- Social critical theory is practical, action-oriented and enlightening. It thereby catalyses social and political changes (Green 1990: 6).

(b) Implications for environmental education

In accordance with the views of Green (1990: 6) and Robottom and Hart (1993: 20) on the implications for environmental education:

- Environmental education should, in the context of social critical theory, improve the quality of human existence through emancipation.
- This process should occur through practical action which is based on knowledge acquired from the underlying theory. That knowledge also serves to enlighten and catalyse social and political changes in an environment,
- In the social critical theory, environmental education should use theory and practice to facilitate the acquisition of knowledge. Theory and practice should therefore count as knowledge for environmental education,
- In environmental education, other things - according to this paradigm - which should count as knowledge include that which changes,

- Truth should therefore be whatever leads to the achievement of good, right, responsible results and that which empowers individuals,
- Inquiry in environmental education which is based on the critical theory should focus on that which uncovers meaning and causes contradictions which operate behind unquestioned interactions of people's daily lives,
- According to the social critical theory, environmental education should make the 'taken-for-granted' assumptions about the environment transparent,
- It should further facilitate the integration of knowledge and purposeful action in the environment (Green 1990: 6; Robottom and Hart 1993: 20).

(c) Implications for teaching methods

- Environmentalists using a social critical theory approach will use teaching methods to facilitate the dialectical unity of theory and practice (praxis), where theoretical understanding of contradictions inherent in a society become constitutive of the very activities in transforming and improving conditions,
- In social critical theory, knowledge which is acquired through the use of teaching methods serves the purpose of rectifying the conditions within which that knowledge was produced.
- Teaching methods uncover the meaning and causes of contradictions which operate behind the seemingly normal unquestioned interactions of our daily lives.

- According to the social critical theory, teaching methods should further be used to render transparent the taken-for-granted assumptions about the environment and its processes to facilitate changes towards improved human existence.
- Teaching methods should be used to focus on environmental education from a holistic and balanced point of view and not from a positivist point of view only,
- Social critical theorists seek to reassert - through teaching methods - history, value and ethical choices into knowledge which people have of social practices,
- The teaching methods employed in seeking to reassert aspects such as history and value represent a cross-checking on the hubris of ideas and power relations that underlie the formation of knowledge itself (Green 1990: 8; Popkewitz in Robottom and Hart 1993: 12).

(d) Using an environmentally related case study to teach from a social critical theory view

To demonstrate how the paradigm on social critical theory could be used to address the problem of the study - to determine how elements from a variety of paradigms and teaching methods can be used simultaneously to teach in an environmentallly directed way, - an extract from an article titled *Toxic Waste* will be used as a case study.

"In November 1990, Earthlife member, John Harris, noticed a large number of toxic chemical drums, some of which were leaking, in an abandoned factory site in Germiston. This toxic waste is a serious health health risk for everyone, but particularly for the community of homeless people who live at the site.

Earth life made another chilling discovery on the East Rand. In co-operation with the Katlehong Civic Association, they investigated the old munipal waste dump. They found illegally dumped waste of many types. In addition to household rubbish, there were sweets dumped by a Wadeville company, and used bandages, syringes, medical drips and needles from Natalspruit Hospital. Experts were concerned that these items could lead to the spread of blood borne diseases such as hepatitis and even AIDS. The homeless people who live off the dump and children who play on the dump and eat the dumped sweets are especially at risk.

Two years ago, Earthlife Africa's Pietermarizburg Branch discovered a toxic waste dump in a rural village outside town. A large number of drums containing slurge from a printing works had been dumped in the veld, and the lethal cocktail of solvents and heavy metals had begun to leak out, contaminating the environment. The village people had been emptying the drums and using them to collect rain water for drinking..."
(Coetzee 1991: 11-13).

Using the content of the above case study to teach grade twelve learners land pollution from a social critical theory point of view, the following procedure could be followed:

A holistic view of the concept pollution will firstly be explained to learners. That will be followed by a description of the various types of pollution such as air, water and land pollution. Examples of the causes of pollution - which include the

histories of the various types - will be provided.

Having described and discussed the above types of pollution, a teacher will focus specifically on the case study and state that any type of pollution has a specific history. For example, in the above case study, one type of pollution concerned was probably caused by an overproduction or wrongful production in a company. Lack of facilities for incenerating waste products could be another cause for pollution. In presenting the theory, the teacher will also make use of practical examples which have a bearing on the content of the case study to concretise the theory, that is linking theory and practice (praxis).

The teacher could also use the case study to uncover the meaning of land pollution to the area and its people, and the misery that land pollution causes to human life. That will be done by presenting the data on the waste which is dumped in the cited area in a transparent form. The teacher could, for example, engage learners in a discussion on what in their opinion that type of pollution on that specific piece of land would cause to the land. They could further discuss the possibility of plant growth in such an area and how people who live in the vicinity of the dumping site survive. Issues such as the odour caused by the waste and the result of wasted sweets could be highlighted and critically discussed.

Learners could be further engaged in discussions such as who should be held liable should any of the people who are homeless or who live in the nearby residential

area and are exposed to such waste get sick and hospitalised or even die, be it through inhalation or consumption of such waste matter? Learners will thus be engaged in activities in which they will suggest how such a situation - in which people dump waste illegally - could be rectified and how the quality of life in and around the area could be improved.

From the above discussion, focus is on uncovering the meaning and causes of contradictions. Nothing is said about measuring the quantity of pollutants and their impacts on the environment. The number of people who are exposed to that environment is also not mentioned.

To summarise, the social critical theory's inquiry in to environmental education is based on uncovering meaning and causes of contradictions which operate behind unquestioned interactions of people's daily lives through teaching methods. It also wishes to facilitate the integration of knowledge and purposeful action in the environment. Although social critical theory embarks on facilitating a dialectical unity of theory and practice and aims at uncovering the meaning and causes of contradictions through teaching methods, it also has its critics. These maintain that reality should not be looked at from a holistic or positivistic point of view only but from other views which are thought to be best for these paradigms. An example of such a paradigm is constructivism.

3.3.3. Constructivism

Constructivism is a paradigm which conducts inquiry systematically and publicly, using analytical criteria and an explicit rationale to test and try to disprove claims which may be there (Rapoport 1990: 65). It aims to restore the connection between scientific knowledge, which has become divorced from daily experience and the activities in which it is rooted, through meaning and understanding (Craib 1985: 83). Learners consciously attempt, in constructivism, through the analysis of experience, to uncover and reconcile certain fundamental essences or phenomena by providing meaning to them.

Researchers who operate within this paradigm are also interested in the presentation of value-based, holistic, competing and often conflicting realities of multiple stakeholders and participants (Van Matre as quoted by Robottom and Hart 1993: 23).

(a) Characteristics of constructivism

- Constructivism is based on a relativist ontology (nature of reality).
- Reality only exists within the context of a specific mental framework or construct.
- Social reality is not an independent reality but is reality which is socially constructed by societal members and can have a multiplicity of

meanings (Robottom and Hart 1993: 9).

(b) Implications for environmental education

- Environmental education should, in the context of constructivism, systematically and publicly inquire on and about environmental education or environmental issues or topics (such as environmental literacy and, pollution) through the use of explicit rationale and analytical criteria to test or try to disprove any false claims (see Rapoport 1990: 65; Ritzer 1992: 320).
- Environmental education implies that knowledge of the environment is socially constructed and pertains to a specific context. For example, knowledge of air pollution in a specific area will be socially constructed to a particular context.
- Those who learn environmental education for and about the environment within constructivism acquire knowledge, skills and develop attitudes through meaning and understanding through their senses (of touch, taste, smell, hearing and sight) in relation to the environment of which they are part (Craib 1985: 85; Van Matre 1972: 9-11, in Robottom and Hart 1993).
- A holistic approach is followed in environmental education (Engleson and Yockers 1994: 11).

(c) Implications for teaching methods

- Environmental educationist using a constructivist approach use teaching methods which will facilitate meaning, structures and workings of human consciousness,
- In the constructivist approach, teaching methods such as the question-and-answer methods are used to ask questions which are explicitly formulated within the context of the topic at hand to bring to light meaning and understanding,
- Learning takes place through interaction with the environment (Robottom and Hart 1993: 22).
- Some of the forms through which learners could be enabled to create knowledge, develop skills and values for the environment, are by educating them on the environment as follows:-

1. Facilitating interaction between learners and the environment that is being studied;
2. Using the environment as the context for learning;
3. Understanding the environment through the eyes of the learners while at the same time using all other available human senses, namely taste, touch, smell and sound;
4. Providing learning opportunities through direct emotional sensory experience (Van Matre in Robottom and Hart 1993: 23).

- Constructivism draws on elements from a variety of teaching methods in making possible a holistic and balanced perspective of specific content of each subject or discipline (Robottom and Hart 1993: 22-23).

(d) Using an environmentally related case study to teach from a constructive view

To demonstrate how constructivism could be used to address the problem of the study, a case study which is developed from ideas generated from an article titled - *Toxic Waste* (Coetzee 1991: 11-13) - will be used.

An excursion to a toxic waste dump

A teacher arranged and took learners on an excursion to a toxic waste dump within the area of Gauteng province. Upon arrival, they discovered that the area was condoned with barbed wire and some security members of a reputable security company were watching for any person who comes to dump illegally. A senior health inspector from the local council led the grade twelve learners together with their teacher through the tour of the waste dump. She firstly told them about the history of the waste dump.

"Seven years ago, this toxic waste dump was uncovered by communal members of a village which was about a kilometre from where we are and very close to the outskirts of the town you can see over there. A number of drums and plastics containing toxic waste from an unknown company had been dumped on this piece of land and the toxic solvents and heavy metal had already begun to leak and thereby contaminating the environment.

Some villagers had been emptying the drums and using them to collect water for drinking purposes. The plastics were also emptied and used for covering the leaking houses which were made of cardboard boxes, metal sheets and planks. The exposure of villagers to a contaminated environment and the use of the polluted drums for drinking water and plastics for shelter probably caused illhealth to some villagers. Many of them who went to the clinic were admitted and send to the local hospital and their respective diagnosises were found to be similar. As a result thereof, the hospital doctors contacted the local clinic staff regarding these patients' diagnosises. Some local clinic staff members invited the local health inspectors and some social workers to a meeting regarding this matter. They collectively investigated the area where these people came from. The village and the toxic waste dump were discovered to be close to one another. It was also discovered that almost every house had at least one of those drums which contained toxic waste which was dumped on the dump site. Some villagers already had signs of illhealth. Tests similar to those made to patients who were admitted were made to many other villagers. It was discovered that many also showed signs of skin diseases while others suffered from symptoms which could be the result of lead poisoning.

Because of the threat which the toxic waste was posing to villagers, the health inspectors and the social workers collectively agreed with the recommendation of the medical team that the place was not good for human habitation. An alternative piece of land was identified and offered to the villagers. Many of them declined the offer on the grounds that it was not their ancestral land. Some, on the other hand, voluntarily relocated to the new village after understanding the danger of being exposed and living in such a toxic polluted environment.

At the same time, the health inspectors requested the assistance of the police in tracking down the person, people or company which was responsible for dumping the toxic waste on the site and thereby polluting the environment. That person was trapped and arrested within a week of the investigation. He was not prosecuted because the prosecutor felt that the maximal fine of R400-00 for dumping illegally did not justify the expense and effort of the case. The prosecutor further felt that the villagers had no case against that person because he never gave them the drums to use for drinking water, let alone to give them the plastics to cover their leaking 'houses'.

The fact that person was not prosecuted alarmed many people especially those who are concerned about the deteriorating standard of the environment in general. Many people feel that dumping will continue for as long as stringent legal measures are not in place and enforced against any person who transgresses them. Until then, it is the duty of the community to be aware of and expose illegal waste dumping, whether it is toxic or not, wherever they find it. The question is - once these people have been exposed and paid the fine then what should happen to them if they repeat the same offence?

Should people take the law into their hands and act against anyone who dumps waste in any environment? These are some of the questions we, the health inspectors and many other people who are interested on the environment cannot respond to".

After the talk, the learners were taken to various parts of the dumping area and shown the effect toxic dumping has had on the plants in the area and on the water in the stream which passes by. Questions were responded to during the tour.

In teaching a topic on polluting the environment which is based on this case study, a teacher could ensure the following:

Learners study the case study carefully with the objective of understanding the chronological order of events. Learners are made to enquire systematically and

publicly, using analytical criteria to test or disprove claims which are made about the existing toxic waste dump. Examples of the claims which are made could include the leaking of waste toxic substances containers and the effects these toxics have to people who live in the vicinity of the dumping place.

Learners get a holistic understanding of what of pollution entails within that environment and that they are in a position to contextualise it within the mental framework of the case study. For example, it could be explained to learners that drums are used to collect water for drinking purposes, a result of a lack of taps in the village. Another example which could be explained to learners could be the use of plastics to cover houses which are not well planned and constructed and, many of them have holes.

Learners learn by interacting with the environment through exposure to the environment. It is through that exposure that these learners should see, smell, touch and hear the information regarding that particular environment. Conflicting realities of human life depicted by the dumping of toxic waste within the residential area of a section of the population of the country and insignificant fines imposed on offenders who dump deadly substances illegally will be exposed to learners. The way in which questions are responded to and comments are dealt with will be investigated in the case study. That implies that the interaction between the learners and the environment being studied will be examined.

Learners acquire knowledge, skills and develop attitudes through attaching meaning to and understanding what they see, touch, smell and hear from the health inspector regarding that specific environment.

To Summarise, constructivism's inquiry in environmental education is based on a relativist nature of reality. In constructivism, reality occurs within a mental framework. Constructivism wishes to facilitate the integration of knowledge that is based on a particular mental framework and action in the environment. Constructivism also has its critics such as positivists and social critical theorists who do not agree with ideas and ideals of inquiring about a topic which is based on environmental education by analysing it systematically and using all senses to give meaning to it.

3.4. CONCLUSION

In this chapter, an attempt was made to describe some identified paradigms and how they relate to environmental education and teaching methods respectively. In describing some of the identified paradigms, certain deductions were made. These are discussed later. It is imperative to note that each of these paradigms (positivism, constructivism and social critical theory) has contributed to this research study in their own way in that they respectively show contrasting views with regard to characteristics, implications for environmental education and for teaching methods. None of them converges with the others in terms of

characteristics, implications for environmental education and for teaching methods. These paradigms also do not address the problem of the study specifically, namely to determine how elements from a variety of paradigms and teaching methods can be used by teachers and environmental educators simultaneously for teaching in an environmentally directed way. It is from these views that the question arises: what are the implications of paradigms for teaching methods in environmental education? This question leads to the discussion of teaching methods for environmental education in chapter four. In the said chapter, the implications of paradigms will therefore be discussed in terms of teaching methods because teaching is based on paradigms and paradigms form the basis of teaching any topic. It is also for that reason that teaching methods will be discussed in chapter four.

CHAPTER FOUR

TEACHING METHODS APPROPRIATE FOR ENVIRONMENTAL EDUCATION

4.1 INTRODUCTION

Teaching methods appropriate for environmental education have become a contentious issue since environmental education for the new school curriculum in the South African educational system was proposed (South Africa. White Paper 1995). As very little research has been done in South Africa to establish which teaching methods are most appropriate for teaching in an environmentally directed way, there is a need to discuss and describe teaching methods suitable for environmental education in this study. Although a variety of issues pertaining to teaching are covered in many sources on environmental education (Greenall: 1987; UNESCO:1989; Leketi: 1992; Lisowski & Williams:1993), very little attention is devoted to teaching methods which are best suited for environmental education in many of these sources. It would therefore be appropriate to discuss teaching methods in this chapter to address the problems outlined in chapter 1.

The term *didactics* will first be described because the interpretation of this term determines the interpretation of the terms *teaching* and *learning*. For the purposes of this study, the term *teaching* will be more frequently referred to than

learning, even though the two are closely related in many sources. Teaching will be referred to more frequently because this study focuses on teaching methods, that is, those methods which make teaching possible. This is illustrated as follows in the form of

a diagram:

TEACHING METHODS

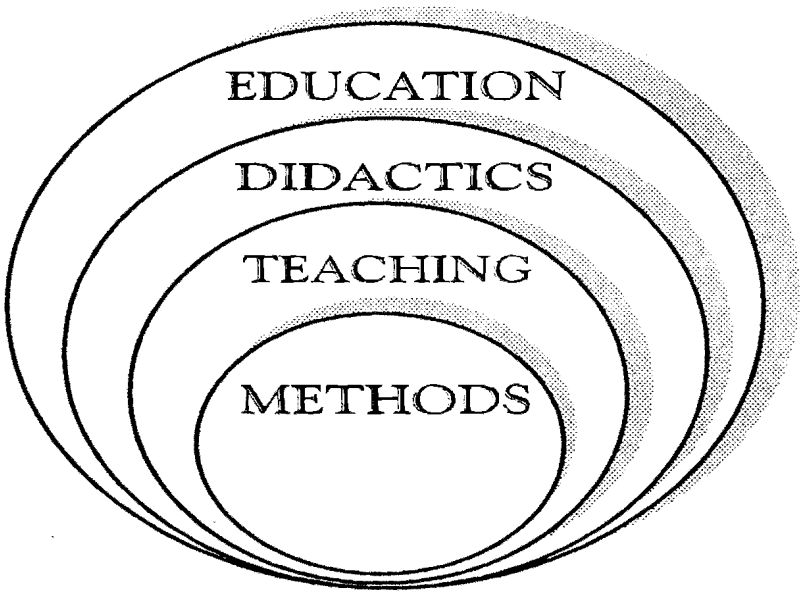


Diagram 4.1

The deduction which can be made from this diagram is that education is a broad field of study. It encompasses didactics, teaching and methods. Didactics focuses primarily on the study of teaching and learning. For the purposes of this study, the focus is on teaching, of which a study of methods forms part.

In the subsequent sections a variety of teaching methods and the possible implications for environmental education will be discussed. This discussion, along with the theoretical perspectives on environmental education discussed in chapter 2 and paradigms discussed in chapter 3, will pave the way for the development of a model for teaching in an environmentally directed way in chapter 5.

4.2 DIDACTICS: TEACHING AND LEARNING

It is necessary first to explain some interpretations of the term *didactics* because this chapter of the study is based on a study of teaching methods which form part of a study of didactics.

Further to the explanation of the conservative and liberal views of education which were discussed in chapter 2, this chapter will commence with a description of the conservative and liberal views of didactics. From these descriptions, a definition of didactics will be formulated for the purpose of the study. The terms *conservative* and *liberal views* will be used in this chapter as they were also used in chapter 2 for the following reasons:

- The term *conservative* is used in this study because it refers to that way of thinking which is narrow in ideas or thought and allows minor changes. It is thus an adult-child relationship in which the adult transmits knowledge to the child so that the child can be intellectually independent.

- The term *liberal* is also used because it refers to that which is progressive, open-minded, accommodating and enhances the possibilities of empowering learners - either adults or children - to construct knowledge on their own and not to have it transmitted to them.

4.2.1 The conservative view of didactics

- The term *didactics* in education has its etymological origin in the Greek word *didaskein* (Van der Stoep & Van der Stoep 1973:1). Originally, this meant to give instruction, to present or convey content, that is, to teach or instruct (Van der Stoep & Van der Stoep 1973:1).
- It is on the basis of this Greek word *didaskein* that Van der Stoep developed his own theory and described didactics in education in general as the theory with regard to teaching (Van der Stoep & Van der Stoep 1973:1). It is also on the basis of Van der Stoep's theory of the term *didactics* that other authors and educationists developed the term in their own ways - as will be seen in the subsequent paragraphs.
- According to the Concise Oxford Dictionary (1984:266) the term *didactics* means the manner of an authoritarian teacher.

A number of educationists such as Stuart, Van Niekerk and McDonald (1985) and Duminy and Sohnge (1987) are in accord with the theory developed by Van der

Stoep and Van der Stoep based on the term *didactics,* namely that it is a theory regarding teaching. They also use elements of this theory to define didactics. For example, *didactics*, according to Stuart et al. (1985:3), is a science which concerns itself with the practice of teaching because it is a prerequisite for the general principles, possible forms and methods of teaching. They further maintain that didactics is a science because it also wishes to discover and describe the universally valid essential characteristics of the teaching-learning phenomenon in all its facets (1985:8). In summarising these notions as indicated by Stuart et al. (1985), didactics could be described as a science which is concerned with the study of teaching and learning which can be proved to be universally valid.

Concurring with the assertion indicated in the previous paragraph, is the definition, as espoused by Duminy and Sohnge (1986:9), that didactics commonly refers to teaching or instruction, but its meaning may also sometimes be restricted to teaching methods. It would seem from the preceding definitions that didactics is a science concerned with teaching and learning from an empirical point of view only. In contradiction to the traditional views of the concept of didactics there are also liberal views of this term. These will now be discussed.

4.2.2 The liberal view of didactics

The views of a number of authors on didactics differ from the liberal view. For example, although Fraser et al. (1990:3) express a conservative view (own

opinion) of the definition of education (refer to chapter 2), they have a liberal view with regard to the definition of the concept of didactics. They refer to didactics as a science which studies teaching and learning. It is a science because it attempts, like other sciences, to come to verified conclusions of reality through the use of specified methods of inquiry (1990:4). As a science (1990:6), it could further be categorised as holistic because it embraces reality as a whole, that is, cultural, economic, social, political, psychological, and other aspects of reality through various means, such as methods and principles.

Arfwedson and Arfwedson (1991:12) refer to didactics as the "whats", "whys" and "hows" of teaching, seen not as separate entities but holistically. They further maintain that didactics deals with questions related to the content of schooling and the teaching of this content - as well as the past and prevailing determinate and developmental influences on the content and on teaching, and consequently, the influence of the contexts of teachers and pupils.

Didactics is regarded by Gundem (1992:65) as a theory of the teaching process. Gundem further notes that didactics also focuses on and stresses teaching methods, that is the 'how-to-do-it' part of teaching. It facilitates the possibility that teachers may act in accordance with theory to seem plausible and obtainable even if it may not be easy (Gundem 1992:65).

Ornstein (1995:185) describes didactics as a flexible, ever-changing field of education within which learners and teachers plan and conduct an optimal educational experience on relevant issues. As learners work to resolve the relevant educational issues, they also encounter specific details, facts and skills.

It would seem that these conservative and liberal views of didactics have some features in common but also differ in some respects. For example, the conservative and liberal views of didactics share the idea that didactics deals with teaching and learning. The conservative and liberal views of didactics both aim at providing knowledge, skills and attitudes through education, though in different ways. The conservative and liberal views of didactics further concur that didactics is a science.

According to the conservative view, however, didactics is a science that is concerned with teaching and learning from an empirical point of view. The liberal view, on the other hand, maintains that didactics is a science which is holistic, in other words, there is a tendency to use the sum of the parts by ordered groupings to form a whole (Concise Oxford Dictionary 1984:495) and not empirical methods (the use of exact scientific methods which are based on exact sciences for performing experiments, observations and testing the soundness of conclusions [Sztompka 1979:30]) only. It is also continuously changing in that it attempts, at all times, to respond to relevant questions of the time. These views are important

for the study in that they add to the development of a definition of the term *didactics*.

4.2.3 Definition of the term *didactics* in the study

Although there are both common and contrasting views pertaining to the definition of the term *didactics* (refer to paragraphs 4.2.1 and 4.2.2), didactics may be defined as follows for the purposes of this study:

Didactics is a lifelong process which studies teaching and learning in terms of how, where and why they take place. This process also includes the use of relevant teaching methods as part of strategies in various environments to accomplish the acquisition of knowledge, skills and a change of attitude.

This definition also relates to some of the characteristics of the paradigm underlying the study (see paragraph 3.2) in that it shows an interdisciplinary nature. When, therefore, accepting, accommodating and using some elements of constructivism, positivism and social critical theory paradigms respectively or collectively, that will probably influence the way in which one thinks about didactics. Therefore, when responding to questions such as the following:

- How does teaching take place?
- Where does teaching take place?
- Why does teaching take place?

it could be said that the definition acknowledges that members of society construct reality (knowledge) as noted in paragraph 3.4.2. It further acknowledges that reality exists within the context of a specific mental framework, as indicated in chapter 3.

4.2.4 Didactics in environmental education

Having defined the term *didactics* in the previous paragraph and *environmental education* in chapter 2, it is imperative that we should discuss didactics in environmental education. Although the concepts *didactics* and *environmental education*, as described in this study, are dissimilar in general, they have elements which are compatible and relate to one another because of a number of things they have in common. Some of these are outlined in the following figure:

DIDACTICS	**ENVIRONMENTAL EDUCATION**
- is a process in education	- is an approach to education
• is lifelong • uses strategies such as teaching methods • makes acquisition of knowledge, skills, and change of attitude possible • facilitates learning	

Environmental education and didactics differ in terms of definitions (refer to paragraphs 2.3.3.3 and 4.2.3). For example, environmental education is an approach to education and didactics is a process in education.

These two terms are compatible and relate to each other in that they are both lifelong processes. They can both facilitate learners in acquiring knowledge and skills, and in changing attitudes towards the environment by using a variety of teaching strategies such as teaching methods.

For the purposes of this study, teaching methods will form part of the focal and starting point of the development of a model of teaching in an environmentally directed way in chapter 5.

If didactics is about teaching and learning - as maintained directly or indirectly in the preceding definitions, including that of the study (see paragraph 4.2.3) - then teaching methods relate to both teaching and learning. It may therefore be concluded that for effective teaching and learning to take place respectively or concurrently in any didactic environment, teaching methods have to be used in one way or another. This means that teaching and learning are made possible through the use of, among others, teaching methods. It is for this reason that this study focuses on teaching methods.

4.3 TEACHING METHODS

In this paragraph, the focus will be on defining teaching and various teaching methods. This will be followed by a characterisation of identified teaching methods and the possible implication teaching methods may have for environmental education.

4.3.1 Teaching

Educationists describe teaching in different ways. The word *teaching* is derived from "taecan" (Old English) which means to show. It also means to direct; impart knowledge or art to; to guide the studies of; to exhibit so as to impress upon the mind; to accustom or counsel (Van der Stoep & Louw 1984:127).

Basing their theory on the meaning of the word *teaching*, Van der Stoep and Van der Stoep (1973:123) maintain that teaching is an aid that an adult gives to a person who is not mature, with the aim of supporting him or her on the way to adulthood.

Duminy and Sohnge (1987:52) define teaching as a process of unlocking or unfolding reality, of the life-world that surrounds the child, through knowledge transmitted to the child. On the other hand, Fraser et al. (1990:198) define teaching as an activity which is aimed at presenting certain learning content

through instruction to someone else in such a way that the person learns something from it.

While Duminy and Sohnge (1987:52) and Fraser et al. (1990

:198) respectively concur that teaching is a process and an activity of transmitting and presenting learning content to the learner, Elser and Sciortino (1991:5) define teaching as both an art and a science.

In justifying their assertion, Elser and Sciortino (1991:5) maintain that teaching is an art because it facilitates the feeling as well as the knowledge about when to talk and when to listen, when to proceed with a lesson and when to change its entire planning. They (1991:5) further maintain that teaching is also a science because it indicates specific acts of the teacher and certain defined learning environments which may cause specific learners' behaviour (1991:5).

In summarising their definition, Elser and Sciortino (1991:5) maintain that for the effective teacher, both the art and the science of teaching are complementary. As the art of teaching therefore supports the science of teaching, the science of teaching also supports the art of teaching (1991:5).

Further to the preceding assertion, Clark and Starr (1991:8) also state that teaching is a task of bringing about effective learning in students, especially through the use of specific teaching methods.

Davis (1993:346) maintains that teaching is a process of communication between a teacher and a student about a subject within a setting. Teaching is also regarded by Wilken and Sankey (1994:183) as a practical activity that can be engaged in intelligently and critically with the knowledge of the content of what is to be taught, the know-how of communicating it, and the cognitive tendency and capacity to grow through reflection and criticism.

In conclusion, teaching could be defined as a lifelong facilitatory process. By this process a learner is empowered to acquire knowledge and skills, and to develop an attitude through mediating specific learning content. This mediation takes place and could be facilitated through the use of a variety of teaching methods as a part of teaching strategies and can be disseminated through a variety of underlying paradigms.

4.3.2 Definition of *teaching methods*

Teaching methods are defined and classified in various ways by various educationists. Some definitions of teaching methods will be given and will be

followed by a classification of teaching methods and their possible implications for environmental education.

Shavelson (1976:383) indicates that teaching methods may be defined as patterns of teacher behaviour that are recurrent, applicable to various subject matters and relevant to learning. To Elser and Sciortino (1991:5), teaching methods are patterns of practices which account for effectiveness in teaching.

Teaching methods are, according to Clark and Starr (1991:9), the means by which the teacher attempts to bring about the desired information which has to be learned in the process of teaching. They are the various instructional and learning activities which are selected and used by a teacher to expose learning content and skills during teaching (Fraser et al. 1993:213).

From the preceding definitions, it would seem that teaching methods are the means through which knowledge (and either skills or attitudes or both) can be imparted to learners during teaching. The ideas generated from the preceding definitions will be drawn on in the development of the definition of the study. While educationists differ with regard to definitions of teaching methods, in this study, teaching methods will be regarded as the means through which learners acquire knowledge and skills and through which they could change their attitudes in the process of both learning and teaching.

Educationists do not, without reservation, accept all teaching methods for use. Some educationists have reservations about the use of teaching methods such as the textbook and rote-learning (Curriculum 2005:6). Many maintain that these are teacher-centred and convert learners into passive participants instead of active learners during the lesson. Although this is indeed the case, a classification of teaching methods and possible implications for environmental education will be discussed.

4.4 CLASSIFICATION OF TEACHING METHODS AND POSSIBLE IMPLICATIONS FOR ENVIRONMENTAL EDUCATION

Some teaching methods have been identified and will be discussed in the study (see Clark & Starr 1991; Duminy & Sohnge 1987; Fraser et al. 1993; Kruger & Muller 1988; Gall & Gall 1976; Jacobs & Gawe 1996; Leonard, Fallon & Von Arx 1972; Ornstein 1992; Ornstein 1995; Stanford & Stanford 1969; Stuart et al. 1985; Werner & Bower 1983).

Teaching methods include the following:

1. Narrative method
2. Textbook method
3. Cooperative learning method
4. Demonstration method

5. Discovery method
6. Discussion method
7. Drill method
8. Experimental method
9. Free-activity method
10. Problem-solving method
11. Project method
12. Question-and-answer method

In elaborating on each of those teaching methods, the following characteristics of the methods will be highlighted:

1. The main aims of the teaching method concerned
2. Nature of teacher involvement
3. Nature of learner involvement
4. Commonly used teaching aids or media
5. Nature of implication for environmental education

4.4.1 Narrative method

a) Main aims

The narrative method aims at facilitating a better understanding of the learning content (Werner & Bower 1983:13-1; Fraser et al. 1993:154; Ornstein 1995:276).

b) Nature of teacher involvement

In this method of teaching, information is communicated to learners through oral reports, telling them stories, et cetera (Werner & Bower 1983:1-7; Ornstein 1992:410; Fraser et al. 1993:154; Ornstein 1995:277).

c) Nature of learner involvement

Learners listen passively (Fraser et al. 1993:154). In some cases learners repeat what their teacher said either verbally or in writing (Werner & Bower 1983:13-7; Ornstein 1995:277).

d) Commonly used teaching aids or media

Debates, guest speakers, oral reports or stories are used as teaching aids or media (Werner & Bower 1983:13-1; Ornstein 1992:420; Fraser et al. 1993:154).

e) Implications of the narrative method for environmental education

It would seem from the foregoing characteristics of the narrative method that this method of teaching could facilitate the acquisition of knowledge and a change of attitude in environmental education through telling. For example, in the narrative method of teaching, a teacher narrates to learners the history of environmental education, thereby creating a teaching-learning environment. That may lead to learners developing a different attitude towards the environment.

4.4.2 Textbook method

a) Main aims

This method of teaching facilitates the dissemination of information from a textbook to learners in any learning environment (Clark & Starr 1991:404; Fraser et al. 1993:157).

b) Nature of teacher involvement

The teacher endorses a point of view and promotes better understanding of the learning content (Werner & Bower 1983:8-8; Ornstein 1992:405).

c) Nature of learner involvement

Learners listen, read or write class work or homework or even take notes while the textbook method of teaching is being used (Werner & Bower 1983:13-7; Fraser et al. 1993:157; Ornstein 1992:405).

d) Commonly used teaching aids or media

Prescribed or recommended textbooks are used when a textbook method of teaching is followed (Werner & Bower 1983:13; Clark & Starr 1991:404; Fraser et al. 1993:157; Ornstein 1992:145).

e) Implications of the textbook method for environmental education

Textbooks are used to disseminate information and acquire knowledge in environmental education. They also enable learners to acquire certain skills and facilitate a change of attitude towards certain information relating to the environment. For example, a teacher could ask the learners to use a textbook in order to identify the characteristics of a polluted atmosphere in a specific environment. In so doing, learners acquire knowledge of and skills in identifying the characteristics of a polluted atmosphere. Both knowledge and skills thus acquired can cause them to change their attitudes towards a polluted atmosphere.

4.4.3 Cooperative learning as a teaching method

a) Main aim

It facilitates the acquisition of knowledge through working together on specified tasks (Clark & Starr 1991: 257; Fraser et al. 1993: 162; Ornstein 1992: 501). It stimulates the development of alternative perspectives through exposure to a multiplicity of viewpoints (Werner & Bower 1983: 13-5; Ornstein 1995: 164).

b) Nature of teacher involvement

A teacher divides learners into small groups of three to six and engages them in specific learning tasks which require the learners' mutual collaboration and support (Werner & Bower 1983: 13-5; Clark & Starr 1991: 257; Ornstein 1995: 164).

c) Nature of learner involvement

Learners mutually collaborate and support each other in the process of learning. Consequently, there is

(i) positive interdependence (where learners understand that they depend on one another to ensure success for the entire group);

(ii) face-to-face interaction (where learners discuss given tasks and learn together and, in the process, learn from one another); and

(iii) a wholesome relationship (where learners are provided with certain skills, are expected to assume roles such as leadership roles and have to resolve conflicts within the classroom or group itself (Clark & Starr 1991: 257; Ornstein 1992: 501; Fraser et al. 1993: 162; Ornstein 1995: 164).

d) Commonly used teaching aids or media

Teaching aids which are used include specific learning tasks which learners are expected to complete within a specified time frame (Werner & Bower 1983: 13-5; Clark & Starr 1991: 257; Ornstein 1995: 164).

e) Implications of a cooperative learning method for environmental education

From the above characteristics of cooperative learning as a teaching method, this method of teaching would appear to facilitate the acquisition of knowledge, skills and changed attitudes for environmental education. This method of teaching would, for example, be suitable for use in a situation where learners are given the task of preparing a holiday programme on environmental education for a group of youths in a built area.

4.4.4 Demonstration method

a) Main aims

It facilitates teaching and better understanding of the learning content to impart skills through the use of such senses as sight, touch and smell (Clark & Starr 1991:218; Fraser et al. 1993:159).

b) Nature of teacher involvement

In a demonstration method of teaching, a teacher sets the stage for learners, demonstrating the procedure and explaining the reasons why specific steps have to be followed (Werner & Bower 1983:9-10; Clark & Starr 1991:218).

c) Nature of learner involvement

Learners use senses such as sight, touch and taste to acquire knowledge and skills and develop specific attitudes (Fraser et al. 1993:158).

d) Commonly used teaching aids or media

Relevant and necessary equipment for a particular demonstration could be used in this method of teaching (Werner & Bower 1983:9-10; Clark & Starr 1991:218).

e) Implications of the demonstration method for environmental education

It would seem that the demonstration method of teaching could facilitate the acquisition of knowledge and skills in environmental education. In this method of teaching, a teacher can, for example, demonstrate to the learners how to conduct a water test.

4.4.5 Discovery method

a) Main aims

The main aim of this method of teaching is to let the learners themselves discover information (Stuart et al.1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275).

b) Nature of teacher involvement

In the discovery method, the teacher plays the role of facilitator (Stuart et al. 1985:71). The teacher raises questions which arouse learners' interest and the learners are expected to discover information on their own by investigating the issues concerned - thinking critically about these issues and drawing reasonable conclusions about them (Stuart et al. 1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275).

The discovery method uses tactics in which the teacher

- asks learners to identify a topic of investigation;
- asks learners to gather data on the topic;
- checks the learners' way of gathering data;
- asks thought-provoking questions regarding the gathered data;
- asks for the explanation and interpretation of the hypotheses (theory or assumption);
- asks learners to test their hypotheses against the collected data and at the same time checking their thinking skills and logic;
- asks learners to draw conclusions from their data;
- questions these conclusions to facilitate better understanding; and

- asks learners to apply their principles and conclusions to their particular situations (Clark & Starr 1991:276).

In this method of teaching, the teacher may use any of the following six categories of the discovery method (Clark & Starr 1991:277) to facilitate teaching:

(1) Socratic method: In this method learners are asked a series of leading questions up to a point where they have to look closely at their own ideas and think rigorously for themselves. Thereafter they should be able to develop their own conclusions and draw inferences (Clark & Starr 1991:277).

(2) Controlled or guided discussion: This entails providing learners with information by means of films or some other expository device, lectures, reading and using probing questions which guide learners to derive principles and to draw conclusions from the presented material (Clark & Starr 1991:278).

(3) Springboard techniques: Any type of presentation that can be used as a 'jumping-off' point for a discussion, research project or any inquiry activity is an example of a springboard technique: moving pictures, still pictures, role- playing, models and textbook selections, are some of the facilities that can be used as a springboard. They can be followed by thought-provoking questions that will bring out ideas and relationships and facilitate the

drawing of conclusions from discovered information (Clark & Starr 1991:278).

(4) Problem-solving approach: This involves a form of trial-and-error learning which provides learners with a chance to learn from their successes or failures. For learning to be effective through this strategy, a learner would have to

- become aware of and identify a problem;
- define and limit a problem;
- gather evidence that may help to solve the problem;
- form a hypothesis of what the solution to the problem may be;
- test the hypothesis against the collected data;
- analyse and interpret the data; and
- draw conclusions and report the findings which may be either positive or negative (Clark & Starr 1991:279).

(5) Case study method: This is, a problem-solving technique in which learners study individual cases which represent a type of institution, issue, problem situation, et cetera, in order to draw conclusions about the type as a whole. Case studies are useful because they give learners insight into knotty problems and also provide them with opportunities to study these problems in depth. The procedure for conducting a case study may include the following steps:

- Selecting a topic to study
- having access to any relevant material regarding the topic of the study, for example, reading material, films, pictures, tapes and laboratory experiments
- Studying the case after having been introduced to the problem, ground rules, questions to be considered and the goal of the study
- Interpreting data, noting the findings and drawing conclusions
- Sharing ideas with other learners regarding the findings and conclusions made in the study (Clark & Starr 1991:282)

(6) Research project: This entails a life-like learning task which involves investigating and solving a problem by an individual or a group of learners, for example, in order to attain a definite goal of personal value. In this research, the procedure is similar to that of problem-solving.

c) Nature of learner involvement

Learners play an active role in discovering, on their own, information that meets their needs (Clark & Starr 1991:279; Ornstein 1995:165). They further discover the interrelationships that are often missed in the traditional presentations of lesson contents (Ornstein 1995:165).

d) Commonly used teaching aids or media

Teaching media or aids which are used in this method of teaching include identifiable, challenging and realistic questions or problems which warrant investigation and solution (Stuart et al. 1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275). Relevant instruments can be used, in addition, to facilitate the discovery of information.

e) Implications of the discovery method for environmental education

This method of teaching would facilitate learners' acquisition of knowledge, skills and a change of attitude towards the environment. Learners could, for example, be given water test kits by their teacher and be asked to test the level of pollution and its impact on the aquatic species in a stream which passes near the school.

4.4.6 Discussion method

a) Main aims

As a purposely organised, skilful method of teaching in which ideas are shared between teachers and learners and among the learners themselves in a dynamic

and universal way (Leonard et al. 1972:223), the discussion method of teaching aims at:

(a) helping learners to air their views, to find out what others (learners or teachers) think, to re-evaluate personal opinions, to solve problems and gain feelings of acceptance and belonging (Stanford & Stanford 1969:15; Clark & Starr 1991:238); and

(b) increasing learners' active involvement in meaningful learning activities, which occurs when a group of persons (normally in the role of facilitator and participants) assemble at a designated place to communicate interactively, using either verbal or any other listening or understandable means in order to achieve learning objectives (Gall & Gall 1976:168).

b) Nature of teacher involvement

The teacher shares ideas with and expresses views to the learners during discussions (Leonard et al. 1972:223; Gall & Gall 1976:168; Clark & Starr 1991:238; Jacobs & Gawe 1996:212).

c) Nature of learner involvement

Learners actively take part in sharing ideas and expressing their views during discussions (Leonard et al. 1972: 223; Gall & Gall 1976: 168; Clark & Starr 1991: 238; Fraser et al. 1993: 154).

Some of the ways in which learners could be engaged in discussions include the following:

- CLASSMATE DISCUSSIONS: These involve the participation of all learners in a classroom (Leonard et al. 1972:223). To ensure that a discussion is productive, a teacher needs to introduce and clarify the pre-arranged topic of discussion and then allow the exchange of ideas related to the topic (Fraser et al. 1993:154). The exchange of views takes place between a teacher and learners and among the learners themselves.

- SMALL GROUP DISCUSSIONS: This type of discussion may consist of three to six members, depending on the size of the class and the subject which is taught. The teacher interferes as little as possible in the discussion and the learners are encouraged to work collectively and independent of their teacher (Leonard et al. 1972:223; Jacobs & Gawe 1996:217).

- PANEL DISCUSSION: A panel could consist of four or five participants who discuss the topic among themselves and respond to questions which are posed from the floor (Leonard et al. 1972: 223; Fraser et al. 1993: 155). Learners who are panellists are supposed to research and study all relevant and available information on the topic in order to acquire adequate knowledge relating to it. After questioning time, a summary of all important facts regarding the discussion should be presented by the facilitator, who could be the teacher.

- BRAINSTORMING EXERCISES: This type of exercise could be performed by small groups within a classroom. Examples are the following:

  - A teacher could pose a problem to learners who will "attack" it with a hail of ideas which are all "correct".
  - After all ideas have been exhausted, the priority stage is engaged into, that is, all ideas are carefully examined and categorised in terms of their quality.
  - These ideas are used to solve the problem in hand.
  - The entire process enables learners to develop a sense of self-worth and confidence (Jacobs & Gawe 1996:218).

- SYMPOSIUM: A symposium is another category of the discussion method in which participants present speeches on the same topic from different perspectives such as the economic, social and political perspectives (Jacobs & Gawe 1996: 219).

  This type of discussion requires thorough preparation by the presenters, because presentations are often followed by open discussions where other participants from the floor may need clarification, ask questions, or make inputs or even propose new ideas (Jacobs & Gawe 1996:219).

- DEBATES: A debate is also a formal discussion in which participants are divided into two opposing sides, namely those who support and those who oppose the other team (Jacobs & Gawe 1996:220). For example, a topic such as "Industries are justified in depositing harmful wastes into streams or rivers" could be debated between two opposing sides: one affirms and the other opposes that view.

d) Commonly used teaching aids or media

Any identifiable, challenging and realistic questions or problems which warrant investigation and solution could form the media for a discussion (Stuart et al. 1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275).

e) Implications of the discussion method for environmental education

It is now imperative to note the assumption that the discussion method of teaching could facilitate the acquisition of knowledge, skills and attitudes for environmental education in any of the following ways:

1) Policy discussions which require participants to see the need for policy and take a position with regard to it or act on that particular issue

2) Explaining particular positions in discussions, that is, making it possible for learners to identify a problem, analyse its causes and provide reasons in response to questions which arise in the process of solving it

3) A predictive discussion in which participants are given the opportunity to predict the likely outcomes of a given situation

4) Problem-solving discussions which require participants to verify any predicted outcomes to given situations and thus solve the problems which face them

5) Debriefing discussions in which there are reviews of shared activities, in other words, a situation where learners discuss their respective experiences after a field trip in which they were collectively engaged (Gall & Gall 1976:168; Jacobs & Gawe 1996:227)

Clark and Starr (1991:238), in agreement with the views expressed for environmental education in the preceding paragraph, maintain that for a discussion to be successful, participants need sufficient background information on the agenda of a discussion, to discuss the issues at hand, basing their argument on facts which facilitate the conclusion reached. In that process, all participants think for themselves and each has the right to express her or his view, no matter how unpopular it may be (Clark & Starr 1991:238).

4.4.7 Drill method

a) Main aims

The drill method of teaching facilitates learning through memorisation of information as well as repeated engagement in specific sections of the learning content to facilitate better knowledge of that content for other situations (Fraser et al. 1993:161).

b) Nature of teacher involvement

The teacher engages learners in memorising facts so that they can acquire knowledge (Werner & Bower 1983:14-2; Fraser et al. 1993:161).

c) Nature of learner involvement

Learners memorise facts to reinforce and solidify knowledge (Clark & Starr 1991:393; Fraser et al. 1993:161).

d) Commonly used teaching aids or media

Any learning content or sections of it could form the teaching aids or media (Werner & Bower 1983:14-3; Fraser et al. 1993:161).

e) Implications of drill for environmental education

It would seem that the drill method is important to environmental education because it could facilitate the acquisition of knowledge through the memorisation of facts relating to environmental education. For example, learners could be made to memorise the formula for measuring the height of a tree in an environment.

4.4.8 Experimental method

a) Main aims

This method aims at discovering reality by means of examples or, where it is possible, actual samples to facilitate effective teaching and reaching generalised conclusions which are based on the findings (Fraser et al. 1993:160).

b) Nature of teacher involvement

The teacher exposes learners to experiments and engages them in discovering reality by allowing them to conduct these experiments on their own (Fraser et al. 1993:160).

c) Nature of learner involvement

Learners actively take part in conducting experiments themselves (Fraser et al. 1993:161).

d) Commonly used teaching aids of media

Experimental equipment is used (Clark & Starr 1991:393; Fraser et al. 1993:161).

e) Implications of the experimental method for environmental education

From the preceding characteristics of the experimental method, it would seem that this method of teaching could be used for environmental education as follows:

- Exploratory learning: That entails allowing learners to gain insight themselves through exploration and self-discovery.

- Excursions: Learners are taken out of the formal school premises so that teaching can take place in a totally different environment. That can further facilitate the observation of new things, the collection of data and examples themselves and self-discovery and exploration of the environment by the learners.

- Laboratory activities: Learners are shown and told what to do, and given opportunities to explore and collect data themselves and further exercise their skills by verifying it scientifically.

- Projects: This entails allowing learners to embark on specific projects such as building models, filming videos and drawing sketches to increase their knowledge and develop their skills (Fraser et al. 1993:160).

This method of teaching is used more often by actively engaging learners in objective sciences such as natural and living sciences.

4.4.9 Free activity method

a) Main aims

This method aims at engaging learners in activities which will enable them to acquire knowledge through self-activity (Fraser et al. 1993:158; Ornstein 1995:163).

b) Nature of teacher involvement

The teacher only plays the role of a facilitator and guides learners where it is required (Fraser et al. 1993: 158). In guiding learners, the teacher may narrate information as set out in paragraph 4.4.1.

c) Nature of learner involvement

Learners play an active role in the teacher-learning situation by participating in the activities (Fraser et al. 1993: 158).

d) Commonly used teaching aids or media

Any media intended for the lesson could be used for that purpose (Fraser et al. 1993:158).

e) Implications of free activity for environmental education

This method probably satisfies the requirement for the acquisition of environmental knowledge, skills and attitudes because learners acquire knowledge and skills and could change their attitudes by active participation in specified learning activities. For example, learners could take part freely in an audit of the school environment whereby they determine the existing environmental problems in a school and determine how these problems could be solved.

4.4.10 Problem-solving method

a) Main aims

This method aims at allowing learners to discover phenomena on their own with the intention of solving specified problems (Clark & Starr 1991:279).

b) Nature of teacher involvement

Teachers guide learners to identify and solve specified problems (Clark & Starr 1991:279). Also refer to paragraph 3.4.5 in this regard.

c) Nature of learner involvement

Learners are actively involved in solving the problems at hand (Clark & Starr 1991:279).

d) Commonly used teaching aids or media

Identifiable, realistic, challenging problems and any other relevant teaching aids or media can be used (Duminy & Sohnge 1987:78; Clark & Starr 1991:279). Also refer to paragraph 3.4.5.

e) Implications of problem-solving for environmental education

The problem-solving method could facilitate the acquisition of knowledge, skills and change of attitudes in learners in environmental education. An example of this could be the use of the problem-solving method where learners are given a problem concerning littering in the school environment as a task and are asked to recommend solutions to that problem.

4.4.11 Project method

a) Main aims

In the project method of teaching, learners are given a project to work on. They are also given the opportunity to discover information on their own and solve the problem in the process of working on the project (Stuart et al. 1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275).

b) Nature of teacher involvement

The teacher plays the role of a facilitator in the project method (Stuart et al. 1985:71). That implies that the teacher raises questions on a particular issue which arouses learners' interest. They then investigate the issue in hand by thinking critically and drawing reasonable conclusions about it (Stuart et al. 1985:71; Kruger & Muller 1988:82; Clark & Starr 1991:275).

c) Nature of learner involvement

Learners play an active role in the project method in that they investigate and discover, on their own, information that meets their needs (Clark & Starr 1991:279; Ornstein 1995:165).

d) Commonly used teaching aids or media

Teaching aids used in this method of teaching include anything that is relevant and which can be used for conducting a project (Clark & Starr 1991:275).

e) Project method in environmental education

From the discussion on this method of teaching, it is clear that the project method can facilitate the acquisition of knowledge and skills, and a change of attitudes towards the environment. For example, learners can use the project method to acquire knowledge and skills and to change their attitudes towards the environment when given the project of auditing the school environment.

4.4.12 Question-and-answer method

a) Main aims

According to Fraser et al. (1993:156) the question-and-answer method ideally aims at introducing a lesson.

b) Nature of teacher involvement

This method of teaching may be used where the teacher wishes to find out what the learners already know about the topic (Fraser et al. 1993:156).

c) Nature of learner involvement

Learners actively respond to questions asked by the teacher (Fraser et al. 1993:156).

d) Commonly used teaching aids or media

Teaching aids or media in this method of teaching are questions which may take the form of an oral or written test or examination (Fraser et al. 1993:156).

e) Implications of the question-and-answer method for environmental education

From the discussion on this method of teaching, it would seem that it could facilitate the acquisition of environmental knowledge.

It is now essential to summarise the teaching methods and their implications for environmental education to facilitate the development of the programme study in

chapter 4 of this study. These will be summarised in accordance with the pattern in which they were discussed.

4.5 SUMMARY

The general impression gathered from the teaching methods which were discussed in this chapter include the following:

a) Main aims

Teaching takes place with the aid of teaching methods.

The teaching methods facilitate learning in different ways.

b) Nature of teacher involvement

Teachers are involved as they facilitate learning.

c) Nature of learner involvement

Learners take part, either actively or passively, in the teaching-learning situation, depending on the method or methods used.

d) Commonly used teaching aids or media

Relevant and appropriate teaching aids or media are used to facilitate teaching and learning. These may differ from topic to topic, and also depend on the method of teaching which is used at the time. For example, the media or teaching aid which is used in the textbook method may not necessarily be relevant for use in the project method.

e) Nature of the teaching methods used in environmental education

On the basis of all the foregoing information, it is evident that a variety of elements of teaching methods could be used simultaneously to facilitate teaching in an environmentally directed way, depending on the topic and the context within which a topic is taught.

4.6 CONCLUSION

In this chapter, an attempt was made to discuss teaching methods appropriate for environmental education. The terms *didactics* and *teaching* were defined and some identified teaching methods were reviewed. It is on the basis of this review that certain teaching methods were identified and classified in the context of the

study. In this classification, it was noted that some teaching methods have certain features in common.

The implications of teaching methods for environmental education were also reflected on. The question of what the implications of teaching methods for environmental education are, was answered. The answer to this question, together with the rest of the content in chapters 2, 3 and 4, will facilitate the development of chapter 5 of the research study.

CHAPTER FIVE

DEVELOPING AN INTERPRETIVE MODEL FOR TEACHING IN AN ENVIRONMENTALLY DIRECTED WAY

5.1 INTRODUCTION

In chapters 2, 3 and 4 some aspects of the theory of environmental education were discussed. In the process environmental education was analysed and the definition, nature, aims and objectives of environmental education were discussed. Paradigms influencing environmental education and teaching methods for environmental education were also investigated. During the study of the theory of environmental education, a solution to the problem of the study was not found, namely establishing to what extent elements from a variety of paradigms are applicable during teaching for the environment and a variety of teaching methods could be used simultaneously to teach in an environmentally directed way. Still, the theory mentioned is important in terms of this study as it was used to develop an interpretive model for teaching in an environmentally directed way. The assumption made during the development of this model is that the model could form part of the solution to the problem of the study (refer to paragraph 1.2.2).

Many people who have expertise in environmental education in formal education

and are interested in environmental education and with whom the author shared ideas on environmental education seem to view environmental education from limited perspectives. They therefore tend to be directed and influenced by one single paradigm, such as constructivism, positivism or the social critical theory to teach a topic dealing with environmental education at a time. Teaching methods such as the cooperative method, demonstration method, discussion method, narrative method, and question-and-answer method used in environmental education influence the way some people teach. Teachers, and environmental educators, for example, use the demonstration and experimental methods during their teaching and adhere to a paradigm such as positivism while ignoring the use of other teaching methods and other paradigms in which quantitative methods of research are not used in teaching and learning. This assertion facilitates the development of the model which could be interpreted for teaching in an environmentally directed way.

5.2 DEVELOPING A MODEL

Models are developed for a variety of purposes to solve problems which could exist. Therefore, it is important to know the real meaning of a model. The values (both general and specific) of a model are also important because they contextualise the development of a model. In paragraphs 5.2.1 - 5.2.3, the term *model* will be defined to ensure that the origin of the development of a model would be well understood in the context of this research. That will be followed

by an indication of the value of a model in general and the value of a model in terms of the study.

5.2.1 Defining a model

The term *model* is defined differently by various authors. In the Webster's Dictionary (1954:333), a model is defined as a pattern of something to be made or reproduced. It is an example for imitation; a standard copy. According to Potter et al. (1981:388) a model is a limited-purpose scientific device that aids in exploring certain segments of the data universe and testing certain propositions. The Concise Oxford Dictionary of Current English (1982:650) describes a model as a design, style of structure or thing which is proposed for imitation. A model is, according to Wallace (1994:332), any system of relations used to represent another system of relations. From the preceding definitions of a model, a model could be characterised as a design which is tailored in a specific pattern to produce a desired shape which could be imitated.

5.2.2 The value of a model in general

Models are regarded by many people as useful. The general value of models is interpreted differently by different authors. For example, the general value of a model is regarded as

- testing how far a particular analogy can be pushed in certain directions

(Potter et al. 1981:388);

- allowing a person to obtain a pictorial representation of ideas which could take the form of a diagram and relate these to another representation which can be regarded as equivalent or not, as the case and intended applications and uses may allow (Wallace 1994:322); and
- giving direction or a picture of a study in what a study is all about (Wallace 1994; 322).

In addition to the fact that models have a general value which is interpreted differently by different authors, they also have a specific value (refer to paragraph 5.2.3) which is important in the context of this study.

5.2.3 The value of a model for this study

The value of a model for this study will be to show to what extent elements from a variety of paradigms and teaching methods could be used simultaneously to teach in an environmentally directed way depending on the topic and the context within which a topic is taught (refer to section 1.4). This value of a model will be depicted by designing a model which is tailored in a specific pattern to produce a desired shape or results (see definition of a model - paragraph 5.2.1). To develop a model which can be used to solve the problem statement of this study, the amoeba organism will be used as a metaphor.

5.3 THE AMOEBA METAPHOR

An amoeba, a unicellular living organism, is an appropriate organism to be used for the model as some of its characteristics can be used to explain the characteristics of environmental education.

The amoeba will be used as a metaphor in this study. This is done by comparing an amoeba as a living organism with environmental education as a concept, although it is recognised that they cannot be directly compared as such. Therefore some of the characteristics of an amoeba will be used in the metaphor to facilitate the development of the model. These will be noted in the description and discussion of the characteristics of the amoeba (refer to paragraphs 5.3.1. - 5.3.3).

In this chapter, a metaphor will be used to show

- the similarities between the characteristics of an amoeba and paradigmatic positions;
- the similarities between characteristics of an amoeba and the use of teaching methods; and
- that different teaching methods and paradigms may be applicable at the same time.

The implications of teaching methods (refer to paragraph 4.4) and paradigms (as discussed in paragraph 3.3) will be used as a frame of reference to explain the three uses of a metaphor mentioned above. Therefore the relevant characteristics of an amoeba have to be discussed.

THE STRUCTURE OF AN AMOEBA

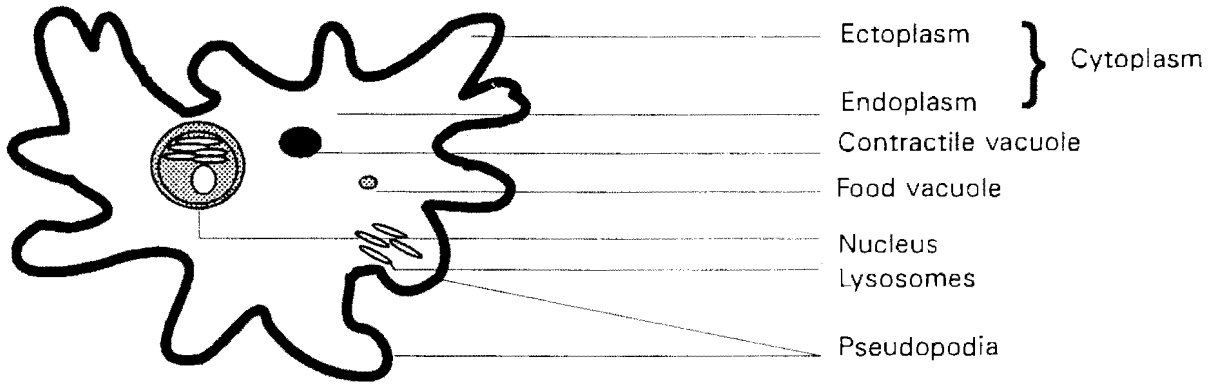


Diagram 5.1

5.3.1 Some characteristics of an amoeba organism

1. STRUCTURE

- An amoeba is a unicellular living organism. It consists of a protoplasm, which can be divided into a cytoplasm and a nucleus. In the cytoplasm cell organelles such as the contractile vacuole, food vacuoles and lysosomes are found. The nucleus makes the process of cell division or reproduction or both possible.

2. SHAPE

- The amoeba is irregular in shape (asymmetrical). An amoeba can also form protrusions called pseudopodia. By means of these pseudopodia, it can change shape and 'catch' or engulf food particles for nutrition purposes.

3. MOVEMENT

- An amoeba can change shape, for example, by moving away from its location. In so doing, it is in a position to excrete all unnecessary substances.

These characteristics of the amoeba were derived from the works of the authors Hatfield (1963), Austoker and Cheeseman (1969) and Austoker and Eloff (1987).

5.3.2 Metaphorical implications of the characteristics of an amoeba for environmental education

The characteristics of an amoeba will be used metaphorically to show their implications for environmental education in terms of structure, shape and movement.

1. STRUCTURE

An amoeba's basic components are a cytoplasm and a nucleus whereas the basic components of environmental education are the concepts 'environment' and 'education'. In the cytoplasm of the amoeba are some components such as the food vacuole, contractile vacuole and lysosomes. The environment, for example, consists of components such as animals, plants, the land, air and water. The nucleus of an amoeba contains genetic material which is influential in the heredity of siblings of an amoeba. Education, like an amoeba, also contains "genetic material" which is influential in the "heredity" of learners. Certain concepts are, for example, learnt from people of previous generations.

The amoeba is unicellular although the 'components' could differ from amoeba to amoeba. The same principle applies to environmental education. Although environmental education is one concept it could be interpreted differently by various people depending on their own contexts (environments) (refer to paragraph 2.3.3).

2. SHAPE

Like an amoeba, which is unicellular but can change its shape, depending on the environment and the circumstances in which it occurs, environmental education may change in meaning, depending on the environment and the context within

which it is constructed. In environmental education, in other words, reality is socially constructed by societal members and could have a multiplicity of meanings, depending on the environment and the context within which it is constructed.

An amoeba may form protrusions, called pseudopodia, in the process of changing its shape. It is by means of these pseudopodia that an amoeba can engulf and ingest food particles for nutrition purposes or even excrete unwanted particles or move from place to place. The change in shape can metaphorically be related to environmental education because environmental educators changes the meaning (shape) of the concept environmental education mainly because of their own varying backgrounds. Environmental education is multidisciplinary. Sometimes it is clear from the views of environmental educators that they come from a positivist, constructivist or critical theory alligned position. The exclusive use of the RDDA (Research, Develop, Disseminate and Adopt data - refer to chapter 3) research method, for instance shows a onesided positivist approach (refer to Sztompka 1979; Hungerford and Volk 1990; Robottom & Hart 1993). Sometimes, however, there are indications that the 'shape' of environmental education is changed because of environmental educators' own shifting paradigms.

3. MOVEMENT

An amoeba can change shape by moving away from its original position. This

characteristic of the organism relates to the previous section on shape, but has a further connection that the organism changes shape to move away from its original position. In the same way, environmental education often moves away from its original position. Through the years of its development it has often changed from original positions such as emphasis on outdoor education or conservation education, resource management (Disinger and or Irwin 19...) to environmental education per se (Irwin 19... ; Loubser 19...) and education for sustainability (Shallcross 19...). These changes are not necessarily wrong but can be seen as a emancipatory action-orientated approach (source?) because environmental education has changed its existing position to 'improving' it to something else.

From the description above it has not only been attempted to relate the characteristics of environmental education to an amoeba (to build a model), but it has been attempted to show that different positions in environmental education are possible and it will also be attempted to show how different positions are possible simultaneously.

5.3.3 Implications of the paradigm underlying this study towards the development of the model for environmental education

Three views on paradigms were presented earlier (refer to paragraph 3.2) in the discussion of the study. A paradigm was defined for this study on the basis of

these views on paradigms (refer to paragraph 3.2).

Implications of the mentioned paradigm which underlies the development of the model, and can be described as a systematic way of identifying, perceiving and interpreting the world view in terms of what should be studied, how it should be studied, when and why it should be studied, include the following:

- A holistic view regarding environmental education should be followed. That is, environmental education should be viewed from all points of view and not from a specific point of view only.
- Reality in environmental education should be systematically identified , perceived and intepreted within a particular mental framework (refer to paragraph 3.3.3). This refers to how reality should be studied (see the definition of the paradigm underlying the study).
- Reality about information on environmental education should be researched, developed, disseminated and adopted, that is, the RDDA model should be used (refer to paragraph 3.3.1). This means reality should be systematically and publicly examined through the use an explicit rationale and analytic criteria to test or disprove any false claims. That should further be intepreted and reasons given for the intepretation. In relating this assertion, for example, to the amoeba's movement and shape, environmental education, like amoeba, should develop by moving away from its original position such as from conservation education to environmental education

for sustainable development (see paragraph 5.3.2).

- Learners of a topic with a theme in environmental education should be provided with an identifiable, observable and measurable knowledge and skills so that they can intepret e and harmonise theory and practice (praxis) and value a topic with a theme in environmental education (refer to paragraph 3.3.1).

The above mentioned implications of the paradigm underlying the development of the amoeba model for environmental education gives rise to the question:
What implications signify for the development of the model for teaching methods?

5.4 IMPLICATIONS OF THE PARADIGM WHICH UNDERLIES THE DEVELOPMENT OF THE AMOEBA MODEL FOR TEACHING METHODS

The paradigm mentioned in the previous paragraph also has implications for the use of teaching methods.

- Teaching methods used by people who adhere to the paradigm underlying the study should be used to focus at environmental education from a holistic (eclectic) point of view and not from either a positivist, constructivist or social critical theory point of view only. Teaching methods such as cooperative learning, discussion, discovery and narrative methods could, for example, be used for that purpose to teach a topic with

a theme in environmental education depending on the topic and the context within which a topic is taught (refer to paragraph 1.3).

- A variety of teaching methods could be used simultaneously to ensure that the RDDA model (a model which is considered positivist in nature) is used in dealing with an environmental education topic in a lesson. That is, data on an environmental education topic could be researched through the project method, developed through cooperative learning and discussions, disseminated through cooperative learning, discussions and free activity methods, and adopted through the use of a variety of teaching methods such as cooperative learning, discussions and the narrative method.
- Environmental educationists adhering to the paradigm of the model of the study will use different teaching methods in order to facilitate a systematic way of the acquisition of knowledge and skills thus inteprete the meaning within the context of a particular framework.
- Environmental educationists adhering to this paradigm underlying the study will use teaching methods to facilitate the dialectical unity of theory and praxis in which theoretical understanding of contradictions inherent in a society contribute towards bringing about changes in the conditions of an environment. The textbook and narrative methods of teaching could, for example, be used to describe certain concepts in a topic and these could be followed by the use of the combination of the project, discovery and experimental methods of teaching.

Having discussed the amoeba as metaphor in this study and shown how it is applicable to the study in terms of the characteristics, interpretation and relationship of the amoeba to environmental education, implications for environmental education and for teaching methods respectively, the following deduction - which depicts the dominant paradigm influencing environmental education in this study - can be made:

- No single specific paradigm could be used to underpin the process of teaching a topic dealing with environmental education. This means that elements from a variety of paradigms could be used for that purpose, depending on the topic, context and environment within which that topic is taught. This deduction, illustrated in diagram form, follows:

PARADIGM INFLUENCING ENVIRONMENTAL EDUCATION

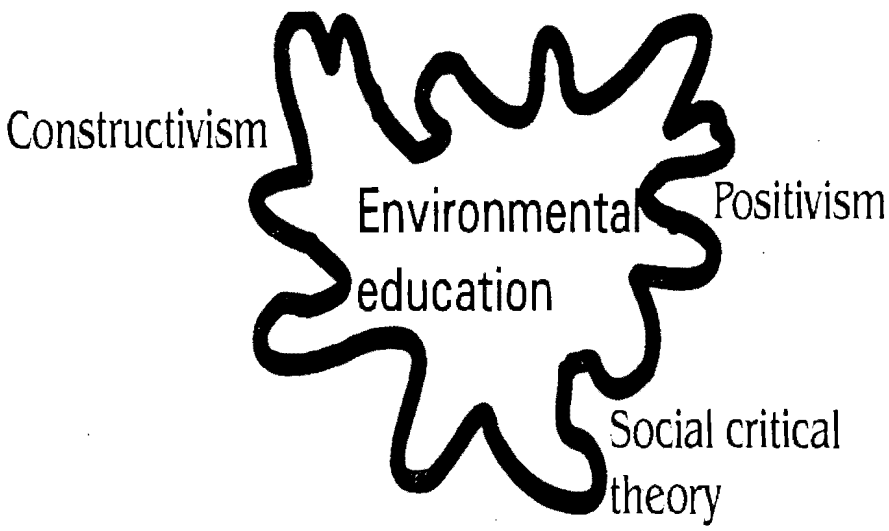


Diagram 5.2

It is from the description of the identified paradigms (refer to chapter 3) and how they relate to environmental education (refer to paragraph 3.3) and teaching methods respectively that ideas were generated for this study. This means that elements from a variety of paradigms such as constructivism, positivism and the social critical theory could be used to facilitate the process of teaching in an environmentally directed way (refer to paragraph 3.3).

If the implications of the dominant paradigm (refer to paragraph 5.4) are studied, it is clear that an interpretive model should show that environmental education

- is holistic;
- is socially constructed;
- can be empirically studied (using the RDDA model); and
- can use theory and practice to facilitate the acquisition of knowledge and skills and accommodate changes in knowledge.

5.5 POSSIBLE IMPLICATIONS OF THE UTILISATION OF TEACHING METHODS FOR ENVIRONMENTAL EDUCATION

The impression gathered from the discussion of teaching methods in chapter 4 gives rise to the possible implications which teaching methods have for the study, namely that

- communication is vital in teaching a topic with an environmental education theme - either verbally or through other media;
- a topic which has an environmental education theme could be taught through the use of different teaching methods. The use of different teaching methods is important to facilitate learning because it exposes learners to different methods of learning a topic with a theme in environmental education;
- teachers play a major role in teaching in that they facilitate learning;
- learners actively or passively take part in the process of teaching-learning depending on the teaching methods used at the time and the environment in which it takes place; and
- the process of teaching and learning is facilitated by the use of relevant teaching media or aids, which may differ from topic to topic and will suit the methods which may be used for a particular lesson.

From the previous paragraph it can be deduced that a variety of teaching methods could be used simultaneously to teach in an environmentally directed way - depending on the topic and the environment within which a topic is taught. This assertion is illustrated in diagram form.

DIAGRAM FOCUSING ON TEACHING METHODS IN ENVIRONMENTAL EDUCATION

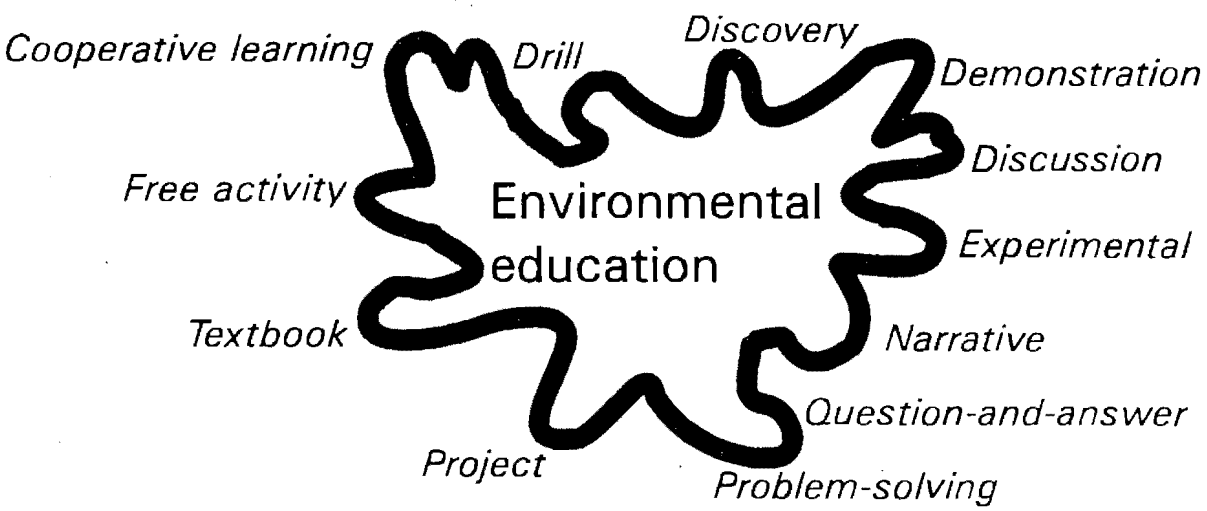


Diagram 5.3

5.6 THE IDEAL AMOEBA MODEL

In reflecting on deductions that were based on discussions on paradigms (refer to chapter 3) and teaching methods (refer to chapter 4), a deduction could be made from the arguments set out in paragraphs 5.4 and 5.5 respectively, namely that teaching in an environmentally directed way could take place through the application of elements from a variety of paradigms and teaching methods depending on the topic and the environment within which it is taught.

This means that no specific paradigm or teaching method can facilitate the process of teaching in an environmentally directed way all by itself, in other words, environmental education does not have a specific paradigm underlying it but could

use elements from a variety of paradigms to form its basis. It does not necessarily have specific teaching methods with which it could facilitate teaching. It could use elements from a variety of teaching methods to facilitate teaching. This assertion is presented in the form of a model, the ideal amoeba model:

AN IDEAL AMOEBA MODEL

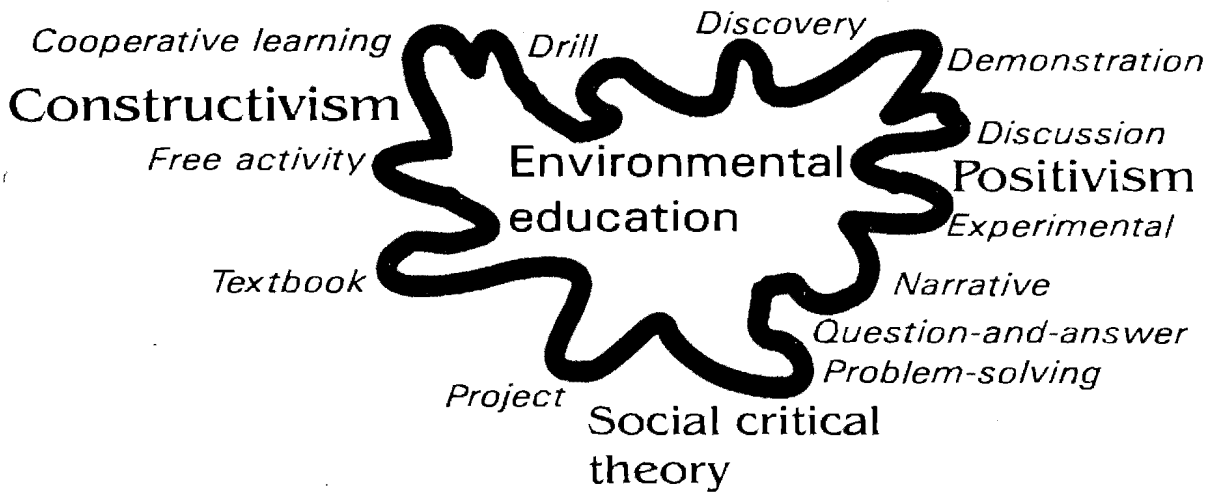


Diagram 5.4

The above model shows that environmental education can be regarded as an approach and not as a field of study (refer to chapter 1) because it could use elements from a variety of paradigms and teaching methods could be used to teach a topic in an environmentally directed way. That is, not only one paradigm or elements of it could be used to teach a topic in an environmentally directed way.

To illustrate how the amoeba model could be used for teaching in an environmentally directed way, a case study will be used (par. 5.8). That will be preceded by a theoretical interpretation of the model for environmental education.

5.7 THEORETICAL INTERPRETATION OF THE MODEL FOR ENVIRONMENTAL EDUCATION

Interpretation refers to bringing out the meaning of something, by artistic representation or performance (Concise Oxford Dictionary 1984:525). In this study, interpretation refers to expressing a view either verbally or physically by means of which the other person(s) would be in a position to understand it. In this section, the meaning of the model will be highlighted by interpreting it with a view to explaining why the researcher believes the model can represent a view about teaching.

There are a variety of reasons - though theoretical - which could cause any person to believe that the model is valid work. These include the following:

- Higgs (1995:16) maintains that naturally, people are not condemned to be imprisoned within a single way of viewing and interpreting things or "...to flit from one position to another..", but to appreciate the contribution of a variety of interpretations at a time. This means that no single paradigm can influence a way of teaching, for example, a topic relating to environmental

education. A variety of these paradigms (that is, the use of elements from a variety of these paradigms) could influence teaching a topic relating to environmental education depending on the topic and the context within which a topic is taught. Critics of this view refer to it as a pluralistic approach and maintain that it accommodates "inconsistent views" and "contradictory underpinnings" (Janse van Rensburg 1995:65).

- The model could allow "...learning that is relevant and connected to real-life situations..." (South Africa. Department of Education 1997:7), that is channelling the ways of thinking of learners. The model could, for example, provide for learning which responds to real-life situations, for example, viewing and interpreting things such as topics on environmental education not only from one paradigm such as the empirical point of view, but from a variety of these, depending on the topic and the context within it is being taught.
- The model will work because it makes provision that paradigms and teaching methods should not be used as strait-jackets, that is, one paradigm for a specific topic at a time, but that they should supplement each other wherever and whenever possible. The teacher should, for example, select paradigms and teaching methods from those available which are worthwhile and practical. Paradigms and teaching methods should, therefore, be used to complement each others' shortcomings, to give a fairly representative coverage of all the ideas dealt with in a topic on environmental education. This means that teachers could work within a

framework of a variety of paradigms and teaching methods, because each of the paradigms and teaching methods has both advantages and disadvantages. The model does not favour some paradigms, for example, the constructivist or the social critical theory paradigms, at the expense of others, such as the positivist paradigm, but it accommodates elements from a variety of paradigms as long as these are relevant to the topic and the context within which a topic is presented at the time. Equally important to note is the fact that the model will work on teaching methods because it allows, for example, the use of a variety of teaching methods to facilitate teaching a topic dealing with environmental education in accordance with the topic and the context within which it is taught.

5.7.1 Theoretical interpretation of the model based on outcomes-based education (OBE)

Outcomes-based education (OBE) is once again mentioned because it forms the core of the new education system in South Africa. In interpreting the model to teach in the outcomes-based education (OBE) system, it is important to note the following:

- In teaching in OBE, teachers could be influenced by elements from a variety of paradigms such as constructivism, positivism and the social critical theory (refer to paragraph 3.3) and teaching methods (refer to paragraph

4.4), to facilitate teaching. Critical thinking, problem-solving and action skills, for example, are viewed as important outcomes and this is in accordance with OBE.

- Within OBE, elements of specific teaching methods and paradigms could enable learners to acquire appropriate outcomes. Knowledge about water pollution in a river could, for example, be acquired by investigating the river itself, using a variety of approaches such as positivism, and a variety of teaching methods, such as the demonstration and experimental methods, which could be relevant. This means that a teacher who teaches a topic relating to environmental education requires thorough knowledge and understanding of a number of paradigms and teaching methods to think about alternatives which may best lead to the desired outcomes. For example, a teacher may need to know the origin of pollution in a river, how the pollution affects the living organisms in the river, when does that take place and what the end result thereof is.
- Although in accordance with OBE, the qualitative paradigms (such as constructivist and the social critical theory) and teaching methods (such as the discussion method and narrative method) are favoured more than the quantitative paradigms such as positivism and teaching methods such as the discovery, experimental, question-and-answer methods, the quantitative process remains important for facilitating the teaching of any topic in any learning area of environmental education.

Having discussed the theoretical interpretation of the model based on OBE, it is important to interpret the views of some international educationists on the model. These will not be mentioned by their names because that was not arranged.

5.7.2 Interpretive views of some experienced educationists regarding the model

Papers on this model were delivered by the author at some international conferences. A variety of views were expressed (in writing, at the request of the presenter of the paper) by some experienced educationists at international conferences such as the Environmental Education Association of Southern Africa (EEASA) in Kwa-Zulu Natal province, South Africa in July 1995 and in the Western Cape province, South Africa in July 1996, the International Seminar for Teacher Educators (ISTE) in St Catherines, Ontario, Canada, in May 1997 and the South African Society for Educators (SASE), Gauteng, South Africa, in September 1997. Their comments have been summarised and include the following:

- Some educationists indicated that this 'sounded' like a good approach to use but that it would need to be tested in order to determine its worth. The author fully agrees with the comment and is also of the opinion that it is important for scholars and educationists to understand that the aim of the study was to develop a theoretical model which could be tested if the need arose.

- In expressing a view regarding the model, one educationist asked: "How can a variety of paradigms be mixed with the objective of acquiring information? That sounds ridiculous".

  Much as the model may sound 'ridiculous', as the previous comment would suggest, the author is of the opinion that in a practical situation, one paradigm only could not be used and guaranteed as an approach to facilitate teaching a topic to learners. Elements from a variety of paradigms could be used for facilitating the process of teaching a topic to learners.

- Some educationists indicated that they would agree to use the model provided it were found to be empirically sound.

  Regarding the comment on using the model only after testing it, the author is of the opinion that it could be tested in any form which would be acceptable to scientific researchers, such as empirically.

From the above positive and negative remarks, it could be deduced that the model developed through this research could be practicable, although it is recognised that it needs to be tested scientifically to prove its worth. This will be done in chapter six.

5.7.3 Deductions based on the interpretation of the model

It is vital to use an approach in which a variety of paradigms and teaching methods could be used to facilitate the process of teaching in an environmentally

directed way. It could enable the acquisition of a broader background understanding of paradigms and teaching methods although working within OBE may imply preference for some paradigms and teaching methods to others. It could further facilitate the process of critical thinking about what should be learned, why that should be learned and how it should be learned.

5.8 ILLUSTRATING THE VALUE OF THE AMOEBA MODEL BY USING A CASE STUDY

The following case study, which will be used to illustrate the design and value of the amoeba model for teaching in an environmentally directed way, comes from a local newspaper article titled: *Education needed to ensure Jukskei River is saved* (The Star, Tuesday, September 9, 1997):

> The water of the Jukskei River, which flows from the south-eastern parts of Johannesburg, through Alexandra township north of Johannesburg, is a potential killer to the at least a quarter of a million residents living along its banks.
>
> The stench of rotting carcases, raw sewage and vegetation hangs in the air, yet the people living along the banks of the river seem oblivious to the lurking danger or foul stench.
>
> One of the residents who lives in a house that is a little more than two metre square and crammed between hundreds of other shacks allowed the environmental reporter to enter the house. The shack has no electricity and the resident has to share a communal tap and portable toilet with at least 10 other families. Sometimes the water to these communal taps is cut off for several days. Almost 500 000 people are sardined together on one square kilometre of land on the banks of the river. Space is so

limited that it is almost impossible to negotiate your way between the crammed shacks. Some of the shacks are precariously situated right on the river bank and are more at risk of being washed away by the next floods. Another risk is that should one of the shacks around there catch fire, the chances are that none of the neighbourhood shacks will escape the fire.

Crime in the area is high and residents say it is often not unusual to see corpses floating in the water especially at the end of the week or month.

Alexandra, one of the oldest townships which also survived many apartheid attacks from many angles, was initially meant to cope with a population of about 70 000 people, but this figure has more than tripled over the past few years. Some have attributed this population explosion to the abolishment of the apartheid's Influx Control Act whereas others attributed this problem to the relaxed control measures at the South African border posts. Because of the high population figures in Alexandra, many resources such as sanitary system, roads and electricity are overburdened, not least so its sewerage system. For example, raw waste constantly flows into the water, along with sewage from the portable toilets and other household waste which is dumped into the river. It is also not uncommon to see residents using the river as a toilet. Sometimes young and old urinate and defecate into the water and every few minutes someone dumps a bucket of waste into the water.

STEPS HAVE BEEN TAKEN TO INVOLVE THE COMMUNITY IN CLEAN-UP

The banks of the river are also a minefield of debris, human and animal waste and even the bodies of large rats. Mangy-looking dogs scavenge among the mess, as some small children play in the dirty river water.

Many residents are well aware that dumping into the river is polluting the environment and that in-itself is "breaking the law", but they claim that they have no alternative to dump the waste as the existing waste removal system in the township is inadequate to cope with the amount of waste generated on a daily basis. The raw sewage flowing constantly into the river has contributed to its E-COLI count - an indication of the degree of contamination by human faeces in water - which can be as high as 6 000 000 counts for every 100 ml of water. An E-COLI count of 200/100 ml of water is considered unsafe. The high E-COLI count in the Jukskei River has contributed to its dubious title of one of the most polluted rivers in the country and a breeding pool for such diseases as diarrhoea

Several kilometres downstream from Alexandra the river winds its way through one of Johannesburg's more affluent areas, Kelvin, Woodmead and Midrand. In those areas, the Jukskei's water is clear but the bacteria are still present, although to a lesser degree. The population in the respective areas where the Jukskei River passes is not as high as in Alexandra. Conditions are totally different. For example, resources such as the sanitary system are not overburdened as in Alexandra. One of the only threats of the river in any of those areas could be companies or individuals who may deposit waste such as toxic waste into the river. Except for that, nature takes its course in cleaning the environment in the Jukskei River around the aforementioned areas. Not much is done to interfere with the environment. That is, very little is done to pollute the environment of the Jukskei River around Kelvin, Woodmead and Midrand.

But, with the shortage of water in South Africa, the river could one day become a viable water source for all the residents of the country. Predictions are that within the next thirty years South Africa will have used all its available water resources and will have joined the increasing number of water-stressed countries in the world. Authorities believe that the solution to the Jukskei River problem lies with education of the people, especially those who live close to the river, and the provision of proper housing and sanitation.

Steps have already been taken by individuals, health authorities, NGOs and other people who are concerned about the environment to involve more people of the Alexandra community in clean-up operations to protect the river.

The process of a clean-up operation is fully supported by many people in Alexandra although many residents themselves still feel and admit that the progress has been slow and that it is difficult to control dumping and pollution in the river. Many others still complain about the lack of enough removal systems.

(The Star, Tuesday, September 9, 1997).

In making use of the above case study to teach grade twelve learners about pollution, a common topic dealing with the environment in the natural sciences learning area, the amoeba model could be applied by the teacher in the following

way:

(1) PROVIDING A BACKGROUND FOR THE CASE STUDY

A teacher could give learners copies of the case study and mention its source. The teacher could narrate and explain the content of the case study to the learners with the objective of providing them with a background to the case study. The teacher could also give learners the opportunity to read the case study carefully in order to acquire understanding of how human activity, such as polluting the environment, affects the natural environment and the people within a specific environment.

In providing the learners with a background to the case study, a teacher could start by explaining a holistic view of the concept of *pollution*. That could be followed by a description of the various types of pollution, such as air, land and water pollution. Examples of the causes of pollution, which include the histories of the various types of pollution, could further be provided. The history and state of pollution in the Jukskei River could be used as an example of pollution.

(2) CAUSES AND SIGNIFICANCE OF POLLUTION IN THE JUKSKEI RIVER

Having described and discussed the various types of pollution, a teacher could focus specifically on the case study and state that any type of pollution has its specific history. In the given case study, for example, the pollution was probably caused by the high number of people who live within the vicinity of and on the banks of the Jukskei River, the lack of a sanitary system such as toilets and the lack of an official dumping area which is within reach of those people. Lack of incinerating facilities could be another cause of pollution. In presenting the theory, the teacher could also make use of practical examples which have a bearing on the content of the case study, to concretise the theory, that is, linking theory to practice (praxis).

In addition, the teacher could use the case study to uncover the significance of water pollution in the river to the environment referred to in the case study and its people, and the different ways in which water pollution affects human life in the Jukskei River area and other affluent areas, such as Kelvin, Woodmead and Midrand. That could be done by presenting the data on the waste which is dumped in the Jukskei River by means of a transparency. The teacher could, together with the learners, study the case study carefully with the objective of understanding the chronological order of events which led to the state of the Jukskei River in the Alexandra area and other areas beyond Alexandra, as presented in the case study.

Learners could be required to inquire systematically and publicly, using analytic criteria to try to test or disprove claims which are made about the existing pollution of the Jukskei River and waste dump within that area. Examples of the claims which are made could include the lack of an adequate sanitary system within the Jukskei River area in Alexandra, lack of a dumping area, contamination of water with raw waste, the stench which people living in the vicinity of the Jukskei River are exposed to, the results of the E-COLI count, the instrument which is used to measure the degree of contamination of water in a dam or a river such as the Jukskei river in the Kelvin, Woodmead and Midrand areas and the effect pollution has on the people who live in that particular environment.

It is from these examples that learners could gain a holistic understanding of the significance of pollution within that environment, the Jukskei River, and that they could be in a position to contextualise it within the mental framework of the case study. For example, the teacher could explain the significance of using the Jukskei River as a dumping site and toilet, which is a result of a lack of enough refuse waste containers and toilets within that part of Alexandra. Another example which could be explained to learners could be the use and importance of the E-COLI measuring instrument, which is used to measure the degree of contamination of the water in the Jukskei River and the contrasting state of the Jukskei River in

other areas than Alexandra, such as Kelvin and Midrand.

(3) LEARNING BY COOPERATING AND INTERACTING

Learners learn by interacting with the environment through being exposed to the environment. It is through this exposure that these learners should see, smell, touch, and hear the information regarding that particular environment. Where it is not possible for learners to interact with the environment which they are studying at that time, a teacher could engage them in discussions on what they think that type of pollution in that specific river would cause to the people around and the living species in the water. They could further discuss the possibility of plant growth in such an area and on the banks of the river and discuss how people who live in the vicinity of the dumping site survive. Issues such as the odour caused by the smell of the waste, dead animals and toxic waste and the result of diseases such as diarrhoea and typhoid would be highlighted and critically discussed.

Learners could be further engaged in discussions such as classmate discussions, small group discussions and symposiums, or could be requested to respond to questions (refer to paragraph 4.4.12) such as who should be held responsible should any of the people who live on the banks of the Jukskei River and are exposed to such waste and water pollution get sick and hospitalised or even die, be it through infection caused by viruses or bacteria from the polluted river and waste. Learners will thus be engaged in activities in which they will suggest how such a situation - in which people living in that area dump waste of various types illegally - could be improved and how the quality of life in and around the area could be improved and sustained.

While the learners are engaged in relevant discussions on the problem in hand, they could actively take part, for example, by working cooperatively (refer to paragraph 4.4.3.) in the following ways:

1. Identifying and testing the type of pollution as noted in the case study (refer to paragraph 4.4.4)
2. Identifying and noting the pollutants and how many of these are added to the river at a time (refer to paragraphs 4.4.3 - 4.4.8)
3. Identifying, observing and measuring the extent of pollution caused by depositing waste of various types within that environment (refer to paragraphs 4.4.3 - 4.4.7)
4. Observing and identifying the harm pollution causes to the people who live in that area
5. Identifying and measuring the speed at which the wind blows to exacerbate and spread the smell coming from the dumped pollutants
6. Identifying and measuring the degree of contamination of water in the Jukskei River by various types of wastes which are deposited in the river concerned (refer to paragraphs 4.4.3 - 4.4 12)

Following the case study and the indication of how teaching methods and how different paradigms may influence the teaching simultaneously to teach a topic dealing with environmental education, it is important to make deductions regarding paradigms and teaching methods respectively.

5.8.1 Deductions based on a positivist paradigm

In using the positivistic approach to teach a topic such as pollution while at the same time making use of the case study, only that which is measurable, observable and testable is acceptable. For example, in the case of the utilisation of the above case study, learners could identify pollution and the nature of pollution.

The extent and degree of contamination caused by pollution could be measured. In measuring these, it was noted in the case study that the banks of the river are a minefield of debris, human and animal waste and even the bodies of large rats

and constant flow of raw waste into the water. The E-COLI count is used as another measuring instrument to indicate the degree of contamination by human faeces.

Data was researched, developed, disseminated and adopted in the utilisation of the case study. In the case study, in other words, information on pollutants of the atmosphere was discovered through research. For example, the causes of pollution were discovered.

Observable, measurable and testable facts were developed from the information which was researched. For example, facts about the odour of the various types of waste, the size and the speed at which some of the raw waste constantly flows into the river along with the sewage from portable toilets into certain directions, were developed from the information generated from the research done.

Data was disseminated in the case study concerned. For example, many people of Alexandra were educated and empowered regarding clean-up operations to protect the river. Many of these people raised concerns about the dumping but complained about the lack of enough waste removal and sanitary systems.

Data was consequently adopted in the utilisation of the case study in that it was noted that pollution indeed occurred in the area. In adopting the data, individuals, health authorities, Non-Governmental Organisations (NGOs) and other people who are concerned about the environment have taken steps to involve some members of the community of Alexandra in clean-up operations to protect the river.

This process is fully backed by many residents, although many of them feel that as long as there are no alternatives to dumping, progress will be slow and the control of dumping difficult.

5.8.2 Deductions based on a social critical theory paradigm

Deductions which could be made from a social critical theory's point of view include that inquiry in environmental education aims at uncovering the significance and causes of contradictions which operate behind unquestioned interactions of people's daily lives through teaching methods. For example, it aims at uncovering the meaning and causes of contradictions of pollution in the Jukskei River. It also wishes to facilitate the integration of knowledge and purposeful action in the environment. Another deduction of the social critical theory is that it embarks on facilitating a dialectical unity of theory and practice. In applying this deduction to the case study it could be noted that physical action such as an operation clean-up, has to be taken in contrast to the theory which is held by many people about pollution of the Jukskei River in the case study. In that way theory will be incorporated in practice.

5.8.3 Deductions based on a constructivist paradigm

A deduction which could be made regarding constructivism is that a constructivist inquiry on the topic relating to environmental education is based on a relativist nature of reality. In constructivism, reality occurs within a specific mental framework. For example, pollution, a topic which is used to drive the development in this chapter, occurs and is interpreted within the framework of the Jukskei River and nothing else. That leads to the integration of the knowledge which people have about the Jukskei River and the action which has to be taken in saving this river. This integration is a reality but nevertheless remains relative in nature.

5.8.4 Deductions made from the application of teaching methods

A variety of teaching methods could be used simultaneously to teach a topic dealing with environmental education in an environmentally directed way, depending on the topic and the environment within which a topic is taught. For

example, the cooperative learning method, discussion method, narrative and many other methods of teaching were applied to teach one topic in the case study. The narrative and textbook methods of teaching were applied to provide background information on pollution of the Jukskei River. The cooperative learning method, discussion method and the question-and-answer methods were applied to provide information on the causes and significance of pollution in the Jukskei River in the case study. The cooperative learning method and the project methods were applied in facilitating learning through interaction with the environment in the Jukskei River.

After having used the case study to illustrate the value of the Amoeba model (refer to paragraph 5.8) by refering to:

- examples of pradigms (refer to paragraph 3.3)
- teaching methods (refer to paragraph 4.4)
- the presentation of the ideal model (refer to paragraph 5.6.)
- deductions based on the theoretical interpretation of the model for environmental education (refer to paragraph 5.7)
- deductions based on the case study (refer to paragraph 5.8)

the author of the research project felt that it was also important to conduct a empirical study in order to consolidate the the theory developed around the model. The empirical study is developed and presented in chapter six of this study.

5.9 CONCLUSION

In this chapter, an attempt was made, with the use of an amoeba as a metaphor, to develop an amoeba model which could be used to facilitate the process of teaching (any learning area) in an environmentally directed way (refer to paragraph 1.2.2).

In developing the amoeba model, certain deductions were made, as indicated below. From the model previously discussed and described, some paradigms, namely constructivism, positivism and the social critical theory, were used to develop the research. It is therefore imperative to note that each of these paradigms contributed to the research in its own particular way, despite the contrasting views they represent. None of them, in other words, coincides with the others in terms of characteristics, implications for environmental education and for teaching methods. In addition, teaching methods appropriate for environmental education were discussed in paragraph 4.4 of this research study. Some were seen to have some features in common (refer to paragraph 4.6). Much as these teaching methods failed to address the problem of the study specifically they, like paradigms, contributed to the research study in their particular way. The theory generated from the examples of paradigms which were used in this study (refer to paragraph 3.3) and the identified teaching methods which were described and discussed in this study (refer to paragraph 4.4) both contributed towards the development of the amoeba model. The amoeba model is therefore presented as a proposal to use environmental education in the curriculum to facilitate the process of teaching in an environmentally directed way. The feasibility of using this model in the curriculum to facilitate the process of teaching in an environmentally directed way, is tested through the use of a emperical research in the next chapter (refer to chapter 6).

CHAPTER SIX

A QUALITATIVE ANALYSIS AND INTERPRETATION OF THE AMOEBA MODEL

6.1. INTRODUCTION

Chapters two, three and four of this study were aimed at developing an interpretative model for teaching in an environmentally directed way, as discussed in chapter five. The outcomes of these chapters collectively necessitated an empirical investigation, as described in this chapter. This is important for the study because it intends to report on the reactions and responses of experts in environmental education to questions regarding the way in which the amoeba model developed in chapter five could be operationalised in practise. The logical aim of this chapter is, in other words, to have a follow-up to the theory as it was developed for the research in chapters two, three, four and five of this study. In order to collect information on how this model might be operationalised in practise, qualitative research was conducted.

In this chapter, qualitative research will be briefly described. Its role will be discussed and its importance will be indicated within the context of the study. The procedure for conducting the research will then be described. It will include the

criteria for the selection of respondents and an outline of research methods. Subsequently, the data analysis and interpretation will be discussed and findings of the research given. Concluding remarks based on this chapter will be made.

6.2 QUALITATIVE RESEARCH: OVERVIEW AND RELEVANCE

Qualitative research is one of the approaches followed in empirical research. It is defined differently by various researchers (Lincoln and Guba 1985; Krueger 1988; Merriam 1988; McMillan 1992; Peshkin 1993; Ornstein 1995). In this study, as in Denzin and Lincoln (1994: 2), qualitative research is defined as a multiperspective approach (using different qualitative techniques and data collection methods) to social interaction, aimed at describing, making sense of, interpreting or reconstructing this interaction in terms of the meanings that the subjects attach to it. Qualitative research will now be described in more detail, according to this definition.

6.2.1 The development of qualitative research

Qualitative research developed as a result of questions regarding deep-level understanding of real life situations. One of the dominant questions was: how could the experience of other people, groups, institutions, subcultures and cultures best be represented (Denzin & Lincoln 1994: 6-11)? From questions of this nature, many other questions were developed, including: can we ever hope to

speak authentically on the experience of others? And if not, how do we create a social science that includes others (Denzin & Lincoln 1994: 6-11)?

On the basis of such questions the following statements regarding the development of qualitative research, based on the so-called interpretivist paradigm (De Vos 1998: 247) can be made. This paradigm could make use of the following strategies:

- Ethnography

It is a strategy in which the researcher observes and describes the behaviour of respondents through participation. Data is analysed and interpreted by describing it as it is (De Vos 1998: 80).

- Phenomenology and ethnomethodology

In this strategy, the researcher should be in a position to put him- or herself into the shoes of the respondents. The researcher should, in other words, interact with the respondents and collect data by observing and interviewing them. This will enable the researcher to analyse conversations with the aim of understanding and interpreting the meaning which respondents attach to their daily lives (De Vos 1998: 80).

- Biographical method

It is a strategy in which the life of a person is documented and reported on. The biographical method could take any of the following forms: portraits, memoirs, life stories, life histories, case studies and autobiographies (De Vos 1998: 80).

- Historical method

This strategy involves the study of historical documents such as diaries, letters and newspapers in their historical context (De Vos 1998: 80).

- Applied and action research

It is from this perspective that the work done aims to make qualitative research more humanistic and relevant to the lives of people. By using this strategy, the researcher empowers respondents participating in a research study to undertake their own research and they then cooperate in collecting data (De Vos 1998: 80).

- Clinical model

This strategy, like the preceding applied and action research, intends to change the situation by focusing narrowly on improving diagnosis and treatment of a problem (De Vos: 81).

- Symbolic interactionism

This strategy attempts to interpret the meaning which symbols such as actions, signs and words have for the subjects. For this strategy to be accomplished, the researcher needs to interact actively with the people who are being studied, thereby focusing on their behaviour and on the meanings and interpretations they attribute to their spheres of living. Data is, in other words, collected by means of participant observations and interviewing. It is further analysed and interpreted systematically.

Qualitative research further makes use of other strategies such as the following:

- Symbiotic interaction

This is a process in which two strategies are attached to each other and act on each other reciprocally (De Vos 1998: 247).

- Analytical induction

This is a strategy in which data is analysed by producing facts which prove a general statement (De Vos 1998: 247).

- Grounded theory

It is a theory which is systematically developed from data inductively derived from the study of phenomena. In grounded theory, a systematic set of procedures of sampling such as theoretical sampling is used to collect data and to analyse it, for example, through systematic coding (De Vos 1998: 81).

Qualitative research is currently moving towards employing a critical perspective, which includes strategies such as participatory research (research in which subjects actively participate) in terms of design and data analysis. This movement has led to the development of a more reflective paradigm which emphasises that reality can only be reflected by those who are personally experiencing it. Despite this development, the question still remains whether qualitative research could elicit a common body of knowledge from which professionals in the caring professions would benefit (Vos 1998: 247). This means that the development of qualitative research has not been completed yet. This kind of research nevertheless serves a purpose, which will be discussed below.

6.2.2 The purpose of qualitative research

The purpose of qualitative research is to understand the reality of social life and the meaning people attach to reality (McMillan 1992: 9; Leedy 1993: 141; De Vos 1998: 241). For example, McMillan (1992: 9) maintains that qualitative research,

unlike quantitative research where reality is accepted mainly as that which can be measured, seen and touched, has reality rooted in the way in which respondents view it. For a qualitative researcher to understand reality, (s)he has to discover the meaning that people in a particular situation attach to it.

Qualitative research occurs in real life situations (Lincoln & Guba 1985: 199; Krueger 1988: 39; Leedy 1993: 142). It is in real life situations that respondents can provide in-depth information regarding phenomena (Krueger 1988: 38).

In qualitative research, the researcher is in a position to communicate personally with the respondents and to discover how they see reality in real life situations (Lincoln & Guba 1985: 199). Respondents, in turn, are free to express their thoughts and opinions without having their views channelled and limited as in quantitative research (Lincoln & Guba 1985: 199).

De Vos (1998: 241) concurs with Merriam (1988: 10) and McMillan (1992: 9) that another purpose of qualitative research is to understand phenomena within a particular context (Vos 1998: 241). In order to do that in terms of ontology (the nature of reality and human behaviour), qualitative research discards all external objective reality (De Vos 1998: 241). The purpose of this is to understand and explain reality by discovering the meaning that people in a specific situation attach to it. In qualitative research, reality and human behaviour are intentional and creative and can be explained and not predicted, as in quantitative research (De Vos 1998: 241).

Qualitative research emphasises the subjective opinions of respondents during an interview. This notion is endorsed by many researchers in terms of epistemology (Lincoln & Guba 1985: 199; Merriam 1988: 10; Peshkin 1993: 23; Ornstein 1995: 275; De Vos 1998: 241). For example, in terms of epistemology (the relationship of researchers to reality and the road that they will follow in search of the truth) the subjective opinion of a respondent is important (De Vos 1998: 241). Qualitative research also stresses subjectivity, in that the qualitative researcher is, amongst others, expected to interact with the respondent, with the purpose of obtaining in-depth information and gaining an understanding of the meaning the respondents attach to everyday life.

Qualitative research stems from an antipositivistic, interpretative approach (McMillan 1992: 10; De Vos 1998: 241). It is ideographic, in other words, unlike quantitative research which makes use of statistical figures to come to conclusions regarding phenomena, it accepts the views of people for that purpose (McMillan 1992: 11; De Vos 1998: 241). Qualitative research is also holistic in nature. It does not measure the social world objectively in order to test hypotheses and control human behaviour. Qualitative research wishes to understand reality by discovering the meaning that people in particular situations attach to it.

The above purposes of qualitative research can be put to practice through the use of a variety of methods. Some of these methods of gathering data in qualitative research are discussed below.

6.2.3 Methods of gathering data in qualitative research

There are no standardised methods of gathering data in qualitative research (Leedy 1989: 139; McMillan 1992: 9; De Vos 1998: 241). The methods which are used to gather data in qualitative research are usually flexible and unique, in other words, they do not have fixed steps which need to be followed or replicated for gathering data. Many researchers (Lincoln & Guba 1985: 79; Krueger 1988: 38; Leedy 1989: 141; De Vos 1998: 242) concur that amongst the various methods of data gathering in qualitative research, the following are used most frequently:

- An emic perspective of inquiry, that is, an inquiry in which a person is interviewed with the objective of deriving information and its meaning from that person's perspective.
- Observing the person who is being interviewed. Observations are not undertaken systematically, but are determined by the richness of information and the situation. These can be modified to enrich understanding of what the respondent says in an interview.

6.2.4 Factors which determine validity and reliability in qualitative research

According to Sykes (1984: 1186), the concept of *validity* is derived from the adjective, *valid*. It refers to something which is well-grounded and defensible because it was executed with proper formality. *Reliable* refers to something which

is consistent in nature (Fraser, Loubser & Van Rooy 1990: 188). For example, a test will be regarded as consistent if the same test is applied to the same group of learners at two different times and the results of the two tests correspond. The two concepts have meaning and play various roles in research in general. In quantitative research, for example, data is referred to as reliable and valid only after it has been statistically tested and if general statements can be made on its basis. In qualitative research, data which is accepted as reliable and valid is presented in the form of words and quotes from documents and transcripts (McMillan 1992: 9; De Vos 1998: 241). In contrast to quantitative research, no exact figures from precise measurements are used (McMillan 1992: 9; De Vos 1998: 241).

In qualitative research, concepts are usually accepted and interpreted in the form of themes and/or categories and not in the form of distinct variables as in quantitative research (De Vos 1998: 241). These themes are analysed by interpreting and attachin meaning to them, and not through statistical procedures.

In qualitative research, the whole is as important as the elements which collectively form the whole. The relationships of elements of the whole and their contexts are accepted as reliable and valid data (De Vos 1998: 281).

6.2.5 Importance of qualitative research for this study

Qualitative research is important and has been considered appropriate for this study because it enables the researcher to empirically investigate the feasibility of the theoretical model which was developed in chapter five. This it does in the following ways:

- It occurs in a real life situation.
- It uses an emic perspective to inquire, that is, it wishes to understand reality by discovering the in-depth meaning that the people in a particular context attach to it.
- The researcher interacts with the respondents.
- Respondents express themselves as freely as they wish and are not restricted or guided in responding to questions.

Following the discussion of the importance of qualitative research for the study (refer to paragraph 6.2.5) the research design will be reviewed.

6.3 RESEARCH DESIGN

This section focuses on the selection of respondents, how they were invited, their profiles and the questions about the model they had to respond to.

6.3.1 Selection of respondents

Ten people who, in the opinion of the researcher, were knowledgeable about and involved in environmental education were identified and selected for the purpose of the evaluation. They were regarded as an adequate sample for giving in-depth responses for the purposes of the study. Environmental education does not focus only on theory; practical aspects are also taken into account. Therefore, five of the ten respondents were environmental education practitioners and the other five were lecturers in the formal academic field. No school teacher(s) could be identified and selected for the evaluation because few teachers are educated about environmental education, let alone knowledgeable about and involved in environmental education (refer to sections 1.1.2. and 1.2.1). The two groups were selected on separate criteria although some of the criteria overlap. A profile of each group member was also recorded (refer to annexure 4).

Environmental education practitioners were selected on the basis of their instructional expertise in environmental education. The following criteria were applied:

1) They had been involved in environmental education programmes and/or projects in an environmental education centre for a minimum period of three years and had gained valuable experience.
2) They had facilitated workshops on environmental education at their centres

for their clients. These clients included some communal members of various age groups and learners from formal institutions of learning such as formal schools. Some of the themes which had been covered during those workshops included pollution and recycling.

3) They were qualified teachers.

4) They had contributed to environmental education through participating in environmental education projects at the environmental education centres where they work, in conferences and in communities.

Lecturers in the formal academic field were selected on the basis of their academic expertise in environmental education and according to the following criteria:

1) They were not necessarily qualified teachers but their experience in environmental education enabled them to facilitate environmental education programmes and/or projects for students and/or communal members of various ages, depending on their preferences.

2) They contributed to environmental education by publishing articles in various media such as scientific journals, newspapers and magazines. They also contributed by writing manuals such as study guides and other tutorial materials and books.

3) They contributed to environmental education by participating in environmental education projects at, for example, conferences, community events, environmental education centres, nursery schools or other types of formal schools.

6.3.2 Invitation to prospective respondents

The researcher obtained the contact numbers, such as the telephone numbers of prospective respondents, with the objective of inviting them to participate in the research study. Those who could not be reached by telephone at the time were invited in writing, either through e-mail or fast mail (refer to annexure 1).

6.3.3 Notes about the model

A copy of notes about the model (refer to annexure 2) was sent to the respondents who had agreed to participate in the research. They were requested to read the notes to prepare themselves for the forthcoming interview. These notes are a summary of chapters two, three, four and five of the thesis and were prepared as an academic paper for the 1995 Environmental Education Association of Southern Africa (EEASA) Conference at Kearsney College in KwaZulu-Natal, South Africa; the 1996 EEASA Conference at the University of Stellenbosch in the Western Cape, South Africa, the 1997 International Seminar for Teacher Educators (ISTE) at Brock University, Ontario, Canada and the 1997 Conference of the Southern African Society for Education (SASE) at the University of South Africa. The same paper was presented at four different conferences with the objective of obtaining the views of various audiences (see paragraph 5.7.2).

These notes were used to facilitate the completion of the research project. In each

of the conferences mentioned, some delegates expressed certain doubts as to the feasibility of the model if it had not been scientifically evaluated (see paragraph 5.7.2).

6.3.4 Questions

Since not all respondents could be gathered for a group interview, it was decided to conduct individual interviews at different times and venues. The ethnomethodology type of qualitative research (refer to 6.2.1) was used to gather data in this research, in order to gain, in the context of this study, an in-depth understanding and interpretation of the meaning that respondents attached to their work as environmental educators, in the light of the questions asked during the interview.

For the purposes of gathering data, the following questions were set as standard questions to start the interview:

1. What is your opinion about the amoeba model in relation to environmental education?
2. Why would you use or not use this model for teaching in an environmentally directed way?
3. What general suggestions would you make regarding the model?

More prompting questions developed during the interview. These have been categorised into three sections because they respectively developed as a result of each of the initial standard questions asked at the beginning of the interview. These included the following:

Question 1

The following questions emerged from this first standard question, "What is your opinion of the model in relation to environmental education?"

- To put it in a nutshell: are you saying the model is positive if I understood you correctly?
- You say that the model is good and fits well and it could be adopted in cross-curricular situations. Can you elaborate on what you mean by saying that it could be adopted in cross-curricular situations?
- Are you suggesting that with the help of this 'flexible model' - as you put it - global and environmental problems can be solved?
- Are you saying that this model has to be used as a cross- curricular approach in schools?
- Are you saying that the model can be used if the teacher is trained to use the model?
- Are you saying the model is good by not viewing things from a positivist point of view only but from other views as well?

- If you say environmental education has to be taught as a separate course at tertiary institutions would you agree with me that environmental education should be a compulsory course?
- What would be your opinion about this model in relation to its use by teachers if they were to use it?
- Are you in favour of the model to the extent that you feel it can be put to practice?
- Do I understand you correctly if you say paradigms or elements thereof could be used sometimes, depending on what a person is saying?
- What other opinions do you have with regard to the model?

Question 2

The question, "Why would you use or not use this model for teaching in an environmentally directed way?", generated the following questions:

- Given that teachers have been empowered to use this model in a workshop, do you think this model could be applicable in practice?
- Having explained how you would teach a theme which is related to the environment such as pollution by linking it to geography, biology and English, how would you relate that to this model?
- Do I understand you correctly when you say teachers would actually make use of elements, say for instance from experimental methods and a

positivist paradigm and from demonstration and discussion methods in order to tailor a lesson to a pattern of their choice?

- Are you saying the model is propagating flexibility in teaching and not the straight-jacket way of doing things?
- In using this model, do you think it could help solve problems in environmental education?
- You said the model encompasses all that needs to be taught to a learner and went on to say it could be used to teach the learner in totality. Could you elaborate on what you mean by saying the model could help to teach the learner in totality?
- You say you could use this model because it is holistic. Could you give the reason why?
- Are you saying that with the use of this type of model learners could also be encouraged to actively participate in the process of learning?
- What do you mean by saying that this model gives you the liberty to take what you want and leave out what you do not need at that moment?
- So, you do not agree with anyone, an idea or even a statement that says environmental education focuses or relates more to nature than to non-natural things?
- Earlier on you said the model is good, fireworks. If somebody out there were to ask you to provide two or three reasons for the statement you made, what would you say to that person?
- If somebody were to say that you should not use this model to teach a topic

in an environmentally directed way, how would you defend that?

- You are saying you will be against any person who will teach environmental education from one paradigm only?
- Except for the books being readily available for teaching in an environmentally directed way, what else do you think would make it possible for this model to be used?
- Now you are coming with very good points with regard to the new curriculum and of which the environment is part. How do you actually relate the new curriculum to the use of this model?
- Do you think there could be any reasons for not using this model for teaching in an environmentally directed way?
- Do you see this model as perhaps actually contributing as a solution to the problems experienced in the education system in our country?
- What other reason would you state for using this model for teaching a theme in an environmentally directed way?

Question 3

The third standard question, namely, "What general suggestions would you give regarding the model?" generated the following questions:

- Do I understand you correctly when you say that the model could be used in practice?

- Do you think that by using the narrative method of teaching, teachers cannot get anything which they can use to facilitate the process of learning in their learners?
- How would you relate the information that you are giving with the suggestion you are making regarding this model?

A tape recorder was used to capture the responses to these questions. The researcher also made key notes about respondents' attitudes and enthusiasm and about general impressions of the course of the interviews.

6.4 DATA ANALYSIS AND INTERPRETATION

Data which was collected through the use of developed questions and other prompting questions (refer to paragraph 6.3), will be analysed and interpreted in this section. The process of analysis and interpretation of data will be categorised into three sections, each of which will be based on the one standard question which started the interview. The researcher will also report on the attitudes and enthusiasm of the respondents and on general impressions gained during the interview. The statements made by respondents in paragraphs 6.4.1 to 6.5 were written down verbatim and were also not edited (by neither the transcriber nor the author) so as to reflect the true meaning of the respondents' opinions. The author did not edit the transcript because he did not want to influence the views which were expressed by any of the interviewees.

6.4.1 What is your opinion of the amoeba model in relation to environmental education?

Most respondents agreed positively and with enthusiasm that the model is good and could be used for a variety of reasons they cited respectively. The following key factors emerged from the reasons respondents gave when expressing their views of the model:

- The model can be used in practice.
- The model is flexible.
- The model can be used across the curriculum.
- The model is holistic.

(i) The model can be used in practice

A few examples of views expressed by respondents in elaborating on this assertion are the following:

"My opinion about the model is that it is practical in the sense that it relates to the environment and it reflects on the issues that are peculiar to the environment ... it can be used and it makes sense".

"... And now we see it is practical, it can be used and it makes sense".

"...my opinion about the model is it can be used if it's a trained teacher who has undergone a workshop using your model ...I firmly believe that. Once you show them they will get excited and use it more and more ...you'll have to have a workbook developed from your thesis off course, ... a practical guide, or teachers' workbook on how to use what you have said."

"... and I think people will accept it and it should be adopted ..."

"I think it's got a lot of good points, a lot of good aspects to it and I think it could be very useful for teachers to work around that model..."

(ii) The model is flexible

In agreeing that the model is flexible, some respondents respectively stressed the following:

"I personally have always been of the opinion that we cannot just take one paradigm in applyment ...it uses many teaching methods..."

"I think it's a good model ...there is that flexibility, ..."

"...I feel that this model is very good ...on the following points ...there are different methods which could be used in teaching and learning situation"

"I fully agree with this model,...it will be better at times even to use a combination of methods you know even to achieve whatever you want to ..."

"I fully agree with this model where it said environmental education is not grounded in one paradigm ... We should at least select good points from each and every paradigm ..."

" The first characteristic that I can align myself, its irregular in shape, I believe that in environmental education its irregular, first it doesn't assume on one shape or one format, its irregular, I believe in that."

" I take things from John Feine and from Ian Robottom socially critically paradigm and I combine it with ease with stuff from Hungerford from North America and I don't find it a problem ...I'm not hooked to one paradigm. In that way I think I deal with what we should deal with".

"...we have to look at it in a flexible way ...because not all classrooms are the same, not all teachers are the same, not all students are the same so I think they would have to take elements of that model and combine them in different circumstances for different situations".

" I think it gives you liberty to take what you want and leave out what you don't need at that moment".

(iii) The model can be used across the curriculum

Respondents also stated in a variety of ways that the model could be used across the curriculum. Some made the following statements:

" ...we have all agreed upon for quite a while already, which links ...with the idea of cross curriculum interdiscipline etc".

" I fully agree with the model that environmental education is to be used as a cross-curricular programme especially school situations".

"...the incorporation of environmental education a cross-curricular approach is very important ...it would lead to the acquisition of certain skills such as critical thinking skills ..."

"Using EE as an approach we know that it should be basically cross-curricular, it means that it should be referred back to other subjects ...".

(iv) The model is holistic

Much as most the respondents respectively concurred with the notion that the model is good and could be acceptable, not all explicitly stated that the model is holistic. Despite that fact, more than fifty percent of the respondents in this study stated that the model is good because it is holistic. The model, in other words, does not focus on one paradigm or teaching method at a time, but on a variety of these, depending on the topic and the context within which a lesson is presented. Examples of some of the statements they made include the following:

"Yes, by holistic I mean it covers a number of good things, it doesn't focus on one line...It does not focus on nature only it focus on human's experiences, past human realities and all those things, ...".

"I'm preaching eclectic approach and that's exactly what this model says, use what is effective and proven to be effective ..."

" ...that makes sense that we as environmental educationist insist that all subjects have to have a taste of environmental education in some way".

"If you use the holistic approach and relate it very well to this model you might find that we can solve environmental problems eventually ..."

"I find the model very very inclusive of all environmental factors that are important ..."

From the above findings, it can be concluded that the assertions made by the respondents that the amoeba model could be put to practice across the curriculum and that it is flexible and holistic, reflect a positive attitude towards the model. Examples of statements some respondents made during the interview further reflect the enthusiasm with which they expressed their views on the amoeba model. The general impression gained from the responses to questions concerning respondents' views on the amoeba model is that there is a need for this type of model to facilitate the process of teaching in an environmentally directed way.

6.4.2 Why would you use or not use this model for teaching in an environmentally directed way?

It was made clear to the respondents that they had an option of responding either positively or negatively to the question, upon which they respectively stated that they could use the model for a variety of reasons. These were categorised, as in the preceding section (refer to paragraph 6.4.1). It was found that respondents would use the model because it is:

- practical and broadens the mind;
- flexible;
- interrelating; and
- holistic.

Below are a few reasons provided by some respondents for using the model:

(i) The model is practical and broadens the mind

"The model contributes towards the education system for it removes us from that old paradigm of thinking that teaching is only about the talk and chalk issues and not addressing the world practical issues that are affecting our children so the model itself can contribute to us improving the type of teaching approaches in the sense that then the teaching can be made more practical and address the real environmental issues affecting kids".

"Actually I have not come across a model which seem to be perfect in relative terms to me like this one so I mean for now this is the only model which I think can go a long way in helping me to teach in an environmentally directed way".

" ... it also broadens that it used history if learners were doing they would learn from a historical point of view the cultures that were involved, ...".

" ... it develops students' curiosity, to be adventurous, to want to know more ...".

"Again it stimulates students' thinking capacity of critical thinking ..."

"...I think ... as a teacher one also has to be like an amoeba and sort of reach out

and grab and assimilate as much material as you can and capitalize on that, because there is no book or textbook or any of that sort of material that is readily useable and suitable for the variety of classrooms that you have got in this country".

(ii) The model is flexible

"So I would use this model ..., its talking about that flexibility also, it is not prescriptive".

"...there is not much material available on environment ... that suits the local situation and if you give teachers that feeling of flexibility and ownership of their learning programmes ...they then have to look at studying their own environment and finding resources within that particular environment ..."

"I think it gives you the liberty to take what you want and leave out what you do not need at that time."

(iii) The model interrelates

"I think we agree on the issue of that it is interrelated in approach and that the teaching methods which are mentioned are used in an interrelated manner and that happens in reality as such."

"I am of the school that believes in cross-curriculum,...integrated, active approaches so therefore as I say what the model says is what has been applied."

"I would use it in that it encompasses everything that is needed to be taught to the child,..."

(iv) The model is holistic

"I'm preaching an eclectic approach and that is exactly what this model says, use what is effective and proven to be effective."

"What means pollution remains pollution, whether it is in english lesson, geography lesson or your lesson. You talk about the causes of pollution for instance, the issues of pollution, the types of pollution whether it is in geography, english or whatever, so I am not actually saying it should be perceived from an english angle or from a geography angle or whatever. All that I want is for students to understand, to have that holistic understanding of pollution".

"... as I said, you can use it to teach in an environmentally directed way because, one, its holistic ...."

"I would use it as I have explained ...it includes, you know, all aspects of ....not only the environment but even aspects which are environmental in nature."

The factors which were discussed in the above paragraphs were found to be closely related to those in the preceding section (refer to section 6.4.1). The difference was due to the fact that the respondents had to elaborate by giving a reason or reasons why they would use or not use the model to teach in an environmentally directed way. The respondents were consistently positive about the model and enthusiastic. They strongly defended the use of the model.

6.4.3 What general suggestion(s) would you make regarding the model?

This section was not categorised like the preceding two sections (refer to sections 6.4.1 and 6.4.2) because respondents were asked to make suggestions regarding the model. These were directed to the researcher and as such the 'you' referred to in this section is the researcher. Suggestions which were made by the respective respondents are reflected below:

"You need to emphasise the flexibility on the part of the teacher in selecting the different methods. Also say that in developing a learning programme you as a teacher act like an amoeba in the sense that you focus on different activities and approaches at a time. You simulate and draw strengths from all over around you".

"... ensure that the terminology you use is linked to the curriculum terminology, for example, terms like phase organiser, and learning programme".

"... you need to make sure that the practical applicability of the model gets addressed in the real classroom situation. That is, you need to train them on how the model should be applied".

"the model is good but will need to be coupled with teaching aids and other relevant media".

"... the model is good and it should be adopted".

"... you will have to have a workbook which will have to be developed from your thesis - which will serve as a practical teachers' guide on how to use the model".

"... the model should be used to train teachers".

"... more practical examples which relate to the curriculum should be given to show how the environment can be used as a learning organiser".

In summarising the general comments made about the amoeba model, it could be stated that there is a general consensus from the respondents that the model should be adopted to contribute towards the improvement of the education system in South Africa. For example, teachers need to be trained how to teach in an environmentally directed way by using the amoeba model.

The model should be made available in the form of a workbook with many

examples which teachers can use as a guide in learning to teach in an environmentally directed way.

6.5. CLARIFICATION OF CONCERNS ABOUT THE MODEL

As much as the majority of respondents in the respective interviews outrightly took positions and responded to the questions asked about the model (refer to section 6.4.), some raised concerns about certain issues pertaining to the model. It was only after they were clarified about the model that they took firm positions in expressing views on the questions asked. For example, one interviewee whose code name was "M" in the interview stated:

"You have environmental education as a centre, on the outside are all the various ones, but what I am not clear to was is that how does it go, I mean how you have to change your teaching in classroom or education is different, I know for I have taught there, I've been there, what I couldn't pick up was how should it change to go to positivism under what circumstances should it go to become a constructivsm approach , what circumstances should be positive, so I'm sort of, I feel there is just a missing link which is the "how to", so if I take myself, If I take myself back to the classroom as a teacher, I got all these approaches like the experimental, the narrative, question-and-answer and I know what's positive and what the teacher should do and what the learner should do. You do

give some examples like air pollution etc, but sort of feel, how do I know which one would be better approach. The positivism or the social or the constructivism for that particular situation".

The interviewer, whose code name is "O" in the interview clarified parts of the model to the interviewee whose code name is "M" in that interview. That process took this form:

O: "If you look from page ..."

M: "That's right, you have the various methods and you explain them, that's quite right".

O: "No exactly, I mean from page 5 where I talk of the paradigms, they have actually been presented over there, and they are actually been shown that they are just examples of this thing, of any other paradigm and as a result I say over there that ..."

M: "I see you write here ...65....which ever one I see that all right".

O: "Now I'm saying that it can make use of elements, of paradigms...".

M: "A, I see, which at once...".

O: "depending on whatever is being taught at a particular time and the context within that actually is being done. Okay".

M: "I see now, that makes sense".

O: " I think it maybe answers your question".

M: "You have to take which one you want. Okay, which is fine...alright I agree with that thank you, that clarifies that".

O: "Does that answer your question".

M: "Yes, I was a bit concerning that - but how do I know which is the correct one to take?"

O: "Over there I am saying there's quite a variety of these and you can take elements from the one and then elements from another paradigm and elements from another just like in the case of teaching methods. You do not make yourself a straight jacked type of a thing".

Later during the same interview, the issue of "how to" came to surface as a concern regarding the use of the model. The interview took this form:

O: "I using this do you think it could actually help solve problems in environmental education?"

M: "I think it will solve it will but you to once again show .... the HOW is important thing to me".

O: "Who needs to show how?"

M: "The model needs to have guidlines to show how to approach these environmental problems environmental issues".

O: "Can I just say that in passing that there is some case studies being used in the thesis and then that is where they are showing how this can be used".

Another concern which was brought to surface was that outcomes based education (OBE) was not mentioned in the model. The interviewee, "M", expressed his view and the interviewer, "O", responded in this way:

M: "... That brings me to the next thing....., is the actual evaluation, this outcomes based education which we are in at the moment I don't think I came across that word, outcomes based education in your model".

O: "It is not exactly in the model, but it is forming part of the thesis".

M: "Oh is it, okay because I think you have to have those things which is essential".

O: "Which things are you referring to?"

M: "The whole outcomes based philosophy and using the environment as a phase organiser so those things I think also need to be brought into your thing".

In a separate interview, an interviewee whose code name is "D" suggested that the study should use and link to the terminology which is used in OBE. The interviewer responded to the suggestion. That part of the interview took this form:

O: "What other suggestion would you actually make".

D: "The other suggestion is that maybe the terminology you use is linked to the new curriculum terminology so terms like learning programme and phase organisers and so on, I don't know if its mentioned in the other parts of your documents".

O: "They are not exactly mentioned because I did not go deeper into OBE, but there is a section wherein ee, teaching methods and paradigms are actually

related to OBE and that is not we did not go that much in depth with regard to that because the research itself is not focused or directed on OBE and teaching methods but it is actually more on ee, that is why we not..."

As much as the interviewee surfaced the concept of OBE, the interviewer emphasised that the thesis is not about outcome based education but OBE forms part of the thesis. The reason thereof is that the thesis is not focused on OBE but on environmental education and teaching methods. However, it is acknowledged by the author that OBE is important for environmental education and for education in general. Hence a section of the study is devoted to OBE and environmental education. The terminology which was used in OBE such as learners and not pupils as was the case previously was used throughout the study. That is the reason why the philosophy behind OBE and other details thereof such as programme organiser are not discussed.

In another interview, an interviewee whose code name is "T" stated that the paper which the interviewees had to read lacked academic depth because it did not have aims, objectives and principles of environmental education clearly written and spelt out on it.The interviewee further proposed a solution to the problem. The interviewee ("T") said:

"In other words what might have solved the problem of lack of academic depth as it is is in this document, I don't know what might be able to solve that problem as I see it as a problem might be to exactly do what I suggested is to follow the

phases prescribed by methodologist in developing a scientific model. In doing that you will maybe find that you are forced to describe certain aspects because for instance what I mean by lack of depth in the model as it is described in this paper that you presented at the conference or wherever. What I mean by that is for instance oupa,what I miss, if we are talking about a model for an approach like ee or any other approach, I would have loved to see in the case of ee for instance how does this model address the principles and you know the principles for ee as well as I. How does it accommodate the different categories of aims, objectives what ever you want to call it, for instance the (??deblusified 82) and for that matter the different levels of aims(???85 Hungerferd and Fork??) there four levels, you know that one starting with the ecological foundation level, the awereness level the investigation and evolution level and the last one the skills, citizen activity skills".

The interviewee further stated that:

"...as far as the practical aspects, the implementation of this, okay let me just finish that comment is from this document without that perspective of how does it accommodate those aspects that lie between the paradigms and the practice of ee namely the principles and the aims and objectives for instance, that's why I won't use it as it is now, here in this format in a teacher education course for instance, I would love to see why because the teacher is being exposed to an academic training and to be fully equipped to apply it in practice as you indicate

with your teaching methods at the end of the paper, to be able to be equipped, really equipped to do that, the teacher in training must just get that missing part, that I'm referring to, the missing part namely how is this model accommodating the principles and the aims and objectives the central things".

In response to the interviewee's concerns, the interviewer ("O") said:

O: "Can say to you that for instance in the thesis itself, is a whole section wherein we talk of aims and objectives of this thing and they are actually in other chapters ....this paper is actually it was actually .....should have your comment with regard to what you opinion about the model, the developed model is in practice".

T: "I wasn't aware of that, but if it is based it accommodates it shows the different essential elements if we can talk about elements in ee, the priciples and the different aims and objectives are indeed being accommodated by this model then okay, fair then I'm satisfied".

It is after explaining to the interviewee that his concerns were overed in the other parts of the thesis that he outrightly supported the model. In presenting his views to the interviewer, "O", that part of the interview took this form:

T: "Because we have in this country, we have people building their ee practice and

by that I mean ee training programmes and ee practice out in schools or centres of where ever public, built on for instance the social critically paradigm and not moving from that, so they are hooked on that one. I see it, some others might be, I'm not aware of some but you might get people in this country leaning over to the other side, to the other extreme, namely the behaviouristic positivist type of approach. So in my opinion it's both of them have ....I'm preaching an eclectic approach and that's exactly what this model says, use what is effective and proven to be effective in, rather from each of those paradigms and that is exactly what an eclectic approach is, is to combine the best elements from different approaches or in this case then different paradigms. So I would....to make it complete, I would, and I'm doing that, I take things from John Finn and from Ian Robottom socially critical paradigm and I combine it with ease with stuff from Hungerford from North America and I don't find it a problem and my seniors don't seem not to find it a problem as well and that is exactly an eclectic approach, I'm not hooked at one paradigm. In that way I think I deal with what ee should deal with".

O: "So are you saying...."

T: "and therefore I like this".

6.6 OVERVIEW OF ALL RESPONDENTS

It could be stated that some of the respondents seem to have understood the paper (refer to annexure 2) and responded to the questions asked. Others seem to have been unsure of what was required of them. That led to some interviewees asking questions and raising concerns about things such as aims, objectives, OBE, which they expected to form part of the paper. The author explained to some interviewees, during the respective interviews that aspects they were concerned about formed part of the thesis and were deliberately left out in the paper (which interviewees had to read in preparation for the interview) because the author wanted the views which were focused on the model only. Besides, adding more information such as that noted earlier to the already long paper could have increased the lenght of the paper further. That could have probably discouraged some prospective interviewees from reading the paper carefully in order to respond better to the questions asked.

The interviewer therefore clarified and explained issues raised by some interviewees during the interviews. That made them to take positions and respond to questions such as those which were asked (refer to 6.3.4. - 6.5). Some of their opinions form part of the examples provided in section 6.4.

6.7 CONCLUSION

An attempt was made in this chapter to analyse and interpret the amoeba model qualitatively. The link between this chapter and the preceding chapters was discussed. That was followed by a discussion of qualitative research and research design. Subsequently, the analysis and interpretation of data were presented. The findings indicate that the amoeba model was positively accepted owing to the fact that it does not focus on one paradigm and teaching method at a time, but could focus on a variety of these, depending on the topic and the context within which a lesson is presented (refer to paragraph 1.3). It was further proposed that the amoeba model should be adopted by the education system in South Africa.

Despite the fact that findings and proposals were made in this chapter, suggestions and recommendations regarding the study will also be made in the chapter 7.

CHAPTER 7

SUMMARY, TESTING THE HYPOTHESIS AND RECOMMENDATIONS

7.1 INTRODUCTION

This chapter summarises the findings of the literature review in chapters 2 to 4, the interpreted data on the developed amoeba model represented in chapter 5 and the qualitative analysis and interpretation of the amoeba model in chapter six. Recommendations will be based on the findings.

7.2 SUMMARY OF FINDINGS

7.2.1 Theoretical perspectives on environmental education

In describing some theoretical perspectives on environmental education, it is important to note that, to some extent, these addressed the problem of the study, namely to determine how elements from a variety of paradigms and teaching method(s) can be used by teachers and environmental educators simultaneously for teaching in an environmentally directed way. After having thus, to a certain extent, addressed the problem of the study, some deductions were made. Amongst others, these included the following:

- Environmental education draws the attention of people to the importance of the environment, about and in the environment. It encourages people to identify environmental problems and to reflect critically on these problems by using any relevant means at their disposal and then to act in accordance with the needs of the environment at the time.

- Environmental education also helps people to be environmentally literate, in other words, it enables them to identify environmental issues and problems, think critically about them and act appropriately within their context.

7.2.2 Paradigms relating to environmental education

In focusing on paradigms relating to environmental education, some deductions which were made include the following:

- Paradigms could generate ideas which may enable a person to interpret the environment from various perspectives, depending on the topic and the environment. For example, a positivist paradigm could be used by a teacher to measure the quantity of water and the extent of pollution in an environment (see chapter 3).

- None of the examples of paradigms which were used for the study is identical to the other in terms of characteristics and implications for

environmental education and teaching methods respectively. Each of these, in other words, addressed the problem of the study in its own way.

7.2.3 Teaching methods appropriate for environmental education

Some teaching methods were identified and classified by the researcher for purposes of convenience in the study. It was noted that some of them have certain features in common which make them appropriate for simultaneous use to facilitate teaching in an environmentally directed way - depending on the topic and the environment. The ideas which developed from the theory in this section of the research study, together with those developed in the preceding sections, facilitated the development of the amoeba model.

7.2.4 Developing an interpretative model for teaching in an environmentally directed way

An amoeba was used as a metaphor to develop a model - an amoeba model - to facilitate the process of teaching in an environmentally directed way. In using the model, some examples of paradigms and teaching methods were used towards the development of the amoeba model. Each of the examples of paradigms and teaching methods contributed to the research in its own way. Some teaching methods showed common features of conversion and also addressed the problem of the study in their own ways. The ideas generated from the examples of

paradigms and teaching methods which were used for the study respectively contributed towards the development of the model - the amoeba model.

7.2.5 Qualitative analysis and interpretation of the amoeba model

Empirical research was conducted to report on the reactions and responses of knowledgeable people in environmental edcation regarding the way in which the amoeba model should be operationalised in practise.

In their responses to the questions asked about the amoeba model, respondents supported the use of the model for a variety of reasons, that is, the findings indicate that the amoeba model was positively accepted due to the fact that it does not focus on one paradigm and teaching method at a time but could focus on a variety of these, depending on the topic and the context within which a lesson is presented (refer to paragraph 1.3). It would appear from the findings, for example, that the amoeba model could, in practice, be used across the curriculum in schools. This could lead to the acquisition of some skills such as critical thinking skills. Furthermore, the model appears to be flexible and holistic. The model, in other words, gives teachers a feeling of ownership of the programmes they teach. It would enable them to study their own environments and find resources which they could use to facilitate teaching within that environment. A teacher could, for example, help learners to gain a holistic understanding of the term pollution from economic, linguistic, political and social

points of view. It was noted that the model would, in addition, broaden the mind and open up new possibilities in environmental education. Moreover, it can promote a more practical approach to teaching and relate it to real environmental issues which affect people's daily lives. When, for example, an environmental crisis is discussed, the topic could be related to a similar incident that ocurred in the past, which could help to avert a future environmental crisis.

7.3 TESTING THE HYPOTHESIS OF THE STUDY

From the findings stated chapter 7 it is important to note that the use of examples of paradigms (refer to paragraph 3.3) as directives for environmental educators and teaching methods (refer to paragraph 4.4) contributed to the study in their own ways despite their contrasting features. They contributed towards the development of the amoeba model which concurs with the hypothesis that no single paradigm or teaching method can be regarded as ideal for teaching in an environmentally directed way. That means that elements from a variety of paradigms and teaching methods could be used simultaneously to teach in an environmentally directed way in accordance with the topic and the context within which a topic is taught. The amoeba model serves as a solution to the problem of the study (refer to paragraph 1.2.2) and indicates that elements from a variety of paradigms and teaching methods could be used simultaneously to teach in an environmentally directed way in accordance with the topic and the context within which a topic is being taught (refer to paragraph 1.3).

Recommendations regarding this study will be made on the basis of the summary of findings cited above.

7.4 RECOMMENDATIONS

The following recommendations are made regarding the amoeba model in an education system:

7.4.1 The amoeba model, which, initially, was a theoretical construct (see chapter 5) and scientifically tested through a qualitative research method (see chapter 6), should be adopted by the Department of Education to contribute towards the improvement of the education system in South Africa. The model should be adopted by integrating it into the curriculum of the South African education system. This can be done by training staff of the professional services of education departments in the various provinces to understand and utilize the model. Concerns which were raised by some interviewees during the interviews (refer to section 6.5.) should also be brought to the attention of whoever will be trained to understand and use the amoeba model. The rationale behind this recommendation is that teachers need to be trained to teach in an environmentally directed way by using the amoeba model, which is particularly appropriate and useful for the purpose. It is related to the environment and reflects on the issues that are peculiar to the environment. This can be done by the then trained

professional staff.

7.4.2 The researcher should design and develop an environmental education workbook focused on the amoeba model propounded in the thesis. That workbook should include a number of examples and case studies which teachers could use as a guide in learning to teach in an environmentally directed way. The workbook could, for example, be used to show the extent to which the environment is inclusive, and that the amoeba model is inclusive of all environmental factors. It could be used to show the need of learners to understand environmental issues from a holistic point of view and not from a linguistic, social or political point of view only. Teachers need to act like amoebae and focus on different activities and approaches across the curriculum. The incorporation of environmental education across the curriculum could lead to teachers acquiring certain skills such as critical thinking skills. It could also put them in a position to refer to nature, human experience and past human realities. They could do this by reaching out, capturing and assimilating information on environmental education which is relevant to the topic at hand. The workbook could also serve to empower teachers with regard to environmental education terminology and further relate it to the new curriculum and OBE strategies of the education system in South Africa.

7.4.3 Teacher education programmes should emphasise the possibility of using

more than one teaching method and paradigm at the same time, especially when teaching a topic with an environmental education theme. Teachers should, in other words, be allowed more flexibility and ownership of earning programmes. They should select and use elements of paradigms and teaching methods which best suit the themes of their lessons at the time. Many teachers seem to use one teaching method only at a time. This could be monotonous for learners and may not fulfil all their needs. There is a need to look at environmental education in a flexible way because not all learners in classrooms are the same. There is a need to combine elements from different paradigms and teaching methods to suit different teaching situations. That would give the teacher the liberty to use a combination of elements of teaching methods and paradigms that (s)he knows to achieve what (s)he wants, and leave out the rest.

7.4.4 The researcher, as a pioneer of the amoeba model, should design and conduct workshops and seminars to empower and make teacher educators, officials from the Department of Education and teachers in practice aware of the principles of the amoeba model. The amoeba model should be used to train teachers to teach in an environmentally directed way by focusing on real life situations. In this way, it can be ensured that all Outcomes-based Education principles, such as integrating and connecting knowledge that is relevant to real-life situations, are realised. This can be promoted by using innovative and creatively designed programmes. The rationale

behind this recommendation is that a clear understanding of the amoeba model can facilitate the realisation of the Outcomes-based Education principles as indicated by the example of a principle above. That is, the researcher, as the developer of the model and person who tested it, should facilitate workshops and seminars on the model in relation to environmental education.

ANNEXURE 1

Dear Sir/Madam

I am a doctoral student in Environmental Education at Unisa. I hereby wish to invite you - as a person who is knowledgeable in environmental education - to take part in an interview I will be conducting as part of my research. This will not take more than two hours of your time.

Should you be willing to take part in the research, please let me know as soon as possible. I will arrange the date, time and venue of the interview and send you a copy of background information (notes) regarding the interview.

You will not be named anywhere as one of the respondents in this study. Your responses will also be kept confidential.

You may contact me at any of the following contact numbers:
Phone: (012)429-4433 (w)
(011)318-1376 (h)
Cell: 0834538148
E-mail: lebelldm@alpha.unisa.ac.za
Fax: (012)429-4922

Yours faithfully
Lebeloane LDM "Oupa"

ANNEXURE 2

Dear Sir/Madam

I wish to express my gratitude for your willingness to take part in the interview.

Enclosed is an article which you are cordially requested to read in preparation for the interview. I wish to apologise for the length of the article. Nevertheless, I trust that reading it will be interesting to you and will not infringe too much on your time.

The three key questions you will be asked are:-

1. What is your opinion about the model developed during my study in relation to environmental education?
2. Why would you use or not use this model for teaching in an environmentally directed way?
3. What general suggestion would you make regarding the model?

Once more, I wish to emphasise that this interview will not take more than two hours of your time. Your name and responses in the interview will also not be disclosed to anyone.

Yours faithfully
Lebeloane LDM "Oupa"

ANNEXURE 3

A MODEL FOR AN ENVIRONMENTALLY DIRECTED TEACHING APPROACH

1. INTRODUCTION

The debate continues in many parts of the world whether environmental education should be a field of study or an approach. The position taken in this paper is that environmental education should be regarded as an approach in an education system. In this presentation a metaphor of an amoeba called the "amoeba model" is identified and seen as appropriate for use and for teaching in an environmentally directed way.

Firstly, the importance of teaching in an environmentally directed way will be discussed. That will be followed by the development and description of the "amoeba model". Lastly, the conclusion and way forward regarding this ideal model will also be cited.

2. WHY TEACH IN AN ENVIRONMENTALLY DIRECTED WAY?

The notion that environmental education should rather be integrated into other areas of study is supported to a large extend by scholars from various quarters in various ways. For example, Okot-Uma and Wereko-Brobby (1985) maintain that as an approach, environmental education in its formal pedagogical sense *implies* cutting across the traditional subject areas in order to enhance in the learner an awareness of, understanding and concern for the environment and its associated problems. That is, environmental education should not be regarded as a separate school subject or an add-on to other school subjects (Joubert and Steenkamp 1993). It emphasises learning through direct experience, leading to knowledge acquisition, development of skills and understanding how to care for the whole environment and all those who share it (Scottish Environmental Eduction Council 1993).

The view that environmental education should be integrated as an approach is also supported by the notion that most of the current environmental crises in the world deal with highly complex phenomena found at global and local level (Kastenholz and Edmann 1992). These crises make it increasingly necessary to achieve global change of attitudes towards the environment, by thinking globally and acting locally (1992). That is, in order to develop, consolidate and achieve such a change so that it has a long-term effects, there is a need to teach in an environmentally directed way.

Teaching in an environmentally directed way can act as a vehicle for the development of environmental awareness and consciousness (Leketi 1992). That is, using an environmental approach in teaching about and for the environment in

a formal school may develop learners into critical thinkers, social inquirers and problem solvers. It may further develop them into active participants in environmental, political or even educational decision making processes (1992). By teaching in an environmentally directed way, teachers may also -

(1) facilitate new patterns of behaviour in learners which include the personal lifestyles and informed social action in order to harmonize with the environment

(2) show the links between elements of the bio-physical and sociopolitical environment and awareness of and concern for the total health of the planet and its people (Council for the Environment 1993).

The notions cited in the preceding paragraphs concur with the assertion that the content of and skills developed through environmental education should be merged into existing school areas of study in such a way that they are compatible with the nature of the areas of study and not dominate their content or jeorpadise the integrity of the course themselves (UNESCO 1989).
Teaching in an environmentally directed way is important because environmental education is, for and about the environment.

After the discussion on the importance of teaching in an environmentally directed way, the next question is - what is the ideal strategy of putting that into practice? That is, how can that process be put into action?

3. THE IDEAL STRATEGY

Because any field of study, study or research is based on a frame of reference or paradigm, research on environmental education in this paper is also based on an underlying paradigm. Paradigms are defined differently by different scholars. A paradigm is defined in this paper as a systematic way of identifying, perceiving and interpreting the world view in terms of what should be studied, how that should be studied, when and why that should be studied.

Because environmental education does not have a straight-jacket paradigm underlying it, elements from a variety of paradigms such as positivism, constructivism, social critical theory, et cetera may be used simultaneously to form the underlying paradigm depending on the topic and the environment. This notion is discussed hereunder with the use of some identified and categorised paradigms.

3.1.1. CATEGORIES OF PARADIGMS RELATING TO ENVIRONMENTAL EDUCATION

Although there are a number of paradigms which could be discussed for purposes of any research, in this paper three paradigms - positivism, social critical theory and constructivism - will be discussed according to their:-

- main characteristics,
- implications for environmental education, and

3.1.1.1. POSITIVISM

Positivism is according to Sztompka (1979) a paradigm which focuses on scientific methodology, that is, using scientific methods which are based on the objective sciences for performing experiments, observations and testing the soundness of conclusions. It is aimed at shaping human behaviour in a particular desirable way through natural scientific method(s) (Hungerford and Volk 1990).

(1) CHARACTERISTICS

- Positivism is characterised by the belief of the natural sciences and concentrates on objective testable observations of the physical world. That is, in positivism only positive, observable and testable phenomena are acceptable (Robottom and Hart 1993).
- Positivism generates theory and assesses data with theory which is based on empirical merits (Seiman and Wagner 1992).
- Data is objectively researched, developed, disseminated and adopted. That is, Research, Development, Dissemination and Adoption (RDDA) model is used in positivism (Robottom and Hart 1993).

(2) IMPLICATIONS FOR ENVIRONMENTAL EDUCATION

- Environmental education should in the context of positivism, provide observable and measurable knowledge, skills, et cetera (Engleson and Yocker 1994). For example, environmental education should:-

1. provide learners with measurable knowledge to acquire a basic understanding of how the natural environment functions, how its functions are affected by human activity and how the harmony between human activity and the natural environment can be achieved,
2. provide citizen action skills to help learners to develop skills needed to identify, investigate and take action towards the prevention and resolution of environmental issues,
3. provide citizen action experiences to help learners to gain experience in applying acquired perceptual awareness, knowledge and skills in working towards the prevention of and resolution of environmental issues at all levels, starting from local through to global level (Engleson and Yockers 1994). All that should be observable and measurable.

- Environmental education should provide learners with observable, measurable and testable knowledge, skills and experiences they need to understand regarding the environment (Robottom and Hart 1993).

While positivism is frequently adopted as the only paradigm by positivists (those people who rely solely on experiments and or that which can be observed and measured), it has its critics and competitors such as those who align themselves either with constructivism, social critical theory, et cetera - some of which will be respectively discussed in the subsequent paragraphs. Some of the critics base their

arguments on some of the facts which will be noted in the subsequent sections respectively.

3.1.2.2. SOCIAL CRITICAL THEORY

To be critical means to expose one's ideological bases, penetrating one's ideological assumptions, through critique (Green 1990). To Popkewitz (1990) it also means developing a conception of reality that ties ideas, thought and language to social and historical conditions which are based on criticism, on notions of power and control. From the preceding descriptions,becoming critical seems to be developing an analytical posture towards argument, procedures and developing an action-orientated commitment to change.

(1) CHARACTERISTICS OF SOCIAL CRITICAL THEORY

- Social critical theory has an emancipatory action-constitutive interest on improving the quality of human existence. That is, social critical theory has interest in improving the quality of human existence by setting them free from their way of thinking and replacing that with an 'improved' way of thinking of a particular community and or society.
- It attempts to relativise issues of methodology by embedding these in their history,
- Social critical theory is practical, action-oriented and enlightens. It thereby catalyses social and political changes (Green 1990).

(2) IMPLICATIONS FOR ENVIRONMENTAL EDUCATION

In accordance to the views of Green (1990) and Robottom and Hart (1993) respectively regarding the implications for environmental education,

- Environmental education should, in the context of social critical theory, improve the quality of human existence through emancipation
- the preceding process should occur through practical action which is based on knowledge acquired from the theory behind it. That knowledge also serve to enlighten and catalyse social and political changes in an environment,
- in using the social critical theory, environmental education should use theory and practice to facilitate the acquisition of knowledge. Theory and practice should therefore count as knowledge for environmental education,
- according top this paradigm, that which changes should count as knowledge in environmental education,
- truth should therefore be whatever leads to the achievement of good, right, responsible results and that which empowers individuals,
- inquiry in environmental education which is based on critical theory should focus on that which uncovers meaning and causes contradictions which operate behind unquestioned interactions of people's daily lives,
- according to social critical theory environmental education should make the

'taken-for-granted' assumptions about the environment transparent,
- it should further facilitate the integration of knowledge and purposeful action in the environment (Green 1990; Robottom and Hart 1993).

Summarily, the social critical theory's inquiry in environmental education is based on uncovering meaning and causes of contradictions which operate behind unquestioned interactions of people daily. It also wishes to facilitate the integration of knowledge and purposeful action in the environment.

3.1.2.3. CONSTRUCTIVISM

Constructivism is a paradigm which conducts inquiry systematically and publicly, using analytical criteria and explicit rational to test and try to disprove claims which may be there (Rapoport 1990). It aims to restore the connection between scientific knowledge, which has become divorced from daily experience and the activities in which it is rooted, through meaning and understanding (Craib 1985). Learners consciously attempt, in constructivism, through the analysis of experience, to uncover and reconcile certain fundamental essences or phenomena by providing meaning to them.
Researchers who operate within this paradigm are also interested in the presentation of value-based, holistic, competing and often conflicting realities of multiple stakeholders and participants (Van Matre in Robottom and Hart 1993).

(1) CHARACTERISTICS OF CONSTRUCTIVISM

- Constructivism is based on a relativist ontology (nature of reality).
- Reality only exists within the context of a specific mental framework or construct.
- Social reality is not an independent reality but is reality which is socially constructed by societal members and can have a multiplicity of meanings (Robottom and Hart 1993).

(2) IMPLICATIONS FOR ENVIRONMENTAL EDUCATION

- Environmental education should, in the context of constructivism, systematically and publicly inquire on and about environmental education or environmental issues or topics (such as environmental literacy, pollution, et cetera.) through the use of explicit rationale and analytical criteria to test or try to disprove any false claims (see Rapoport 1990; Ritzer 1992).
- Environmental education implies that knowledge about the environment is socially constructed which pertains to a specific context. For example, knowledge about pollution in the air in a specific area will be socially constructed to a particular context.
- Those who learn environmental education for and about the environment within constructivism acquire knowledge, skills and develop attitudes through meaning and understanding through their senses (of touch, taste,

smell, hearing, et cetera) in relation to the environment of which they are part (Craib 1985; Van Matre 1972, quoted in Robottom and Hart 1993).

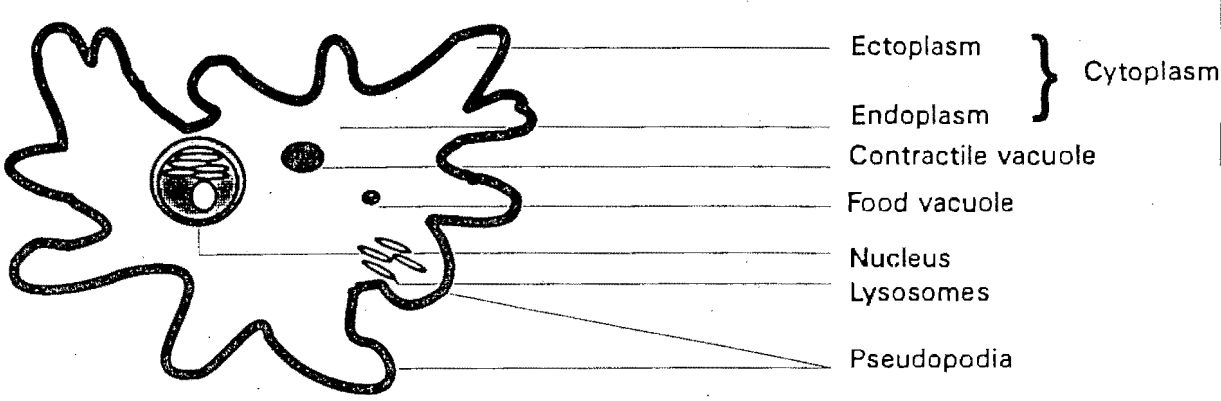
Constructivism's inquiry in environmental education could be summarised in this way that it is based on a relativist nature of reality. In constructivism, reality occurs within a mental framework. Constructivism wishes to facilitate the integration of knowledge that is based on a particular mental framework and action in the environment.

From the above discussed paradigms (positivism, social critical theory and constructivism), it is imperative to note that they respectively show contrasting views with regard to characteristics, implications for environmental education and for teaching methods. It is from these views on paradigms that deductions could be made.

3.1.2.4. DEDUCTIONS MADE FROM THE PRECEDING PARADIGMS

In order to make deductions from the preceding paradigms, a metaphor of an amoeba will be used. It will also be discussed according to the characteristics and implications for environmental education as in the preceding paragraphs. These three factors will be preceded by a structure of an amoeba.

THE STRUCTURE OF AN AMOEBA



1. CHARACTERISTICS

- An amoeba is a unicellular living organism. It consists of a protoplasm, that is, a cytoplasm and a nucleus. For example, in the cytoplasm are some cell organelles such as contractile vacuole, food vacuoles and lysosomes. The nucleus makes the process of cell division and or reproduction possible.
- It is irregular in shape. That is, an amoeba can also form protrusions called pseudopodia. It is by means of these pseudopodia that it can change shape and 'catch' or engulf food particles.

2. IMPLICATIONS FOR ENVIRONMENTAL EDUCATION

In view of this paper, implications which could be deduced for environmental education - depending on the topic and or environment thereof - include the following that:-

- Like an amoeba environmental education includes the concepts environment andeducation. The environment, for example, includes the land, air and water. In education, learners are empowered to discover, explore, interpret and how understanding of knowledge.
- It is irregular in shape, that is, according to this model, reality is ocially constructed by societal members and could have a multiplicity of meanings depending on the environment within which it is constructed,
- It can change its shape by moving away from its position. In interpreting this characteristic in this paper, environmental education could be referred to as having an emancipatory action-oriented interest, that is, it can change its position by 'improving' on the existing position regarding the environment.
- It is unicellular, that is, reality about the environment remains the same. For example, environmental pollution remains pollution to the environment and nothing more or less. That means reality remains within the context of a specific mental framework.
- It has the ability to perform various functions such as engulfing and ingesting food for nutrition purposes, excretion, locomotion and reproduction. In environmental education data can be researched, developed, disseminated and adopted, that is, the RDDA model can be used for environmental education. That is, as an approach, environmental education is also interdisciplinary because it accepts, accommodates and may exclude information that is not relevant at the time. This can be done through the use of some elements of constructivism, positivism and critical theory paradigms respectively and or collectively for as long as they are relevant for a topic and the environment within which it is taught. This notion is based on the argument as presented by Gramsci in Kearney (1986) that without a theoretical critique of the political and cultural structures which dominate human existence in the modern industrial society, the concrete liberation of people will forever be postponed. This is the reason why these paradigms - constructivism, positivism and critical theory were referred to and discussed in the preceding sections.

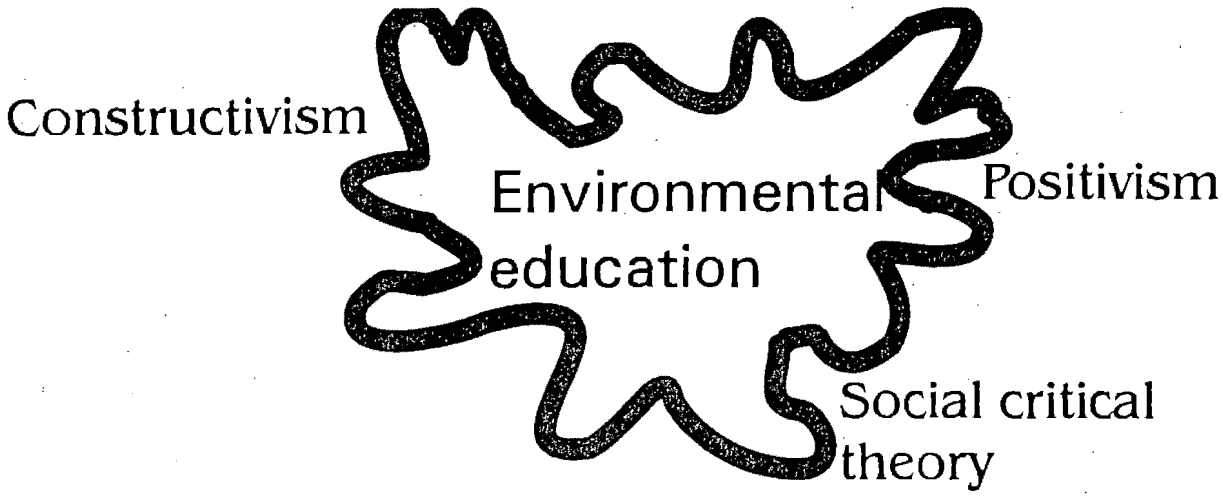
In elaborating on the implications for environmental education, this means that:-

- Reality in environmental education should be socially constructed within a particular mental framework,
- Reality should be systematically and publicly inquired on through the use of explicit rationale and analytical criteria to test or disprove any false claims,

- Reality about information on environmental education should be researched, developed, disseminated and adopted, that is, the RDDA model is used,
- Learners should be provided with observable and measurable knowledge, skills, et cetera. to harmonise theory and practice (praxis),
- A holistic view regarding the environment should be followed.

Having discussed the metaphor of the amoeba and shown how it is applicable for the paper in terms of the characteristics, implications for environmental education, a deduction of the model on the paradigm of the study is made. That is, an amoeba model - which depicts the major paradigm influencing environmental education - is developed. It is shown hereunder in the form of a diagram.

AMOEBA MODEL (focusing on paradigms)



3.2. TEACHING METHODS RELATING TO ENVIRONMENTAL EDUCATION

The developed model (though incomplete at this stage) and paradigms from which it was developed show how elements from different paradigms such as positivism, constructivism, social critical theory, et cetera may be used simultaneously to form the underlying paradigm of teaching in an environmentally directed way (depending on the topic of discussion and the environment). Equally, a variety of teaching methods could be used simultaneously for teaching in an environmentally directed way - also depending on the topic of discussion and the environment. Some examples thereof include the following teaching methods:-

1. Narrative method
2. Textbook method
3. Cooperative learning method
4. Demonstration method
5. Discovery method

6. Discussion method
7. Drill method
8. Experimental method
9. Free-activity method
10. Problem-solving method
11. Project method
12. Question-and-answer method

In elaborating on each of those teaching methods, focus will be on the following characteristics thereof:-

1. the main aim(s) of teaching methods
2. nature of teacher involvement
3. nature of learner involvement
4. commonly used teaching aids or media
5. nature of implication for environmental education

3.4.1. NARRATIVE METHOD

1. MAIN AIM(S)

The narrative method aims at facilitating better understanding of the learning content (Werner and Bower 1983; Fraser, Loubser and Van Rooy 1993; Ornstein 1995).

2. NATURE OF TEACHER INVOLVEMENT

In this method of teaching communication to learners occurs through telling them oral reports, stories, et cetera in the process of teaching (Werner et al 1983; Ornstein 1992; Fraser et al 1993; Ornstein 1995).

3. NATURE OF LEARNER INVOLVEMENT

Learners listen passively (Fraser et al 1993). In some cases learners repeat what their teacher said being it verbally or in writing (Werner et al 1983; Ornstein 1995).

4. TEACHING AIDS OR MEDIA

Debates, guest speakers, oral reports or stories are used as teaching aids or media (Werner et al 1983; Ornstein 1992; Fraser et al 1993).

5. THE NARRATIVE METHOD IN ENVIRONMENTAL EDUCATION

It seems, from the preceding characteristics on the narrative method that this method of teaching could facilitate the acquisition of knowledge and changing of

attitude through telling for environmental education. For example, the narrative method of teaching could be used wherein a teacher narrates to learners about the history of environmental education as a teaching-learning environment. That may lead to learners developing a different attitude towards the environment.

3.4.2. TEXTBOOK METHOD

1. MAIN AIM

This method of teaching facilitates the dissemination of information from a textbook to learners in any learning environment (Clark and Starr 1991; Fraser, et al 1993).

2. NATURE OF TEACHER INVOLVEMENT

The teacher endorses a point of view and enhances better understanding of the learning content (Werner et al 1983; Ornstein 1992).

3. NATURE OF LEARNER INVOLVEMENT

Learners listen, read or write class or homework or even taking notes during the use of the textbook method of teaching (Werner et al 1983; Fraser et al 1993; Ornstein 1992).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Prescribed and or recommended textbook(s) are used when a textbook method of teaching is used (Werner et al 1983; Clark et al 1991; Fraser et al 1993; Ornstein 1992).

5. THE TEXTBOOK METHOD IN ENVIRONMENTAL EDUCATION

It seems as if textbooks are used to disseminate information and acquire knowledge for environmental education. They also enable learners to acquire certain skills and facilitate a change of attitude towards certain or information on the environment. For example, a teacher could ask the learners to use a textbook in order to identify the characteristics of a polluted atmosphere in a specific environment. In so doing learners acquire knowledge and skills of identifying the characteristics of a polluted atmosphere. Both the knowledge and skill can also make them to change their attitudes towards a polluted atmosphere.

3.4.3. CO-OPERATIVE LEARNING AS A TEACHING METHOD

1. MAIN AIM

It facilitates the acquisition of knowledge through working together on specified

tasks (Clark and Starr 1991; Fraser, Loubser and Van Rooy 1993; Ornstein 1992). It stimulates the development of alternative perspectives through exposure to a multiplicity of viewpoints (Werner and Bower 1983; Ornstein 1995).

2. NATURE OF TEACHER INVOLVEMENT

A teacher divides learners into small groups of three to six and engages them in specific learning tasks which require the learners' mutual collaboration and support (Werner et al 1983; Clark and Starr 1991; Ornstein 1995).

3. NATURE OF LEARNER INVOLVEMENT

Learners mutually collaborate and support each other in the process of learning, that is, there is:-

(a) positive interdependence (where learners understand that they depend on one another for the success of the entire group)
(b) face-to-face interaction (where learners discuss and learn together on given tasks and in the process learn from one another)
(c) wholesome relationships (where learners are provided with certain skills and are expected to assume roles such as leadership role and have to resolve conflicts within the classroom or group itself (Clark et al 1991; Ornstein 1992; Fraser et al 1993; Orntein 1995).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Teaching aids which are used include specific learning tasks which learners are expected to complete within a specified time frame (Werner and Bower 1983; Clark and Starr 1991; Orntein 1995).

5. COOPERATIVE LEARNING METHOD IN ENVIRONMENTAL EDUCATION

From the above characteristics on cooperative learning as a teaching method, it seems as if this method of teaching could facilitate the acquisition of knowledge, skills and attitudes for environmental education. This method of teaching could be suitable for use in a situation wherein learners are given a task of preparing a holiday programme for a group of youths on environmental education in a built area.

3.4.4. DEMONSTRATION METHOD

1. MAIN AIM

It facilitates teaching and better understanding of the learning content to get skills across through the use of senses, such as those of sight, touch, smell, et cetera (Clark and Starr 1991; Fraser, Loubser and Van Rooy 1993).

2. NATURE OF TEACHER INVOLVEMENT

In a demonstration method of teaching, a teacher sets up the stage for learners, demonstrating the procedure and explaining the reason(s) why specific steps have to be followed (Werner and Bower 1983; Clark and Starr 1991).

3. NATURE OF LEARNER INVOLVEMENT

Learners use senses such as sight, touch, taste, et cetera to acquire knowledge, skills and develop specific attitudes (Fraser, Loubser and Van Rooy 1993).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Relevant and necessary equipment for a particular demonstration could be used during the use of this method of teaching (Werner et al 1983; Clark and Starr 1991).

5. DEMONSTRATION METHOD IN ENVIRONMENTAL EDUCATION

It seems as if the demonstration method of teaching could facilitate the acquisition of knowledge and skills for environmental education. This method of teaching could be used wherein a teacher demonstrates to the learners on how to conduct a water test.

3.4.5. DISCOVERY METHOD

1. MAIN AIM

The main aim of this method of teaching is to let the learners themselves discover information (Stuart, Van Niekerk and McDonald 1985; Kruger and Muller 1988; Clark and Starr 1991).

2. NATURE OF TEACHER INVOLVEMENT

In the discovery method, the teacher plays the role of facilitator (Stuart, Van Niekerk and McDonald 1985). The teacher raises questions which pique learners' interest and the learners are expected to discover information on their own by investigating issues at table - thinking critically about these issues and drawing reasonable conclusions about them (Stuart et al 1985; Kruger and Muller 1988; Clark and Starr 1991).
The discovery method uses tactics in which the teacher is:-

1. asking learners to identify a topic of investigation
2. asking learners to gather data on the topic
3. checking the learners' way of gathering data
4. asking thought-provoking questions regarding the gathered data
5. asking for the explanation and interpretation of the hypotheses (theory or

assumption)

6. asking learners to test their hypotheses against the collected data and at the same time checking their thinking skills and logic
7. asking learners to draw conclusions from their data
8. questioning these conclusions to facilitate better understanding
9. asking learners to apply their principles and conclusions to their situations (Clark and Starr 1991).

In this method of teaching, the teacher may use any of the following six categories of the discovery method (Clark and Starr 1991) to facilitate teaching:-

(1) Socratic method: That is, a method in which learners are asked a series of leading questions up to a point where they have to look into their own ideas and think rigorously for themselves. Thereafter they should be able to develop their own conclusions and draw inferences (Clark and Starr 1991).

(2) Controlled or guided discussion: That is, providing learners with information by means of films or some other expository devise, lectures, reading and using probing questions which guide learners to derive principles and to draw conclusions from the presented material (Clark et al 1991).

(3) Springboard techniques: That is, any type of presentation that can be used as a 'jumping-off' point for a discussion, research project or any inquiry activity. For example, moving pictures, still pictures, role playing, models, textbook selections, etc. are some of the facilities that can be used as springboard. They can further be followed by thought-provoking questions that will bring out ideas, relationships and drawing of conclusions from discovered information (Clark et al 1991).

(4) Problem solving approach: That is, a form of trial-and-error learning which provides learners with a chances to learn from their successes or failures. For learning to be effective through this strategy, a learner would have to:-

   (A) become aware of and identify a problem
   (B) define and limit a problem
   (C) gather evidence that may help to solve the problem
   (D) form a hypothesis of what the solution to the problem may be
   (E) test the hypothesis against the collected data
   (F) analyze and interpret the data
   (G) draw conclusions and report the findings which may be either positive or negative (1991).

(5) Case study method: That is, a problem-solving technique in which learners study individual cases which are a representative of a type of institution, issue, problem situation, etc. in order to draw conclusion about the type as a whole. Case studies are useful because they give learners insight into knotty problems and also provide them with opportunities to study these problems in depth. The procedure for conducting a case study may include

the following steps -

1. selecting a topic to study.
2. having access to any relevant material regarding the topic of the study, for example, reading material, films, pictures, tapes, laboratory experiments, etc.
3. Studying the case after having been introduced to the problem, ground rules, questions to be considered and the goal of the study.
4. Interpreting data, noting the findings and drawing conclusions
5. Sharing ideas with other learners regarding the findings and conclusions made in the study (1991).

(6) Research project: That is, a life-like learning task which involves investigating and solving of a problem by an individual or a group of learners, for example, in order to attain a definite goal of real personal value. In this research, the procedure is similar to that of the problem-solving.

3. NATURE OF LEARNER INVOLVEMENT

Learners play an active role in discovering information that meets their needs on their own (Clark and Starr 1991; Ornstein 1995). They further discover the interrelationships that are often missed in the traditional presentations of lesson contents (Ornstein 1995).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Teaching media or aids which are used in this method of teaching include identifiable, challenging and realistic questions or problems which warrant investigation and solution (Stuart, Van Niekerk and McDonald 1985; Kruger and Muller 1988; Clark and Starr 1991). Relevant instruments can further be used to facilitate the discovery of information.

5. DISCOVERY METHOD IN ENVIRONMENTAL EDUCATION

It seems that this method of teaching could facilitate the acquisition of knowledge, skills and a change of attitude in learners for the environment.
For example, learners could be given water test kits by their teacher and be asked to test the level of pollution and the impact thereof on the aquatic species in a stream which passes near the school.

3.4.6. DISCUSSION METHOD

1. MAIN AIM

As a purposely organised skilful method of teaching in which ideas are shared between teachers and learners and among the learners themselves in a dynamic

and universal way (Leonard, Fallon and Von Arx 1972), the discussion method of teaching aims at:-

(a) helping learners to air their views, to find out what others (learners or teachers) think, to re-evaluate personal opinions, to solve problems and gain feelings of acceptance and belonging (Stanford and Stanford 1969; Clark and Starr 1991)

(b) increasing learners' active involvement in meaningful learning activities. It occurs when a group of persons, (normally in the role of facilitator and participants) assemble at a designated place to communicate interactively, using either verbal, or any other listening and-or understandable means in order to achieve learning objectives (Gall and Gall 1976).

2. NATURE OF TEACHER INVOLVEMENT

The teacher shares ideas with and expresses views to the learners during discussions (Leonard, Fallon and Von Arx 1972; Gall and Gall 1976; Clark and Starr 1991; Jacobs and Gawe 1996).

3. NATURE OF LEARNER INVOLVEMENT

Learners actively take part in sharing ideas and expressing their views during the discussion (Leonard, Fallon and Von Arx 1972; Gall and Gall 1976; Clark and Starr 1991; Fraser, Loubser and Van Rooy 1993). Some of the ways in which learners could be engaged in discussions include:-

1. CLASSMATE DISCUSSIONS: It involves the participation of all learners in a classroom (Leonard, Fallon and Von Arx 1972). In ensuring that a discussion is fruitful, a teacher needs to introduce and clarify the pre-arranged topic of discussion and thereafter allow the exchanging of ideas which are related to the topic (Fraser, Loubser and Van Rooy 1993). Such type of view exchange takes place between a teacher and learners and among the learners themselves.

2. SMALL GROUP DISCUSSIONS: This type discussion may consist of three to six members depending on the size of the class and the subject which is taught. The teacher interferes as little as possible in the discussion and the learners are encouraged to work collectively and independent of their teacher (Leonard et al 1972; Jacobs and Gawe 1996).

3. PANEL DISCUSSION: A panel discussion could consist of four or five participants who discuss the topic among themselves and respond to questions which are posed from the floor (Leonard et al 1972; Fraser et al 1993). Learners who are panellists are suppose to research and study all relevant and available information on the topic so that they should acquire adequate knowledge regarding it. After questioning time, a summary of all important facts regarding the discussion should be presented by the

facilitator who could be the teacher.

4. BRAINSTORMING EXERCISES: This exercise could be done by small groups within a classroom. For example,
- a teacher could pose a problem to learners who will "attack" it with a hail of ideas which are all "correct"
- After all ideas have ben exhausted, the priority stage is engaged into, that is, all ideas are carefully examined and categorised in terms of their quality
- These ideas are the ones which are being used to solve the problem at hand
- The entire process enhances learners to develop a sense of self-worth and confidence (Jacobs and Gawe 1996).

5. SYMPOSIUM: A symposium is another category of the discussion method in which participants present speeches on the same topic from different perspectives such as from economic, social, political, etc. perspectives (Jacobs and Gawe 1996).

This type of discussion needs thorough preparation by the presenters because presentations are often followed by open discussions where other participants from the floor may need clarification, ask questions, or make inputs and or even propose new ideas (Jacobs and Gawe 1996).

6. DEBATES: A debate is also a formal discussion in which participants are divided into two opposing sides, that is, those who affirm and those who oppose the other team (Jacobs and Gawe 1996). For example, a topic such as "Industries are justified to deposit harmful wastes into streams or rivers" could be debated between two opposing sides wherein the one affirms and the other opposes that view.

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Any identifiable, challenging and realistic questions or problems which warrant investigation and solution could form the media for a discussion (Stuart, Van Niekerk and McDonald 1985; Kruger and Muller 1988; Clark and Starr 1991).

5. DISCUSSION METHOD IN ENVIRONMENTAL EDUCATION

Having discussed the characteristics of the discussion method in the preceding paragraphs, it is imperative to note the assumption that this method of teaching could facilitate the acquisition of knowledge, skills and attitudes for environmental education through any of the following ways:-

1. policy discussions which requires participants to see the need for policy and take a position with regard to it or act on that particular issue
2. explaining particular positions in discussions, that is, making it possible for learners to identify a problem, analyze its causes and provide reasons

to questions which arise in the process of solving it

3. a predicting discussion in which participants are given an opportunity to predict the likely outcomes of a given situation
4. problem-solving discussions which require participants to verify any predicted outcomes given situations and thus solve the problems which face them
5. debriefing discussions in which there are reviews of shared activities, that is, a situation where learners discuss their respective experiences after a field trip in which they were collectively engaged (Gall and Gall 1976; Jacobs and Gawe 1996).

In line with the views expressed for environmental education in the preceding paragraph is Clark and Starr (1991) who maintain that for a discussion to be successful, participants need sufficient background to know what the agenda of a discussion is, to discuss the issues at hand basing their argument on facts which facilitate the conclusion thereof. In that process, all participants think for themselves and each has the right to express her or his view no matter how unpopular it may be (1991).

3.4.7. DRILL METHOD

1. MAIN AIM

Drill method of teaching facilitates learning through memorisation of information as well as repeated engagement in specific sections of the learning content to facilitate better knowledge of that content for other situations (Fraser, Loubser and Van Rooy 1993).

2. NATURE OF TEACHER INVOLVEMENT

The teacher engages learners in memorising facts so that they can acquire knowledge (Werner and Bower 1983; Fraser et al 1993).

3. NATURE OF LEARNER INVOLVEMENT

Learners memorise facts to reinforce and solidify knowledge (Clark and Starr 1991; Fraser et al 1993).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Any learning content or sections thereof could form the teaching aids or media (Werner and Bower 1983; Fraser et al 1993).

5. DRILL IN ENVIRONMENTAL EDUCATION

It seems as if the drill method is important for environmental education because

it could facilitate the acquisition of knowledge through the memorisation of some facts in environmental education. For example, learners could be made to memorise the formula for measuring the height of a tree in an environment.

3.4.8. EXPERIMENTAL METHOD

1. MAIN AIM

It aims at discovering reality by means of examples or where it is possible, real samples thereof to facilitate effective teaching and reaching generalised conclusions which are based on the findings (Fraser, Loubser and Van Rooy 1993).

2. NATURE OF TEACHER INVOLVEMENT

The teacher exposes learners to experiments and engages them into discovering reality by allowing them to execute these experiments on their own (Fraser et al 1993).

3. NATURE OF LEARNER INVOLVEMENT

Learners actively take part in the execution of experiments themselves (1993).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Experimental equipments are used (Clark and Starr 1991; Fraser et al 1993).

5. USING THE EXPERIMENTAL METHOD IN ENVIRONMENTAL EDUCATION

From the preceding characteristics of the experimental method, it seems as if this method of teaching could be used for environmental education in:-

- exploratory learning: That is, allowing learners to gain insight themselves through exploration and self-discovery.
- **excursions**: That is, taking learners out of the formal school premises so that teaching can take place in a totally different environment from that of the formal school. That can further facilitate the observation of new things, own collection of data, examples and self-discovery and exploration of the environment by the learners.
- laboratory activities: That is, showing and telling learners what to do, and giving them opportunities to explore and collect data themselves and further exercise their skills by verifying it scientifically.
- **projects**: That is, allowing learners to embark on specific projects such as building models, filming videos, drawing sketches, etc. to increase their knowledge and develop their skills (Fraser et al 1993).

This method of teaching seems to be used more often by actively engaging

learners in objective sciences such as natural and live sciences.

3.4.9. FREE ACTIVITY METHOD

1. MAIN AIM

It aims at engaging learners in activities which will enable them to acquire knowledge through self activity (Fraser et al 1993; Ornstein 1995).

2. NATURE OF TEACHER INVOLVEMENT

The teacher only plays the role of a facilitator and guides learners where there is need (Fraser et al 1993). In guiding learners, the teacher may narrate information.

3. NATURE OF LEARNER INVOLVEMENT

Learners play an active role in the teacher-learning situation by participating in the activities (Fraser et al 1993).

4. TEACHING AIDS OR MEDIA

Any media which is meant for the lesson could be used for that purpose (Fraser et al 1993).

5. FREE ACTIVITY IN ENVIRONMENTAL EDUCATION

It seems as if this method satisfies the requirement for the acquisition of environmental knowledge, skills and attitudes because learners acquire knowledge, skills and could change their attitudes in taking part actively in specified learning activities. For example, learners could take part freely in an audit of the school environment wherein they determine the existing environmental problems in a school and further work out how these problems can be solved.

3.4.10. PROBLEM-SOLVING METHOD

1. MAIN AIM

It aims at allowing learners to discover phenomenon on their own with the intention of solving specified problems (Clark and Starr 1991).

2. NATURE OF TEACHER INVOLVEMENT

Teachers guide learners in identifying and solving specified problems (Clark and Starr 1991). Also refer to section 3.4.5.

3. NATURE OF LEARNER INVOLVEMENT

Learners are in this regard actively involved in solving the problems at hand (Clark et al 1991).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Identifiable, realistic, challenging problems and any other relevant teaching aids or media (Duminy and Sohgne 1987; Clark and Starr 1991). Also see section 3.4.5.

5. PROBLEM-SOLVING IN ENVIRONMENTAL EDUCATION

It seems as if the problem-solving method in environmental education could facilitate the acquisition of knowledge, skills and change of attitudes in learners for the environment. An example thereof could be the use of the problem-solving method wherein learners are given a problem of littering in the school environment as task and further asked to recommend solutions to that problem.

3.4.11. PROJECT METHOD

1. MAIN AIM

In this method of teaching, learners are given a project to work on. They are further given the chance to discover information on their own and solve the problem in the process of working on the project (Stuard, Van Niekerk and McDonald 1985; Kruger and Muller 1988; Clark and Starr 1991).

2. NATURE OF TEACHER INVOLVEMENT

The teacher plays the role of a facilitator in the project method (Stuart, Van Niekerk and McDonald 1985). That is, the teacher raises questions on a particular issue which prique learners' interest. They then investigate the issue at table by thinking critically about it and drawing reasonable conclusions about them (Stuart et al 1985; Kruger and Muller 1988; Clark and Starr 1991).

3. NATURE OF LEARNER INVOLVEMENT

Learners play an active role in the project method in that they investigate and discover information that meets their needs on their own (Clark and Starr 1991; Ornstein 1995).

4. TEACHING AIDS OR MEDIA WHICH ARE USED

Teaching aids which are used in this method of teaching include anything that is relevant and which can be used for executing a project (Clark and Starr 1991).

5. PROJECT METHOD IN ENVIRONMENTAL EDUCATION

From the discussion on this method of teaching, it seems as if the project method can facilitate the acquisition of knowledge, skills and change of attitudes towards the environment. For example, learners can use the project method and acquire knowledge, skills and change their attitudes towards the environment when given the project of auditing the school environment.

3.4.12. QUESTION- AND- ANSWER-METHOD

1. MAIN AIM

According to Fraser, Loubser and Van Rooy (1993) the question-and-answer method ideally aims at introducing a lesson.

2. NATURE OF TEACHER INVOLVEMENT

This method of teaching may be used where the teacher wishes to find out what the learners already know about the topic (Fraser et al 1993).

3. NATURE OF LEARNER INVOLVEMENT

Learners actively take part in responding to questions which are asked by the teacher (1993).

4. TEACHING AIDS OR MEDIA

Teaching aids or media in this method of teaching are questions which may take the form of an oral or written test or examination (1993).

5. USING THE QUESTION-AND-ANSWER METHOD IN ENVIRONMENTAL EDUCATION

From the discussion on this method of teaching, it seems as if it could facilitate the acquisition of environmental knowledge.

Having discussed the identified and classified teaching methods and their implication for environmental education in this section, it is essential to summarise these hereunder to facilitate the further development of the amoeba model. These will be summarised in accordance to the pattern in which they were discussed in the preceding sections.

3.5. SUMMARY

The impression gathered from the teaching methods which were discussed in this

paper is that there is communication which is either verbal or through other media which is used to facilitate teaching.

1. MAIN AIM

Teaching takes place through the use of teaching method(s). Various teaching method(s) facilitate learning in different ways.

2. NATURE OF TEACHER INVOLVEMENT

Teachers are involved in that they facilitate learning.

3. NATURE OF LEARNER INVOLVEMENT

Learners take part actively or passively in the process of teaching-learning situation - depending on the method(s) used.

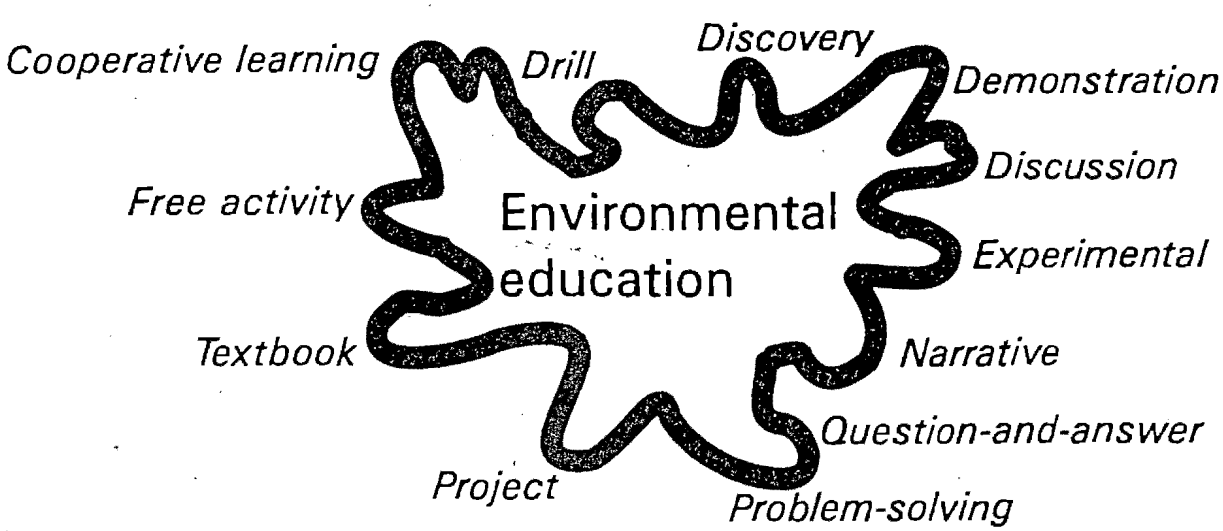
4. TEACHING AIDS OR MEDIA USED

Relevant and or appropriate teaching aids or media are used to facilitate teaching and or learning. These may differ from topic to topic and also from the method of teaching which is used at the time. For example, the media or teaching aid which is used in the textbook method may not necessarily be relevant for use in the project method.

5. NATURE OF THE TEACHING METHODS IN ENVIRONMENTAL EDUCATION

Regarding this section, it seems as if a variety of elements of teaching methods could be used simultaneously to facilitate teaching in an environmentally directed way - depending on the topic and the context within which a topic is taught. This assertion is illustrated hereunder with the use of a model - an amoeba model.

AMOEBA MODEL (focusing on teaching methods)

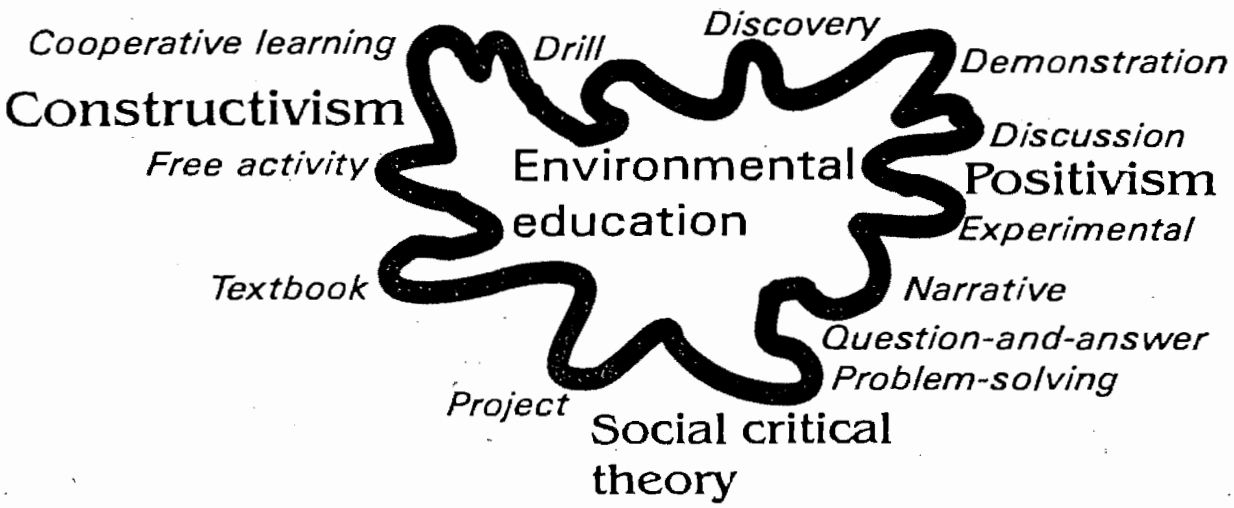


From the preceding discussion, deductions could be made regarding an ideal amoeba model.

3.3. AN IDEAL AMOEBA MODEL

It could be deduced that teaching in an environmentally directed way could take place through the use of elements from a variety of paradigms and teaching methods depending on the topic and the environment within which it is taught. This means that no specific paradigm or teaching method can facilitate the process of teaching in an environmentally directed way. This assertion is presented hereunder in the form of a model - amoeba model.

AN IDEAL AMOEBA MODEL



4. CONCLUSION

In conclusion, it could be stated that environmental education does not have a specific paradigm underlying it but can use elements from a variety of paradigms to form the basis thereof. It does not have specific teaching methods with which it could facilitate learning and or teaching. Equally, it can use elements from a variety of teaching methods to facilitate learning and or teaching. These statements make environmental education to be rather regarded as an approach and not a field of study. As an approach, the ideal model, the "amoeba model", could be used for teaching in an environmentally directed way. Before this model is used, it needs to be tested to prove its worth. This is a challenge to TEACHERS FOR A GLOBAL SOCIETY as a way forward.

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ANNEXURE 4

Information about the respondents is given below. They are not identified by their real names for purposes of confidentiality (refer to annexures 1 and 2). Instead they are refered to as respondents A - J. (see chapter 6). Respondents A to E were environmental education practitioners and respondents F to J were lecturers in the formal academic field. They all had to provide the following information:

1. appointment
1.1 place of work
1.2 present position
1.3 number of years in present position
2. Experience and expertise in environmental education
3. Contribution to environmental education

RESPONDENT A

1. 1988
1.1 Environmental education centre
1.2 Executive officer
1.3 10 years
2. Environmental education officer (1988 - 1991)
3. Facilitated programmes for gifted child programme and environmental education; presented papers at Environmental Education Association of Southern Africa (EEASA); written articles for EEASA bulletin' Enviroteach magazine; Member of education commission and communication International Union for the Conservation of Natre (IUCN).

RESPONDENT B

1. 1991
1.1 Formal school
1.2 Part-time environmental education officer
1.3 7 years
2. Environmental education officer (1991 up to date)
3. Facilitated and developed programmes in environmental education and Outcome-Based Education in relation to environmental education;
facilitated programmes for schools to develop their own environmental education policies.
Facilitated environmental education workshops at various venues in the country.

RESPONDENT C

1. 1987
1.1 Environmental education centre

1.2 Executive officer
1.3 3 years
2. Environmental education officer (1987-1993)
3. presented papers at EEASA conferences; written articles for bulletins and journals of environmental education; facilitated workshops for teachers, learners, communual members in environmental education.

RESPONDENT D

1. 1995
1.1 Formal school
1.2 Part-time environmental education officer
1.3 3 years
2. Environmental education officer (1995 up to date)
3. Facilitated environmental education programmes and workshops at environmental education centres for school learners and adults; facilitated environmental education competitions for groups of various age groups at different venues in the country.

RESPONDENT E

1. 1995
1.1 Environmental education centre
1.2 Fundraising and marketing officer; part-time environmental education officer.
1.3 2 years
2. Part-time environmental education officer (1995 up to date)
3. Facilitated programmes to groups of learners and adults respectively in environmental education; facilitated workshops for university students.

RESPONDENT F

1. 1981
1.1 University
1.2 Academic
1.3 11 years
2. Professor in environmental education
3. Written articles; read papers in national and international conferences; written study material for environmental education students for undergraduate and postgraduate levels; teaches environmental education to students from undergraduate to doctoral level; consultant in projects in environmental education; one of the directors of an environmental education centre.

RESPONDENT G

1. 1995
1.1 College for teacher education

1.2 Departmental head of environmental education
1.3 3 years
2. Lecturer of environmental education
3. written articles; facilitated workshops, student projects and lectures for environmental education students at teriary institutions; written study material on environmental education; organised conferences on environmental education.

RESPONDENT H

1. 1986
1.1 College for teacher education
1.2 Lecturer
1.3 4,5 years
2. Lecturer in environmental education
3. Written modules in environmental education; done video on environmental education; presented academic papers at conference on environmental education; developed environmental education programmes for some school children in parts of Gauteng, Mpumalanga and North West.

RESPONDENT I

1. 1990
1.1 College for teacher education
1.2 Lecturer
1.3 01 year
2. Lecturer of environmental education
3. Coordinated pilot projects of training teachers on Outcome-based Education and environmental education; presented a paper on environmental education in a conference; coordinated world environmental day.

RESPONDENT J

1. 1991
1.1 College for teacher education
1.2 Lecturer
1.3 01 year
2. Lecturer of environmental education
3. written study materials of environmental education for the college students; written articles in internal magazines of the college; presented papers at environmental education conferences; member of environmental education body in the community.

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