Learners' Understanding of the Impact of Air Pollution on the Environment in Rural Communities

A dissertation by

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DECLARATION

I declare that this study entitled

Learners' understanding of the impact of air pollution on the environment in rural communities

is my own work, that all the resources I have used or quoted have been indicated and acknowledged by means of complete references and that neither I nor anyone else at this university or any other educational institution previously submitted this study for degree purposes.

Valerie Essie Malebye

Signed _____   Date _____

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SUMMARY

This research is an attempt to determine learners' understanding of the impact of air pollution in rural communities. The study focuses on the need to teach learners through Environmental Education about air pollution as an environmental problem that prevails in their areas and worldwide. The main aim of the study is to assess learners' perceptions and understanding of air pollution and its impact in their various residential areas.

It is revealed in chapter one that knowledge of the causes and effects of air pollution is essential. In chapter three various factors that are contributing to environmental problems are indicated as a result of lack of knowledge of Environmental Education. Environmental Education does not reflect in black schools' timetables, nor is it taught; therefore learners are not familiar with the role they have to play in protecting their environment.

A literature study together with an empirical investigation by means of a questionnaire has been used in this regard. The data collection methods used proved to be useful in providing insights into learners' understanding of the impact of air pollution on the environment in rural communities and the role of EE in assisting them to partake in the whole exercise.

The findings and recommendations of the study are expected to assist learners in dealing with air pollution in their area and other related environmental issues they may encounter. Based on the findings of the study it is recommended that Environmental Education be actively taught, especially in black schools. Schools should have a plan that suits them to include EE in their curricula.   Schools together with their immediate communities should be involved in environmental projects.

KEY WORDS

1. Environmental Education
2. Air pollution
3. Pro-environmental behaviour
4. Environmental attitude
5. Environmental policies
6. Sustainable development
7. Environment
8. Learners
9. Questionnaire

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CHAPTER 1

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PROBLEM STATEMENT, AIM OF THE STUDY AND RESEARCH METHOD APPLIED

1.1   INTRODUCTION

The air we breathe is one of the main foundations of human life. It is made up of a fine balance of a number of different elements. Interfering with this balance could be dangerous to people and the environment. Air pollution is an age-old problem that probably started when humans built fires in poorly ventilated caves; it has grown into a global, serious problem that needs urgent attention. Botkin and Keller (in Lindemann, 2002:22) support this statement by indicating that there is increasing concern among scientists about the state of the environment.

Air pollution is a major environmental problem throughout the whole of South Africa; for example, South Africa suffers a serious smoke pollution from coal combustion. At present most of South Africa's electricity, about 93.5%, is produced in coal-burning power stations. The power stations have been built close to the coalfields of Mpumalanga. This area has the highest level of air pollution in South Africa. It covers an area of 30 000km^2 and is home to ten Eskom Power stations, of which five are the largest in the world (Minnie, 1999:215).

The coal burning power stations and air pollution problems resulting from man's energy use and production have serious environmental impacts. The pollutants are dispersed through the atmosphere in concentrations high enough to cause serious health problems. Thus air pollution can affect living and non-living environments resulting in serious damage or even lethal consequences. It is evident that as the impact of human activities and influences on the environment has accelerated, so too have the risks and threats associated with it. Hence Schwartz (2003:1037) maintains that the health effects of air pollution exposure have become an area of increasing focus in the past 30 years. People have been affected seriously and have been killed by polluted air ever since the industrial revolution. Population reports indicate that air pollution kills an estimated 2.7 million to 3.0 million people every year; this constitutes annually in the world.

Therefore the seriousness of air pollution calls for environmental management. Fuggle and Rabie (1994:436) support this point of view saying legislation dealing with air pollution control in its entirely is essential. South Africa and most other countries have laws controlling environmental pollution. These laws establish and enforce air quality standards and provide for environmental impact assessment. The control of air pollution is the responsibility of the Department of National Health and Population

One of the aims of the study is to present a thorough discussion of the issues of air pollution as one of the major threats to the entire environment. The sources and effects of air pollution are illustrated together with the factors that contribute towards this problem; legislation that is in place to control air pollution in collaboration with the role of EE is looked at. Recommendations and solutions from an EE point of view are provided as a way of attempting to assist in minimising the problem of air pollution as a few environmentally friendly choices can go a long way in addressing this problem.

1.2   PROBLEM STATEMENT

Air pollution is much more than the presence of foul-smelling substance or gases; it is a major environmental problem. There are many experts who rank air pollution first among conservation problems because of its potential to threaten the life and health of millions of people and ultimately perhaps all life on earth. Samet and Spengler (1991:1) support this by stipulating that pollution of the atmosphere has now reached a level that poses a potential threat not only to the health and well being of entire populations, but to the survival of life. Hugo, Viljoen and Meeuwis (1997:135) reiterate this by saying that air pollution is generally being regarded as detrimental to humans and the environment.

Due to the fact that the goal of EE is the development of people's ability to act and effect change, it becomes imperative that associated knowledge and insight should be action oriented. Four different aspects of action-oriented knowledge are illustrated in Figure 1.1 in the Model of Jensen (2002:330).

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                    ┌─────────────┐
                    │   Causes    │
                    │   "Why?"    │
                    └─────────────┘
                          ↑
         ┌──────────┐  ⬭⬭⬭⬭⬭⬭  ┌──────────┐
         │  Change  │ Environmental │ Effects  │
         │strategies│  Problems  │  "What?" │
         │  "How?"  │           │          │
         └──────────┘  ⬭⬭⬭⬭⬭⬭  └──────────┘
       ←──────────────        ──────────────→
                          ↓
                    ┌─────────────┐
                    │   Vision    │
                    │  "Where?"   │
                    └─────────────┘
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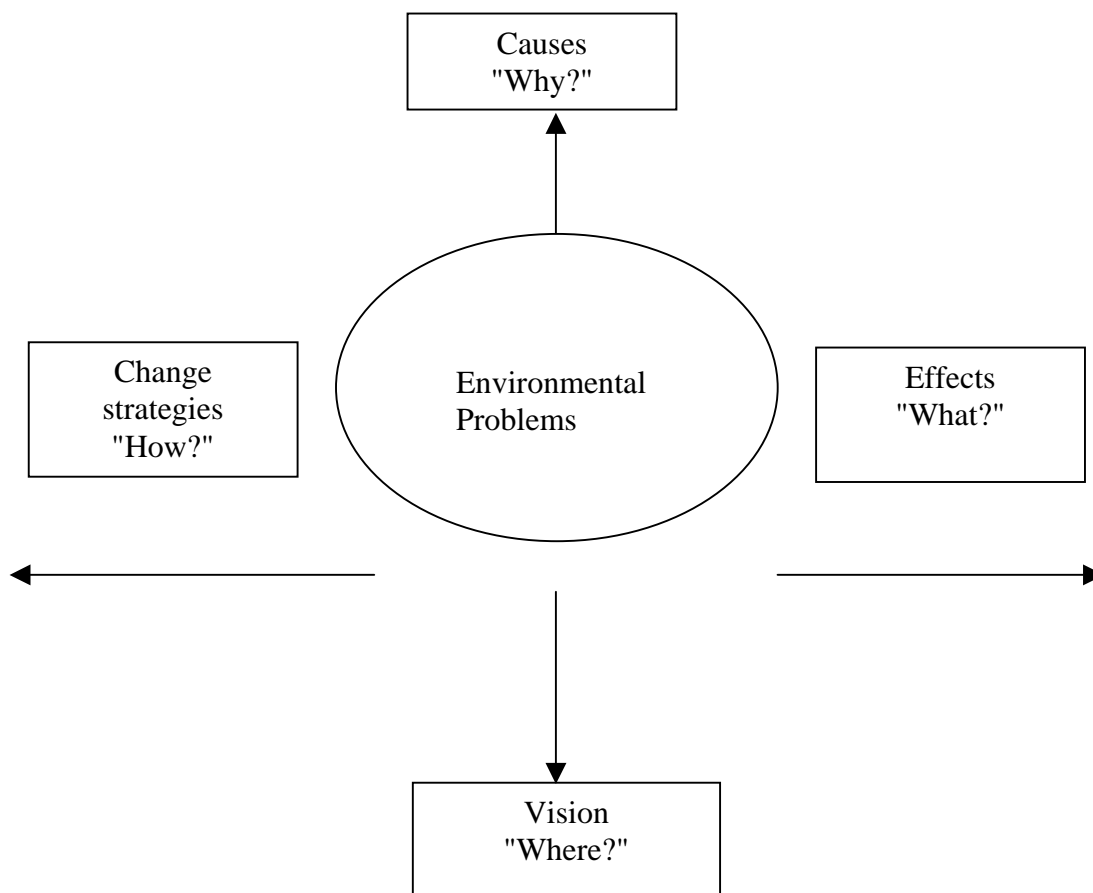
FIGURE1.1: FOUR DIMENSIONS OF ENVIRONMENTAL-RELATED KNOWLEDGE (JENSEN 2002)

The model has four dimensions of different perspectives of the types of knowledge through which a given environmental problem can be viewed and analysed.

1st Dimension

What kind of problem is it? Knowledge about effects.

- It deals with knowledge about the existence and spreading of environmental problems.
- Knowledge raises concern and attention, and creates a willingness to act.
- Knowledge is a prerequisite for developing people's competence to
- take action and change behaviour.

2nd Dimension

Why do we have the problem we have? Knowledge about the root

causes.

- What are the causes?
- What are the social factors influencing our behaviour, attitudes?

3rd Dimension

How do we change things? Knowledge about strategies for change.

- It deals with both knowledge about how to control one's own life and to contribute to changing living conditions in society at large, involving direct and indirect possibilities for action.
- Who do we turn to, whom could we ally ourselves with?
- How to encourage cooperation.

4th Dimension

Where do we want to go? Knowledge about alternatives and visions.

- It deals with the necessity of developing one's own visions.
- It includes knowing about how people go about things in other   places and cultures.

The research problem statement probes the following research questions:

- If learners are sensitised about to air pollution at schools, why then do they remain negative towards resolving issues related to air pollution?
- Do learners understand the extent of air pollution and do they know what the impact of air pollution is on living organisms?
- What is being done in the classrooms with regards to air pollution?
- What impact does the living environment have on learner perception of air pollution?

1.3   AIMS OF THE STUDY

The main aim of the study is to review air pollution and its impact on the environment and also to assess learners' understanding of air pollution as requirement for effective environmental decision practice. Learners should note that once air has been

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contaminated, it cannot be hundred percent purified. It will destroy many lives on earth, and hiding in one's home is not a solution as air inside the house is as harmful as outside. It is therefore important for learners to know and understand the impact of their actions on the environment. In order to achieve this aim the following objectives will be pursued:

1.3.1 Objectives Of The Study

1. To investigate and identify the causes as well as the dangers of air pollution by means of literature study.
2. To look into the roles of people especially the government, community, teachers and learners with regard to air pollution.
3. To examine ways in which various policies and EE can be helpful in assisting learners to assess their understanding and perception about air pollution in their area of residence.
4. To assess learners' understanding of air pollution as requirement for effective environmental decision practice.
5. To try to propose guidelines which can be helpful in dealing with air pollution in the school curriculum and classroom.

1.4   SIGNIFICANCE OF THE STUDY

The significance of this study lies in assisting learners in knowing and understanding EE as the principal solution of minimising air pollution. Acquiring knowledge about and understanding EE will hopefully enable them to practise responsible environmental behaviours. The study also brings to the fore the various policies on environmental management together with EE as some of the ways of becoming environmental protectors.

1.5   RESEARCH METHODS

A literature review as well as a quantitative strategy will be employed, as these will be of help in acquiring information necessary for this study.

1.5.1   Literature review

A literature review will be employed as it helps to acquire a theoretical basis for the research. This literature study method is preferred in the research as the research relies

on the available written information on the subject dealt with. According to Bennet, Glatter and Levacic (1994: 225) books and journal articles "... are usually the most productive primary sources".

The main objectives of employing a literature search are the following:
- To find out what others have said about the topic of this study.
- To determine what researches have done previously on the same topic.
- To expose theories that address the same, topic and what they say about it.
- To find out whether there is consistency in the findings on the same topic.
- To determine whether past studies on the same topic disagree.

1.5.2 Quantitative Research Design

The quantitative study was conducted through the use of structured and unstructured questions in questionnaires used to assess the understanding of learners in terms of air pollution. The researcher decided to embark upon a quantitative investigation mainly to yield results (refer to methods in chapter 5).

1. 5. 2 .1 Questionnaire design

A questionnaire was selected as research tool for this study to yield quantitative data about the knowledge learners have with regard to air pollution. The questionnaire is a useful tool for obtaining information because it can be applied to individuals as well as groups of different sizes. Komote (1992:9) maintains that the researcher should be careful that the technical layout of the questionnaire, for example numerical notations, is clear and every question must be correctly and unambiguously formulated.

In this study the questions in the questionnaire are in closed form. The closed question requires the respondent to tick or mark one or more of several provided possible answers (refer to methods in chapter 5).

1.6   EXPLANATION OF TERMS

The following key terms are explained to give readers a better understanding of the use and application of selected terms in the investigation.

1.6.1 Air Pollution

The Tenth Report of the Royal Commission on Environmental Pollution, in Colls (2002:1) defines air pollution as the introduction by man into the environment of substances or energy liable to cause hazard to human health, harm to living resources and ecological systems, damage to structure or amenity or interference with legitimate use of the environment.

The World Health Organization (WHO) in Kumar (1999:32) defines air pollution as substances put into air by activities of mankind in concentration sufficient to cause harmful effect to the health, vegetation, property or to interfere with the enjoyment of property.

We cannot rely on one definition of air pollution, but irrespective of the number listed, the emphasis is on the emission of one substances or more into the atmosphere which cause harm to people, animals, plants, buildings, thus the environment at large. Though air pollution has been there since man's first presence we need to combat it as effectively as we can.

1.6.2 Environment

The environment is defined as the aggregate of surrounding objects, conditions and influence that influences the life and habits of man or any other organism or collection of organism (Environmental Conversation Act 1989).

According to the National Environment Management Act of 1998 the Environment means the surroundings within which humans exist and that are made up of the land, water and atmosphere of the earth, micro-organisms, plant and animal life, any part or combination of 1 and 2 and the interrelationship among and between them, and the physical, chemical, aesthetical and cultural properties and conditions of the foregoing that influences human health and well-being.

The Environmental Management Policy for South Africa 1998 defines the environment as the biosphere in which people and other organisms live. It consists of the following:

- ✓ Renewable and non-renewable natural resources such as water (fresh and marine), land and all forms of life.
- ✓ Natural ecosystems and habitats.
- ✓ Ecosystems, habitats and spatial surroundings, modified or constructed by people, including urbanised areas, agricultural and rural landscape places of cultural significance qualities that contribute to their value.

By understanding what the environment is all about, learners will realise that the environment is our home, our place for survival. Keeping our environment safe is beneficial for the future generation and us.

1.6.3 Environmental Education

Project Environment, School Council, in Chambers (1995:5) defines environmental education as "…a learning situation, which develops the sort of attitudes, which will lead to concern for the welfare of the environment and community.

Environmental education is education needed to prepare environmentally literate citizens, who would play an active role in protecting the environment through making informed decisions and taking environmentally friendly actions (Tibilisi, UNESCO-UNEP 1977:81)

Environmental Education is a long-life process that should be undertaken by all members of the society if sustainable development is to be attained.

1.6.4 Sustainability

Sustainability, in Agenda 21 implies the use of resources in a manner which

- ✓ Does not jeopardise the environment and the wellbeing of humans living on other continents.
- ✓ Does not destroy the capacity of future generations to satisfy their needs adequately.

Sustainable development refers to improving the quality of human life while at the same time living within the carrying capacity of supporting ecosystems (Beazley 1993:13).

Sustainable development simply implies protecting the natural environment without undermining the prospects of future generations.

1 6.5 Education for Sustainable Development

The Council for Environmental Education, in Summers (2000:294), defines education for sustainable development as the prevention of damage to the environment. Education for sustainable development enables people to develop the knowledge, values, and skills to participate in decisions about the way we do things individually and collectively, both locally and globally that will improve the quality of life now and without damaging the planet for the future.

Environmentally sustainable development and sustainability is the key to human well-being and improved quality of life for all our people now and in future. Proper education that is pro environment cannot be complete without including educating for sustainability.

1.6.6 Pro-Environmental Behaviour

Kollmuss and Agyeman (2002:240) say pro-environmental behaviour simply means behavior that consciously seeks to minimise the negative impact of one's action on the natural and built world, (e.g. minimising resource and energy consumption, use of non-toxic substances and reducing waste production).

Pro-environmental behaviour refers to the ability to conduct yourself in such a manner that you respect, value and have concern for the environment.

1.6.7 Environmental Rights

Environmental right means that all human beings have the fundamental right to an environment adequate for their health and well being (Miller, 1998:2).

Miller (1998:2) defines environmental rights again as the declaration, which emerged from the United Nations (Rio de Janeiro) Conference in 1992 as follows:

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Environmental right means the right to live in an environment that is conducive to the welfare of human beings.

1.6.8 Environmental Law

Environmental law gears legal provisions with an "ecological nuance" to the new-found objective of protecting and caring for the environment, in other words the environmental media, soil, water and air, and flora and fauna including climate, landscape and the eco-balance, as well as the relationship between these sectors of the environment both among themselves and within man (Environmental Legislation 2000:6).

1.7 RESEARCH PROGRAM

The research is divided into the following seven chapters:

CHAPTER 1

The chapter introduces the research topic and contains research problem, establishment of the study aim and objectives, and application of appropriate research strategies and explanation of terms.

CHAPTER 2

The chapter provides a critical investigation of the literature on the theoretical background on the nature and sources of air pollution, with reference to its impact on the environment. It is the aim of the chapter to highlight those environmental effects and their impact on the environment.

CHAPTER 3

The chapter focuses on the essence of the environment and the important roles played by various groups. The question why to protect the environment is discussed by looking at factors contributing to an environmental crisis.

CHAPTER 4

This chapter discusses policies on environmental management as part of the literature study with special attention placed on EE as a way of helping in dealing with air pollution.

CHAPTER 5

The research methodology and an outline of the data collection methods are provided in this chapter.

CHAPTER 6

The chapter gives an analysis and interpretation of data collected.

CHAPTER 7

In this chapter the findings of the study are summarized and distinct recommendations and concluding remarks resulting from the study are made.

1.8   CONCLUSION

The introduction to the study together with the definition of key concepts and the outline of various chapters have been explained in this chapter as a way of preparing the reader what to expect. Chapter two gives an in-depth discussion of the sources of air pollution and their negative impact on the environment.

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CHAPTER 2

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SOURCES OF AIR POLLUTION AND ITS EFFECTS ON PEOPLE AND THE ENVIRONMENT

2.1   INTRODUCTION

Air pollution is an environmental problem that does not affect South Africa only, but the whole world. It is vital that this environmental problem be taken seriously, as it will eventually make life on earth uncomfortable, if man's actions are not altered. It is therefore the aim of this chapter to highlight the causes of air pollution and also to stipulate that people are only concerned or aware of outdoor air pollution and ignore indoor pollution. The chapter indicates that it is also imperative to note the seriousness of both indoor air pollution and outdoor air pollution, as they are equally harmful.

The chapter reveals the effects of air pollution on the environment and people. Various effects of air pollution like ozone pollution, greenhouse effect or global warming and its effects on vegetation and health are looked at. The intention of the chapter is to make learners aware of the detrimental effects of air pollution.

People should note that air pollution belongs to the family of environmental disasters and is accompanied by widespread public fear, disruption of day-to-day living, physical discomfort, illness and even death. It is important that we understand how our actions affect the environment and us and that we try to have a positive relationship with our environment. A detailed discussion of the roles played by the government, the community, teachers and learners and the role of EE in assisting us to harmonise our relationship with the environment constitutes chapter 3.

2.2   NATURAL   AIR   POLLUTION   VERSUS   MAN-MADE   AIR POLLUTION

2.2.1   Natural Air Pollution

Natural processes account for more that ten times the amount of nitrogen oxides that is harmful to health. Their contributing factors to air pollution are usually beyond

man's sphere of control, for example natural processes of particular matter in the atmosphere, together with the winds that drive dust from the land and salt from the sea. The Department of Environmental Affairs and Tourism (2000:1) highlights the point by mentioning that it is estimated the eruption of Krakotoa in 1883 alone was responsible for the release of tens of millions of tons of dust and sulphur compounds into the atmosphere up to a height of 50km.

2.2.2   Man-Made Air Pollution

Though man-made air pollution does not account for all pollution of the environment it does contribute to the burden of pollution generated by natural sources. Anthropogenic air pollution has always and will always be viewed as a serious problem that should be monitored.

The seriousness of man-made air pollution rests on the fact that high potentially harmful pollutant levels are produced in the environment where harm to human health and welfare is the most likely. Man-made pollution is more serious in urban area as a result of various activities and it is often many times higher than natural levels due to its concentration in space and the time it takes for natural processes of rain, wind and chemical change to disperse, dilute or eliminate them from the urban air. According to Park (1997:199) London, England, has long had a serious air pollution problem and is particularly well known for the December 1952 smog incident which damaged many people's health, put many in hospital and killed an estimated 4000 people. This chapter will therefore look at man-made air pollution, its sources and impact on the environment and people. It will discuss how the negative environmental effects affect people, animals and the environment.

2.3   SOURCES OF INDOOR AIR POLLUTION

People usually think of the indoor environment as a safe place from the harmful effects of air pollution. During smog alerts people are generally advised to stay indoors. Yet scientific research indicates that the indoor environment may be at times more polluted than the outdoor environment. According to Reifer (2000:3) the U.S Environment Protection Agency (EAP) ranks indoor air pollution as one of the top

five threats to public health. It is further supported by the latest studies on human exposure to indoor pollution, by the European Commission's at Joint Research Centre (JRC) revealing that indoor environments pose their own threats to health and in some cases, can be at least twice as polluting as outdoor environments. Yet millions of people around the world are not able to realise the serious nature of the problem, or even worse fail to recognise that there is a problem. If exposed to indoor air pollutants people are at the high risk of contracting allergies. Here are some of the sources of indoor air pollution:

2.3.1   Buildings

Some authorities such as the American Environmental Protection Agency as stated by Crockford, in Leslie and Lunau (1992: 275) state that the risk to health and comfort from air-borne pollutants may on occasions be worse inside buildings than outside them and indoor air pollution could represent for many people a major portion of their exposure to air pollution. The air inside and outside the building becomes exchanged and as a result the pollutants from outside the building will play some part in determining what the occupants of a building are exposed to, at what degree and for how long. Thus the outdoor air is going to influence the concentration of pollutants of indoor origins.

The location of the building in relation to the source of pollution is also essential in determining what enters at what degree of concentrations and the frequency of exposure. Leslie and Lunau (1992: 275) cite the dramatic examples of outdoor air influencing indoor air conditions during the smog that occurred in many big cities until the 1960's and that penetrated buildings both as visible aerosol and as invisible gases. The smog caused many thousands of deaths and bronchitis in a considerable proportion of the population.

Pollutants enter the buildings through windows, ventilation ducts doors and other gaps in various forms of particulate such as dust, smoke, fume, and mists. Though it does not matter how pollutants have entered the buildings, the fact remains they are harmful to one's health. These pollutants cause what is termed "Sick Building Syndrome" (SBS). SBS is a term sometimes used to describe a collection of symptoms experienced by a high proportion of those living or working in a particular

building or part of a building. There are known common symptoms associated with SBS, which are allergies, asthma, eye, nose and throat irritations, fatigue, headaches, nervous-system disorders, respiratory congestion and sinus congestion. The SBS only affects occupants when they are in the building but when the occupants leave the building the cause of the illness disappears. According to Schwartz (2003:1038) Winkam et al. found out that Sudden Infant Death Syndrome (SIDS) has related to respiratory illness, which resulted in air pollution. SIDS is more frequent during cold months when air pollution problems are also more prevalent.

SIDS has also been linked to tobacco smoke in winter, as people tend to keep warm by closing windows and any opening that might cause a draught. As a result not enough ventilation is experienced, especially if there is smoking activity; therefore the air becomes stale. Increasingly smoking is becoming a controversial issue, as medical research has proved that cigarette smoke harms not only the smoker, but also non-smokers who inhale it. According to Schwartz (2003:1038) Winkam et al. support the above-mentioned statement by indicating that environmental tobacco smoke is associated with low birth weight.

2.3.2   Coal and Wood Use

Outdoor pollutants like combustion products of coal strongly influence the indoor environment though these are also indoor sources. Women and their children spending a lot of time indoors can contact serious health problems by being exposed to indoor air pollution arising from the use of coal or wood for cooking. The quality of indoor air is increasingly being recognised as an important factor affecting the respiratory health of both children and adults. Wright (1992:16) states that people who lived near smoky chimneys during the Industrial Revolution breathed in polluted air every day. As recently as 1951 nearly 3000 people died from a killer "smog" in London.

According to the World Health Organisation, indoor air pollution is responsible for more deaths worldwide. It should be remembered that to some extent pollution is economically beneficial to some people, e.g. when a coal factory sell its coal to people at reduced price the factory owners sell more products and make greater profits. The consumer of the products buys them at a lower price than he would have to pay if

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pollution of the atmosphere were avoided. "Suid-Afrikaners betaal tot 68% goedkoper vir hul elektrisiteit as mense elders ter wêreld, maar dok jaarliks tot R4, 2 miljard aan mediese koste op wat direk verband hou met lugbesoedeling wat die gevolg is van die verbranding van die laegraagse steenkool" (Beeld, 2004:3) Thus the pollution situation exists because of society's desire for consumer products and its eagerness to purchase them at the lowest short-term market cost, even if this means generating substantial quantities of waste materials.

2.4   SOURCES OF OUTDOOR AIR POLLUTION

2.4.1   Domestic Coal Burning

According to Beeld (2004:3) "coal coulaius 34% swael en is grootliks verantwoordelik vir die lugbesoedelingsprobleme waarmee die land worstel". Coal is the main source of fuel and air pollution in black urban townships where it is burnt in domestic stoves for cooking and heating. According to the Department of Environmental Affairs (1992: 7) it is estimated that the power stations in the South Eastern Transvaal coalfields discharge more than one million tons of sulphur dioxide per year. South Africa uses low quality coal that causes high concentrations of sulphur dioxide and particular matter at ground levels for both indoor and outdoor purposes and these emissions of sulphur dioxide and particulate matter are probably largely responsible for the low air quality faced by many metropolitan and rural areas of South Africa. In Alexandra Township, near Johannesburg, there is so much smoke hanging over the township in winter that you can see it from miles away. This results in severe air pollution of these areas because of all the smoke, (McKay, 2000:16).

According to Caldwell (1993:2) electric power generation by coal burning is the largest single source of SO2 pollution and also contributes significantly to NO2 and particulate matter pollution. Many people in townships have developed breathing problems and lung illness because of the polluted air they breathe. Thus the use of poor quality coal results in social, health and environmental risks. The low price of coal in South Africa is not conductive to proper fuel consumption management. Therefore the introduction of smokeless domestic stoves can reduce the air pollution rate.

2.4.2 Motor Vehicles

Motor vehicles, particularly the diesel-driven vehicles, like the trucks and buses that ply their trade along the long roads of South Africa, contribute greatly to air pollution. These diesel vehicles often emit smoke due to various reasons, such as the inefficiency of the engine, or incomplete combustion owing to poor mechanical conditions or incorrect engine adjustment. Straining an engine results in poor combustion and poor combustion emits smoke. Inefficient driving of the vehicles by inexperienced drivers also contributes to poor engine performance. The combustion in motor engines produces hydrocarbons and contributes approximately 50% of the planet's nitrous oxide (NO) emissions (Department of Environmental Affairs and Tourism, 2000: 8).

Cars and lorries cause the most pollution. Petrol engines for example pump number of harmful gases into the air and carbon monoxide when in the atmosphere is poisonous, it interferes with the supply of oxygen to the brain and in some other instances causes brain damage or behavioural problems in young children. According to Schwartz (2003:1038) infant death from respiratory disease is associated with air pollution, particularly from traffic. Vehicle emits fumes that contribute both to acid rain and to the build-up of carbon dioxide in the atmosphere. Vehicles have a bad environmental record; none of the pollution they cause is necessary.

2.4.3 Population Explosion

A rapid increase in the population may damage the environment and lead to consequential air pollution. The increase in population beyond the carrying capacity of the earth exerts additional pressure on the natural resources including air, water and food systems South Africa with its fast-growing population is encountering problems of straining available resources. According to Urban Foundation as quoted by McKay (2000:12), the South African population stood at 38.4 million in 1991. It is estimated that by the year 2010 the South African population will be 59.7 million, which means that between 1991 and 2010 the total population will increase by 55%.

We breathe oxygen and exhale carbon dioxide and emitting excessive carbon dioxide puts our health in great danger. However the world population is increasing at an alarming rate. It is therefore essential to control this due to the impact more people

might have on the greenhouse effect. More people mean more land is cleared for agriculture and more fuel is used for heat and cooking. Both these activities involve increased burning and thus create extra carbon dioxide. Thus a growing population poses mounting problems for public health. Air pollution kills an estimated 2.7 million to 3.0 million people every year, about 6% of all deaths annually (Schwartz 2003:1040).

2.5   GLOBAL AIR POLLUTION

The problem of global air pollution cannot be considered in isolation from the rest of the global environment. Global air pollution is one of the threats to the planetary environment and to the survival of the occupants. The recognition that the major international action must occur to preserve the global environment for future generation is an important focus (Bridgman 1999:216)

2.5.1   Some Major Environmental Effects of Global Air Pollution

2.5.1.1 Ozone pollution

Ozone pollution is the result of man using chemicals that are released into the atmosphere causing enormous damage. Household activities such as open fires for heating purposes, burning of household refuse and cooking food intensify the problem, especially in poorer residential areas. Lowering of the ozone concentration in the stratosphere is of fundamental importance in solving environmental problems. Ozone concentration above the South Pole has been monitored since 1950 and it appears as if 97,5% of the ozone has already been destroyed. (Hugo et al. 1997:137). Here are some examples of ozone depleters as indicated by Park (1997:205):

- Halons (used in some fire extinguishers)
- Methyl chloroform and carbon tetrachloride
- Some Chloro-fluorocarbons (CFCs)
- The pesticide methyl bromide.

The (CFCs) Chloro-Flouro-Carbon compounds are the major damaging chemicals to the ozone layer. Fisher (1992:33) estimated that if CFCs production continued to increase at the present rate of 10% a year until 1990 and then leveled out after that,

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the effect on the ozone layer would be depletion of between 5% and 7% by 1995 and between 30% and 50% by the year 2005. Fisher (1992:34) further estimated that depletion of 5% in the ozone layer would result in 40,000 extra skin cancers each year. More ultraviolet radiation at ground level could also cause millions of cases of cataracts (a clouding of the eye lens that results in blurred vision) in the next century. Many medical experts also believe that a significant increase in UV-B would disrupt the human immune system, potentially leading to epidemics of infections diseases (Fisher, 1992:34)

Though the aerosol industry has made the greatest contribution to reducing the use of CFCs, the use for CFCs for the refrigeration may be difficult to reduce. One of the largest users is the mining industry, which uses large cooling plants in order to provide acceptable working conditions for miners in deep-level mines. According to the Department of Environmental Affairs (1992:129-130) South Africa uses about 12000 tons of CFCs a year, approximately 10% of the world consumption. The principal applications of CFCs are as propellants in spray cans (50%), foam plastics (30%) and coagulants in refrigerators, freezers and air conditioners. A small amount of halons (700 tons) in total is used in fire extinguishers.

People on earth rely on the ozone layer in the atmosphere to absorb dangerous ultraviolet radiation from the sun, which could damage plants, animals and people if it reaches the earth. Ozone gas which is highly reactive produces oxidative damage in the lungs, this is supported by Krupa (1997:81) when saying "ozone affects lung functions, it increases respiratory or pulmonary diseases and decreases tidal volume (rise and fall) of air intake and changes in respiratory mechanisms".

Polluting the ozone layer means destroying the important role the ozone layer plays. The ozone layer should be protected for its important purpose, which is as taken from Fisher (1992: 14)

- It creates an environment on this planet suitable for life.
- It blocks out ultraviolet light to protect life while letting in enough radiation of
- other wave lengths to keep the earth warm and provide light by which to see.

- It serves as a thermal covering with carbon dioxide (CO2) and other gases
- trapping sufficient heat to keep the planet from freezing, yet letting enough
- space so that it does not over heat.

South Africa signed the Montreal Protocol on January 15, 1990 and the Department of National Health and Population has issued a policy of which the following is an extract:

- The National Policy for the protection of the ozone layer aims at restricting and ultimately phasing out the use of harmful substances.

It is the intention of the State to encourage industry, professional groups, conservation movements, prominent individuals and the media to accept joint responsibility for the implementation of the national strategy of phasing out those harmful substances.

2.5.1.2 Greenhouse effect or global warming

The greenhouse effect, also referred as to global warming, is generally believed to come from the build-up of carbon-dioxide gas in the atmosphere. It is mainly caused by the mass emissions of gases into the atmosphere from burning fossil fuel. It is difficult to stop the emission of these greenhouse gases as almost all activity in the industrialised society, such as transport and industrial production relies on the burning of fossil fuels. The fate of the earth's climate depends on how much concentrations of carbon dioxide and other gases are likely to increase in the future. Carbon dioxide from the burning of fossil fuels is the largest single source of greenhouse gas emissions from human activities (Department of Environmental Affairs, 2002:22).

The supply and use of fossil fuels account for about 80% of carbon dioxide emissions. If the current rate of emission of greenhouse gases is not reduced, global temperature may cause serious environmental problems. The Department of Environmental Affairs and Tourism (2002:13) supports this by indicating that if global warming is not curbed, it may result to sea-level rising, as temperature rises, the oceans warm and the water within then expands. Glaciers and possibly ice caps would melt. Scientists

predict an increase of 1 C of the average global temperature by 2025 and 3degrees Celsius by 2100.

In order to maintain balance more plants should be saved as plants convert carbon dioxide back to oxygen, but the release of carbon dioxide from human activities is higher than the world's plants can process. The situation is made worse since many of the earth's forests are being removed and plant life is being damaged by acid rain. It therefore means the amount of carbon dioxide in the air is continuing to increase; this build-up acts like a blanket and traps heat close to the surface of our earth. Changes of even a few degrees will affect us all through changes in the climate and even possibly that polar ice caps may melt as already explained.

Fisher (1992:15) mentions the following as the main greenhouse gases:

- Carbon dioxide, most come from burning fossil fuels and from forests fires
- (particularly associated with tropical deforestation).
- Methane is a by-product of agriculture coming mainly from cattle, termites,
- sheep and rice.
- CFCs come entirely from industrial activities, refrigerators, and air
- conditioners, fire extinguishers as aerosol propellants and solvents and foam-
- blowing agents for plastics.
- Water vapour is an important greenhouse gas, which varies from place to
- place, and through time. It is affected much less by human activities than
- by normal atmospheric processes.

2.5.1.3 Acid rain

Acid rain is also another consequence of outdoor air pollution. When a pollutant, such as sulphuric acid combines with droplets of water in the air, the water or snow can become acidified. According to McKay (2000:41) clouds travel long distances, often hundreds of kilometers before they drop their load of rain, which can be acidic enough to damage trees, crops, lakes and rivers.

Life-giving rain is now being poisoned by pollution in the air. Polluted rain threatens people's health, destroys life in the ponds, lakes and rivers, harms and kills trees, damages buildings, (Hare, 1990:5). These effects of acid rain run in a chain, destroying every organism in that chain. For example, soils naturally contain small amounts of poisonous minerals like aluminium, cadmium and mercury. Normally these do not cause serious problems, but as the acidity of the soil increases, chemical reactions allow the minerals to be absorbed by plants. The plants are damaged and any animals eating them will absorb the poisons, which will remain in their bodies. The harmful minerals are also leached out of the soil into streams and lakes, where they can kill fish and other living creatures.

The majority of wild plants and animals that live in clean, unpolluted lakes are not able to tolerate acidic water. According to Hare (1990:16) they are poisoned by substances the acid washes out of the surrounding soil into the water. The fish in the water find it difficult to reproduce successfully if the level of acidity rises. They are unable to tolerate the high level of acidity and die. The birds that eat these fish also suffer as the harmful minerals become more concentrated inside their bodies. Acid rain is also recognised as a serious threat to forests, it puts trees under stress as it damages the soil exposing it to susceptible viruses, fungi and insect pests.

2.5.1.4 Damage to health

Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature (Palmer, 1998:70). Air may have life- damaging properties if the balance between its important constituents, oxygen, nitrogen and carbon dioxide is sufficiently disturbed, or if sufficient amount of contaminants are present. Due to the fact that there is no such thing as an absolutely safe contaminant, the specific concentration at which the contaminant will damage health depends on how the word "health" is defined, the nature of the contaminant, the length of time, and the air containing the specific pollutant.

The health effects of air pollution exposure have become an area of increasing focus. A growing body of evidence has demonstrated that there are serious health consequences to community air pollution and that these consequences are not spread

equally among the population. Children have been shown to be at particular risk due to the fact that their immune system is still developing, their lungs also are developing and are immature at birth. Schwartz (2003:1040) highlights this fact by indicating that it is believed that air pollution is associated with nontrivial increases in the risk of death and chronic diseases in children.

Another major factor is that children spend more time outdoors than adults where contamination is high; the concentration of pollution from traffic, power plants and other combustion sources are generally high. The failure to look after our environment now, and to provide the foundation of healthy living for future generations, will cause and exacerbate chronic diseases and deaths for years to come. The single most vulnerable population group is children. Unhealthy environments cause an estimated million deaths in children per year worldwide, and contribute to one third of the total burden of disease among children (Jordan, 2004:140).

2.5.1.5 Effects of air pollution on vegetation

Air pollution can affect plants to varying degrees. At the lowest levels that are below the threshold, there is no effect, such as visible damage, cumulative chronic effects, genetic effects or even gradual changes in the composition of the plant community. However, even at this level air pollutants can be stored in the plants and introduced into the food chain, affecting animals that eat plants. Plants take up air pollutants either directly or indirectly through the moisture taken up from soil. The soil may have been exposed to the air pollutants that are then dissolved in water in the soil. More direct is the entry of gaseous pollutants into the plants through stomata. Gaseous air pollutants after entering the plant tissue dissolve in the intercellular water. Then the pollutants attack the cell structure within the leaf, causing damage to the plant or defoliation. This is supported by the fact that in South Africa the plantations of the Eastern Transvaal are also damaged by acid precipitation and by the combustion of coal (Department of Environmental Affairs and Tourism, 2000: 3).

Sulphur dioxide is the main cause of damage in both cases, but other air pollutants are also involved. Acute injury to plants from sulphur dioxide initially takes the form of bleached patches on broad-leaved plants or bleached necrotic streaking on either side of the mid-vein of parallel-veined leaves. Krupa (1997:120) indicates that acute injury

appears as bleaching of the chlorophyll to give a mild chlorosis or discoloration yellowing of the leaf in many plants. In other plants, the bleaching of the chlorophyll reveals the presence of real, brown or black pigments, which are normally concealed. Whatever the form of the damage, the result is a reduction in growth and yield.

2.6   CONCLUSION

It is critical for people to be conscious of the impact of air pollution on the environment and people. They also need to know and understand the causes of air pollution and its extent to be able to understand their effect. Air pollution, whether indoor or outdoor, has detrimental effects, which should be taken seriously, as ignorance will lead to more harm and death. The impact of air pollution is not good for the present and future generation as it places the human conditions and the environment in serious jeopardy.

Positive interaction with the environment will save our environment from man's cruelty. Environmental Education is capable of empowering people with the ability to solve environmental problems. This is mentioned in chapter three where factors contributing to environmental crisis are discussed together with the reason why Environmental Education should be introduced to deal with environmental crises. The important roles that should be played by the government, community, the teacher and the learners are highlighted in chapter three as ways of fighting air pollution.

CHAPTER 3

THE ESSENCE OF THE ENVIRONMENT AND FACTORS CONTRIBUTING
TOWARDS ENVIRONMENTAL CRISES

3.1   INTRODUCTION

The environment is our basic home irrespective of our various ranks in life, our language, race, background or culture. We all depend on the environment for our survival and the survival of our future generation. Humans have always been concerned about the environment and their role in it though our concern varies greatly amongst communities because of the wide spectrum of cultures, attitudes, values and beliefs. Our background shapes our relationship with the environment. Hence it has become necessary that we align ourselves with UNEP, 1976's proposal as quoted by Filho and Roberts (1996:112) which is "to develop a world population 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 solutions of current problems and the preventions of new ones".

The importance of caring for our environment is discussed here where Environmental Education comes as the solution to why the environment should be protected. Environmental Education by involving all members of the community to partake in protecting the environment is discussed.

Through the various roles played by the government, the community, the teachers and the learners readers can be made aware of the problem of air pollution which is for everyone. The chapter also indicates that the actions of people in harming their environment are triggered by several factors.

Lack of concern for the environment, no sense of ownership, the crisis of the man-environmental relationship and insensitive actions toward the environment are discussed in detail. In attempting to highlight these contributory factors of air pollution, it is

believed that readers will weigh their actions towards the environment so as to be environmentally friendly citizens.

One's change of attitude and behaviour towards the environment will definitely make a difference. The chapter's main aim is to try to send a message to people to take ownership of their environment and value it because they cannot live without it.

3.2   WHY SHOULD THE ENVIRONMENT BE PROTECTED?

3.2.1   The environment is essential for life

A healthy environment is essential for human existence and well-being and the contamination of the environment with heavy metals, physical agents and certain organic compounds can have far-reaching effects like serious illness and death. The most basic steps in preventing human illness are the protection of the environment and preservation of ecosystems.

Many of today's environmental problems such as the depletion of the stratospheric ozone layer and changes in global climate due to the emission of "greenhouse gases" into the atmosphere have the potential to affect virtually every human being on the planet. These environmental problems are not easy to be fixed either by putting in much money into projects or developing environmental policies. They are rather long-term problems and are harmful to every living organism on the planet. Due to these environmental problems many South African inhabitants live in an environment that is harmful to their health and well being.

According to Alerby (2000:26) UNCED states that since the interest in and awareness of environmental issues increases as time pass away, our knowledge is expanded. People need increased environmental knowledge and awareness through education and training, which will encourage critical thinking and conservation of the environment. This will then lead to appreciation of the beauty of the environment and development of some sense of responsibility towards the environment. Experiencing one's natural environment

is part of environmental education. Ott, in Swonke (2000:259) says finding beauty in nature is one reason for humankind to preserve nature in its beauty. The environment needs to be protected for its beauty for our generations and us.

3.2.2   The Crisis of The Environment due to the Impact of People

McKay (2000:4) mentions that according to Markhan "When people talk about the environmental crisis they mean that humans are altering the environment in such a way that the delicate balance of various ecosystems, indeed of the global (world) ecosystem is being destroyed". The Earth is in "chaos" due to the fact that human beings are pushing it to the limits of its capacity. We abuse the earth to satisfy our selfish needs ignoring the fact that damaging the environment causes irreversible damage to the entire planet. Thus we disturb the normal functioning of the ecosystem. The solution to the environmental crisis lies much more in people's attitudes, values and expectations. Thus people tend to expect too much from the environment due to their selfish attitudes and lack of value for the environment and exert excessive pressure that will crumble the delicate balance of the ecosystem.

Many of the problems stem from the way in which people interaction with their resources resulting to pollution. A descriptive diagram illustrating the interaction is indicated below as shown in Park (1997: 5):
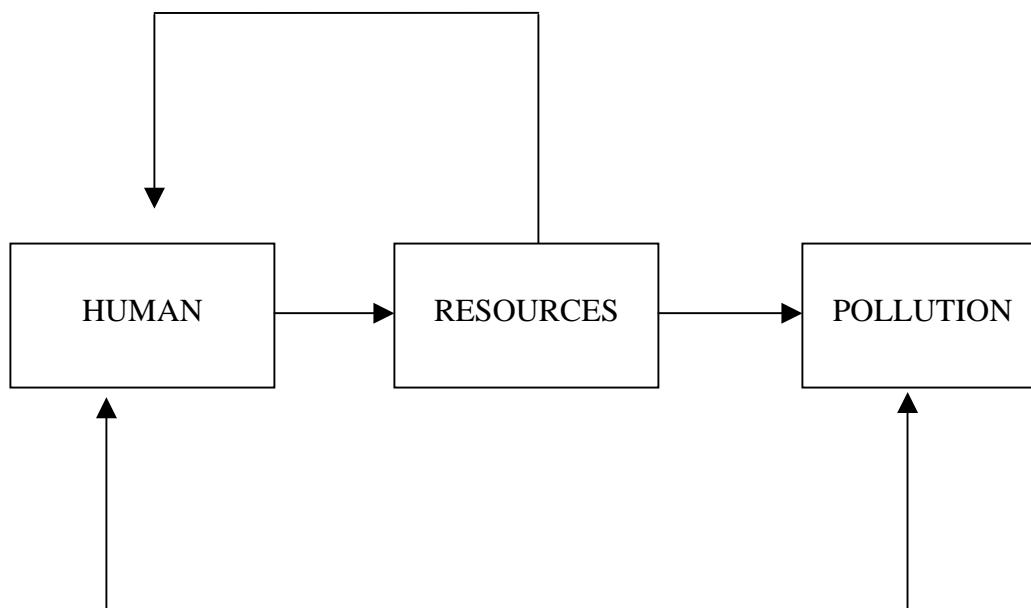
DECREASED IN ENVIRONMENTAL QUALITY IMPACTS ON HEALTH

Figure 3.1:   THE INTERACTION BETWEEN PEOPLE, RESOURCES AND POLLUTION

The negative interaction of people with their environment indicates a negative relationship leading to environmental disaster if their actions are not monitored and improved. Their action can be modified only if they become aware of the impact of their action and are willing to deal with them. Park (1997:9) stipulates some of the root cause of environmental problems as the following:

- Developments in technology through history, which have given people a better ability to use the environment and its resources for their own ends.
- The rapid increase in the human population in recent centuries, which has significantly increased population densities in many countries.
- A significant rise in human use of natural resources, particularly over the last century.
- Attitudes towards the environment, particularly amongst western cultures, which regard it as freely available for people to do whatever they like.

- The short-term time horizon over which many people, companies and countries make decisions which means that short term profit maximisation has generally been taken more seriously than long-term sustainable use of the environment.

From the causes mentioned, it becomes clear for humans to realise that the environment is our own home that needs to be protected for our survival. Doing harm to the environment is equal to destroying our own lives as we totally rely on the environment for almost everything. It is essential that we understand how the environment works and appreciate its complexity and diversity.

3.3   THE INVOLVEMENT OF ENVIRONMENTAL EDUCATION IN DEALING WITH AIR POLLUTION

Environmental Education can also be regarded as a global concept developed in a time of social, economic and ecological globalisation. Due to the fact that environmental problems touch on all aspect of society, it is imperative that people are instilled with a knowledge of EE so that they are able to deal with global and national environmental problems. This is further reiterated by the Tibilisi principle (Tibilisi UNESCO-UNEP:1977) which states that EE is regarded as a permanent process in which individuals and the community gain awareness of their environment and acquire the knowledge values, skills, experiences and also the determination which will enable them to act individually and collectively to solve present and future environmental problems.

The White Paper on Education and Training RSA (1995:5) mentions EE as the key principle of education, stating that EE involving an interdisciplinary and active approach to learning must be a vital element of all levels and programs of the education and training system in order to create environmentally literate and active citizens and ensure that all present and future South Africans enjoy a decent quality of life through sustainable use of resources.

Environmental Education enhances critical-thinking, problem-solving and effective decision-making skills. It also teaches individuals to weigh various sides of an environmental issue to make informed and responsible decisions. Environmental Education does not advocate a particular viewpoint or course of action, (Knapp & Poff, 2001:56), but seeks to empower people to understand and to take action on environmental issues, which may be drawn from ecological concerns and may have implications either for the quality of human life or sustainability of the ecosystem.

It therefore becomes necessary that Environmental Education should occupy an essential role within the school situation and even in our community, so as to educate everyone across the board. Palmer (1998:9) stipulates an important review provided by the report "Environmental Education" published by the Scottish Education in 1974 which supports the idea by indicating some of its recommendations which are truly relevant in today's life if Environmental Education is to occupy the essential part of our way of living. They are the following:

- Both formal and informal education should use the local and distant environments to provide knowledge, training in appropriate skills and first hand experience.
- Pupils and young people should be introduced to environmental concepts and values and be given practice in decision-making and afforded opportunities for personal involvement in their environment.
- Pupils and young people should be trained to assess critically the many view being expressed today on current environmental issues.
- Environmental Education should permeate the whole curriculum both inside and outside the school.
- The programme of Environmental Education should begin in primary school and be pursued to secondary school and should continue into informal education and later life.

By so doing we would instilled in our community the accepted values and attitudes which will enable them to promote sustainability towards their environment. Thus the conservation, improvement and development of the environment will be regarded as the integral part of the goal of environmental education.

3.4 THE ROLE OF EE IN COMBATING AIR POLLUTION

Environmental Education should come as a solution to the growing need of the society to live in an environmentally friendly situation, where air pollution is reduced. This essential role can be achieved when Environmental Education is able to touch the largest possible number of people in the most varied sectors of societies. The Intergovernmental Conference on Environmental Education (Tibilisi UNESCO-UNEP:1977) stresses that questions of education in the field of the environment should concern all sectors of the population and should be regarded as a life-long process. The basic aim of Environmental Education is to provide different groups of people with the knowledge needed to develop a sense of responsibility towards the environment. This education should inculcate the competence needed for the correct solutions to environmental problems. It can be easily achieved if the government, the community, the teachers and the learners all play an important role in bringing sustainability towards their environment. Agenda 21 (1993:28) states that sustainable development must be achieved at every level of society.

3.4.1 The Role of the Government in Dealing with Air Pollution

The fight against pollution is not the sole responsibility of the national government and the international organisation alone; it must be recognised that each individual must also become personally involved if the fight is to be won. According to Palmer (1998:201) the Climate Change Convention demonstrated that the people of the world could tackle global problems together by collaborating through the United Nations system. Therefore government must anticipate problems and prevent a negative impact on the environmental rights. They can do so by establishing mechanisms and processes to ensure effective public participation in environmental governance.

Through promoting environmental literacy, education and empowerment of South Africans, people will increase their awareness of and concern for environmental issues and assist in developing their knowledge, skills, values and commitment necessary to achieve sustainable development. Summers (2000:294) emphasises this by saying education for sustainable development enables people to develop the knowledge, values, skills to participate in decisions about the way we do things individually and collectively, both locally and globally, that will improve the quality of life now and without damaging the planet for the future.

3.4.2   The Role of the Community in Dealing with Air Pollution

The state of the environment can be improved substantially if all members of the community are inculcated with the aims and principles of Environmental Education. The whole nation must be in a position to understand how to become responsible citizens within their environment throughout their lives by becoming familiar with Environmental Education. Environmental Education is the only hope for protecting the environment as its aims are focused on harmonising people's relationship with their environment. The National Environmental Management Act of 1998 supports this statement by emphasising that the community well-being and empowerment must be promoted through Environmental Education, the raising of environmental awareness and the sharing of knowledge. Therefore the community must be aware of its aims, which according to the White Paper on Environmental Education 1989 are:

- To stimulate education process that develop responsible life-style in harmony with the environment as a whole on the part of all inhabitants of the RSA and make them aware of the fact than an acceptable quality of life is dependent on their judicious utilisation of the environment.
- To make the population aware of the various elements of the environment and their interrelationships, and of the need for a healthy environment for the survival of mankind.

- To motivate people to accept responsibility for the environment and to cultivate to necessary knowledge and values in order to that solutions may be found for identified problems.

The Department of Environmental Affairs is the key role player in addressing the issues of the environment in South Africa by making information on environmental education programmes available through the involvement of schools. And by taking steps to facilitate communication and co-operation between and within bodies concerned with formal and non-formal education activities on matters related to environmental education. Encouraging schools and the communities to work closely with the NGO's when dealing with environmental matters can propagate this idea since NGO's are groups striving to raise environmental awareness by implementing projects, that intend at maintaining sustainable living. Agenda 21 supports that by indicating that peoples' organisations, women's groups and non-governmental organisations are important sources of innovation and action at the local level and have a strong interest and proven ability to promote sustainable livelihoods. Governments, in cooperation with appropriate international and non-governmental organisations, should support a community-driven approach to sustainability.

3.4.3   The Role of Teachers in Dealing with Air Pollution

If Environmental Education is to be successful in helping to combat local and international environmental problems, the key to success lies in the hands of teachers. Without a motivated, committed teaching body, the goals of Environmental Education are unlikely to be realised. Teacher's initiative is the point of the greatest focus in Environmental Education program design, requiring the investment of decision-making power and resources at the teacher's level (Ballantyne & Oelofse, 1989:10).

Teachers play a very significant role in EE; therefore their efforts should not be underestimated at all costs. It is their task to create environmental awareness in learners, which will ultimately instill in them a sense of responsibility towards their environment. Palmer (1998:114) provides their opinion by saying Environmental Education should

ideally involve students, teachers and community agencies in collaborative investigations of real environmental issues in their local environment.

Although educational institutions readily embrace the idea of teaching in, about and for the environment, putting it into practice becomes a problem. This indicates that the educational systems do not meet the necessary conditions that are important for Environmental Education to be successful. Walker (1997:156) suggests the following conditions required if Environmental Education is to be successful:

- A teacher with a specific expertise in relation to the problem being investigated or an outside expert.
- Committed teachers and principal.
- A committed community.
- The recognition of a shared, community-based environmental problem.
- A preparedness on behalf of the teachers, students and community participants to confront their own values and the values held by others
- School and parental agreement that the environmental problem will become the focus of the curriculum.
- The acquisition of the appropriate skills and a willingness to take action to remedy the environmental problems identified.
- A problem that is solvable by school students.

Therefore it becomes necessary for a school to realise the goals of Environmental Education so that they should have adequate arrangement for planning and implementing its programme This can be achieved if Environmental Education forms part of the curriculum both inside and outside the school so as to create new patterns of behaviour for individuals, groups and society as a whole towards the environment. According to Bynoe (1996:52), Connet mentions that Environmental Education is the cornerstone of long-term environmental strategies for preventing problems, solving those, which have occurred, and assuring environmentally sound, sustainable development.

3.4.4   The Role of Learners in Dealing with Air Pollution

It is important for children to be environmentally aware, as their knowledge will be life-long. We must encourage children to be involved in protecting their environment. Investing in children the knowledge of Environmental Education may be the best way the government can build a foundation to address national and global environmental problems. Therefore the obvious place to start educating the public about the environment is the classroom. Children are curious about the natural environment and adapt to an environmentally conscious life style more easily than adults. Boon (1997:28) says if we educate learners in pollution prevention during their formal education it would be "Pollution Prevention Source Reduction Education". If we wait until they are already employed and go to a company or business and educate them it is "End-of-Pipe Pollution Prevention Education."

Schools must be the relevant place to address the multitude of environmental problems faced by our society. By learning to explore those problems and reflect on them, children and young people would have approached the fundamental goals of the educational process, which according to Kyburz-Graber, Rigendinger, Hirsch and Werner (1997:19) are:

- Self-education by unfolding the personality through a process of interacting with herself/himself, with other people and with the environment.
- Developing a distinct understanding of the world through a critical reflecting on the dominant mode of exploiting nature.
- Undertaking an active and responsible role within the world, through participating in societal processes and cooperating on measures towards a sustainable society.

Due to the fact that the South African society comprises diverse cultures it is imperative that the environmental educator considers young children's different perceptions about the environment from this point of view. Thus the teacher needs to be familiar with learners' background knowledge of environmental issues to facilitate discussion and

involvement by all children in the group. Without knowing the kind of learner one is dealing with in regards of concerns, interests, expectations and ambitions in general, the teacher will not be able to involve the learner in solving environmental problems. The teacher should let learners know that their input and participation are important by involving them in the classroom. This could motivate learners to participate in sharing their environmental knowledge because they will know that their voices are important. Hutchinson (1997:189) supports this by stipulating "if our efforts as environmental educators are to be empowering rather than disempowering in what we do in our schools, in our classes and in the field, then we need to actively listen to what our children are saying about the environment and the future".

Since many teachers are not qualified in Environmental Education, training of qualified personnel remains a priority activity in maintaining a community that is knowledgeable with regard to Environmental Education. The training of environmental teachers should be the government's first priority if we are to strive for the protection of the environment. The application of new Environmental Education programmes and proper use of teaching materials depends on suitably trained personnel. Teachers well trained in the contents, methods and process of EE development can also play a crucial role in spreading the impact of EE. Schulze (1998:121) states that the need for Environmental Education teacher training in South Africa is supported by the results of a pilot study conducted to determine secondary school teachers' understanding of the concept of Environmental Education and their willingness to develop environmental knowledge and attitudes during subject lessons.

3.5   FACTORS CONTRIBUTING TO ENVIRONMENTAL CRISES

The way we respond to the environment and our opinions about environmental problems and issues facing the planet depend not only on our knowledge but also on our concern for the environment. Through Environmental Education our lack of concern can be minimised if we gain knowledge of how to access and deal with the range of viewpoints on environmental matters

3.5.1   **Lack of Concern for the Environment**

Individual Barrier. Individual in

social context

**Social
institutions
barriers**

Environmental Concerns	Individuality e.g. laziness, wrong person, lack of interest	Responsibility e.g. lack of efficacy, no need, lack of trust, does not own property	Practicality e.g. lack of time, money, information, encourage- ment, facilities, Storage	Pro-environ- mental behaviour
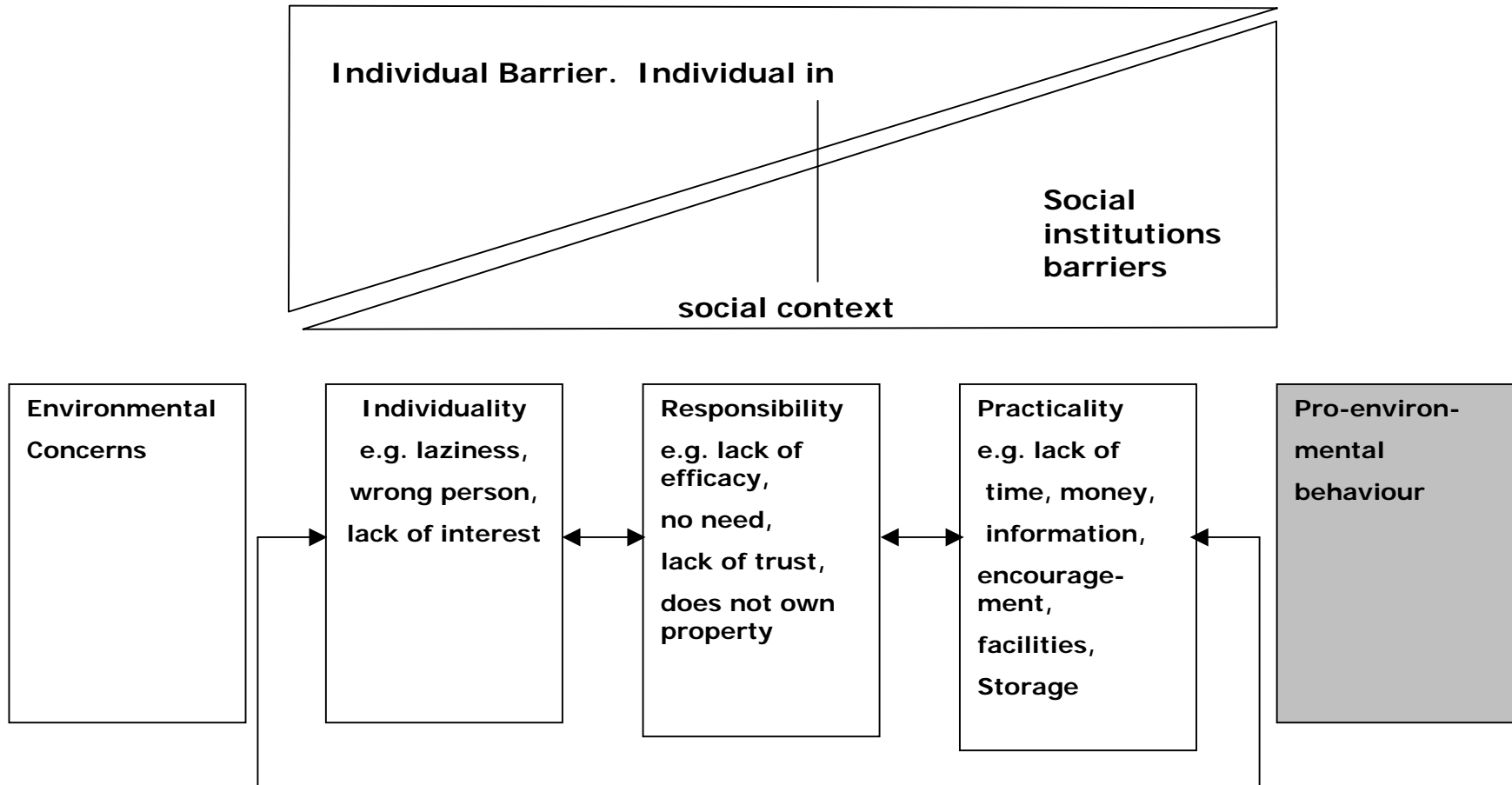
Figure 3.2: Blake's model of barriers between environmental concern and action

According to Kollmuss and Agyeman (2002:246) Blake's model explains the attitude-behaviour gap, which he also refers to as the value-action gap. According to him the problem is the results of most pro-enviromental behaviour models that fail to consider individual, social and institutional constraints that are involved when people interact with their environment. The models rather assume that people are rational and will make use of available information when taking a decision rather than recognising that people's power to make significant difference to global or local environmental change are unevenly distributed and sometimes contradicting hence change of attitude or lifestyle seems to be ineffective (refer to figure 3.2).

Blake then identified three barriers between environmental concern and action are:

- *Individuality*

    These are barriers within the person which have got to do with attitude and temperament. They are laziness, wrong person and lack of interest and are influential in people with no environmental concern. Their environmental concern is overpowered by conflicting attitudes like strong desires and needs to use resources to one's satisfaction irrespective of damage done to the environment (refer to figure 3.2).

- *Responsibility*

    People who do not act pro-environmentally feel that they cannot influence the situation or should not have to take responsibility for it. Blake points out that the lack of trust by the community in the institution often stops people from acting pro-environmentally, since they are suspicious of local and national government. They are less willing to follow the prescribed actions (refer to figure 3.2).

- *Practicality*

    It is social and institutional constraints that prevent people from acting pro-environmentally regardless of their attitude or intentions. Such constraints are lack of time, lack of money and lack of information (refer to figure 3.2).

The model indicates that lack of action in the environment caused by lack of environmental concern will automatically lead to environmental problems being unsolved. An individual who expresses an intention to take action will be more likely to engage in the action than an individual who expresses no such intention However, before an individual can intentionally act on a particular environmental problem, he or she must be well aware of the existence of the issue. An individual must have knowledge of the causes of the issue so as to take the action, which will be most effective in given situation. In addition an individual must possess a desire to act. Kollmuss and Agyeman (2002:242) state that one's desire to act appears to be affected by a host of personality factors… locus of control, attitudes, (towards the environment and towards taking action), and personal responsibility (towards the environment).

3.5.2   The Crisis Between People and their Environmental Relationship

The relationship between people and the environment is experiencing a crisis, and is rapidly deteriorating. People's negative actions towards the environment are irreversible and the consequences are immeasurable. This negative relationship between people and the environment is increased by the fact that people lack the know-how of interacting harmoniously with the environment.

As a result of the ongoing damage to the environment, by people, the proper functioning of the ecosystem has long been disturbed. Nature can no longer afford to maintain its balance, hence we are experiencing more environmental crises. The atmosphere can absorb polluted air if it is minimal, but due to the excessive emission rate, nature fails to take its course. People with their selfish and dominating behaviour are stressing the environment and leads to environmental distress syndrome. Epstein (2000:5) uses environmental distress syndrome to identify deteriorating environmental conditions and resulting threats to health.

The term environmental distress syndrome has come up as a result of a huge concern about the long-term effects of deteriorating environmental conditions on the health not only of humans but also of nature itself. We are no longer talking only of an increased

exposure to specific extraneous hazards as a cause of bad health. We are also recognising the depletion or disruption of natural biophysical processes that are the basic source of sustained good health (Epstein, 2000:4). The results of environmental distress syndrome are the increased risks of ecosystems that determine food productivity and the depletion of stratospheric ozone shield that protects against excessive solar ultraviolet radiation which has a wide variety of negative effects on human health.

Epstein (2000:5) lists four symptoms of the syndrome are:

- Re-emerging infectious diseases, including typhoid, cholera and pneumonia and the emergence of new diseases, such as drug-resistant tuberculosis and human reproductive disorder linked to industrial chemicals.
- Loss of bio-diversity and the consequent loss of potential sources of new medicinal and food crops.
- The decline in pollinators, such as bees, birds, bats, butterflies and beetles that are indispensable.
- The proliferation of harmful algae on the world's coastlines leading to more deadly outbreaks of disease such as ciguatera poisoning and paralytic shellfish poisoning.

It is crucial that the relationship between man and the environment be improved as a negative relationship is harmful to all as it results in both human and environmental health being poor.

3.5.3   No Sense of Ownership of the Environment

Pollution and other environmental problems stem from the absence of property rights in natural resources. It is in the nature of human beings to care and protect what is theirs and what is common for the public will be neglected. Aristotle in Cole (2002:2) supports this when he states, "whatever is common to the greatest number has the least care bestowed on it". Many environmental goods that are never subjected to private ownership for a

variety of economic, technological, political and cultural reasons will be neglected or damaged.

No one can claim to own the air, even though you do not have the right to pollute it deliberately, as everyone's health is endangered by such an act. The Roman poet Ovid, in Cole (2002:2) put these words into the mouth of Daedalus:"Though he may posses everything, Minos does not posses the air". This indicates that the air is common to human life; its protection is the duty of us all, and we need clean healthy air for survival.

According to Cole (2002:2) Grapel mentions that by the law of nature these things are common to mankind; the air, running water, the sea and consequently the sharing of the sea. It is essential that these environmental goods continue to remain off limits to private ownership. Changing or shifting our mind-set about caring for what belongs to us only, but rather becoming environmentally literate citizens who strive for sustainability is the key solution to our problems.

Environmental protection should be achieved automatically when at an early stage children are inculcated with the aims of Environmental Education. The Tibilisi UNESCO-UNEP (1977:63) recommendation stresses this as it says that Environmental Education must be regarded as a holistic, lifelong process for developing environmentally responsible citizens. If this is attained it will be easier for people to value their environment at all times. The environment needs to be valued for the special services it provides us. Here are some of the services the environment provides as stipulated by Winpenny (1991:2)

- General life support. The environment contains ingredients essential for life, health and human welfare. Some of these are being lost or modified by the present course of development (e.g. ozone layer, the composition of the atmosphere, natural beauty), while others are "finite" and subject to irreversible loss (bio-diversity). The life-support service is shorthand for a large and complex range of environmental functions which we currently only partly understand.

- Supply of raw materials and energy, which are physical inputs in current production and consumption and which may be either renewable or finite. Finite resources are always depleted when worked, whereas renewable resources (e.g. soil, forests) can either be worked sustainably or depleted by excess use and insufficient maintenance.

- Absorption of the waste production of economic and social activity, through the air, soil or water sometimes called the 'sink' function up to certain level, the environment can safely assimilate waste which can be regarded as a sustainable in any quantity, i.e. heavy materials, radio active substance certain chemicals. Beyond that level, however natural systems become saturated and overloaded, this is tantamount to the unsustainable use of the environmental waste function.

Appreciating these services simply implies appreciating your environment. The environment's aesthetic aspect should be recognised at all times. With the help of Environmental Education, which seeks to clarify and harmonise the ethical, aesthetic concerns and values of individual and communities towards their environment, sustainability will be achieved.

3.5.4   Confined Education in the Environment as a Barrier to Addressing Environmental Problems

A confined education is such that its teaching limits children to the classroom only; it does not reflect the child's reality outside the classroom. This kind of education does not set children free, or give them a better life, a better job, a better world. It does not prepare them for the outside world where creative individuals who are able to come up with problem-solving skills are needed. Burt (1998:8) quotes Orr in saying "Education may be part of the problem rather than a solution. Such education does not advocate the aim of Environmental Education, which strives for education as a practice of freedom". Therefore it is true that Environmental Education aim at helping people to become conscious of their potential as creative human beings to make them see that they can control their environment and themselves in a better way. It needs individuals to take

back their power of choice and to realise that they can re-construct their reality and change their oppressed situation.

According to Burt (1998:81) DOE mentions that Environmental Education promotes outcomes identified by educational reforms such as Curriculum 2005 (e.g. learners need to be able to identify, research and analyse problems). This can be attained with the relevant environmental educators who are well aware of the goals of Environmental Education and who are willing to give children education that is free, not restricted to the classroom only. We should move away from the confinement of education, which does not prepare learners for the future.

Since learners are regarded as coming to school with their own valued ideas, teachers are to act as facilitators of learning which relates strongly to local context, drawing on curricula they design themselves (Tiley in Burt, 1998:81) Environmental teachers are the key to successful implementation of Environmental Education. Environmental educators have the responsibility to assist learners in knowing how to solve environmental problems by introducing them to an education that solves the problem.

3.5.5   Insensitive Actions towards the Environment

Chawal (in Siemer & Knuth 2001:24) defines environmental sensitivity as a predisposition to take an interest in learning about the environment, feeling concern for it and acting to conserve it on the basis of formative experiences. Palmer (1998:124) quotes Hungerford and Volk's definition of environmental sensitivity as an empathetic perspective towards the environment. Insensitive actions in the environment destroy the functioning of the ecosystems

Through environmental education people may gain the knowledge, skills and values needed to make decisions and to take actions that will sustain rather than deplete the planet. They will be empowered with essential skills, which they will apply when they are confronted by various environmental problems. In order to attain this it becomes

imperative that people, especially children, be offered the opportunity to explore three simple important dimensions of learning as explained by Murdock (1993:48):

- **Learning in the environment**

    Experiences in the environment can be the most powerful way to learn about and appreciate the way the natural world works. Outdoor experiences may be planned purely for fun to raise awareness or to develop specific understanding. Through positive experiences in the environment, children can be helped to overcome fears of the environment and establish that important sense of being connected with nature.

- **Learning about the environment**

    Many environmental problems are the direct result of sheer ignorance. In order to appreciate the need to conserve the environment, children first need to understand something of the fascinating ways in which it works. By understanding nature's cycles, interdependency, adaptation and diversity we can better understand the impact that our actions have upon it. Environmental Education teaches children about ecology.

- **Learning for the environment**

    Environmental Education encourages children to reflect on their learning and develop the skills to act on what they have learned. It affirms the relationship we all have with the earth and is grounded in real-life, active experiences. Environmental Education is empowering. It teaches children to use problem-solving and decision-making skills to help bring about change.

Effective Environmental Education will occur when learners' learning needs are considered and when the issues chosen for study are meaningful and relevant to them. Through its practices and procedures, it should reinforce the commonly held values of individuals and collective responsibilities. It should be able to develop the following in its teaching as listed by Marcinkownski (2003:191):

- Awareness of and sensitivity to the environment and related
- Knowledge and understanding of the environment and the impact of people on it.
- Attitudes and values that reflect feelings of concern for the environment.
- Skills involved in identifying, investigating and problem solving associated with environmental issues.
- A sense of responsibility through participation and action, as individuals or members of groups in addressing environmental issues.

Producing environmental literate citizens who demonstrate responsible environmental behaviour is the ultimate goal of Environment Education. Responsible environmental behaviour will automatically lead to sensitivity towards the environment.

3.6   CONCLUSION

Public awareness should be spread by familiarising people with EE so as to attain sustainability in the environment It is important that people's attitude and behaviour are moulded and motivated towards caring and respecting their environment. The relevant departments in the national government should introduce people to environmental laws, to help them to take up their responsibility. It is the intention of chapter four to discuss those environmental policies simultaneously with EE to determine their compatibility. Chapter four also looks at how environmental policies together with EE can fight air pollution. The fight against air pollution is the war that can be won when the community, schools and national and international governments come together with one intention of sustaining the environment.

CHAPTER 4

POLICIES ON ENVIRONMENTAL MANAGEMENT AND THE ROLE OF ENVIRONMENTAL MANAGEMENT IN DEALING WITH AIR POLLUTION

4.1   INTRODUCTION

Although air pollution is one of the major environmental problems, the government believes that pollution prevention is one of the most effective means of protecting South Africa's people and the environment. As a result of the inequitable development attaining sustainability is virtually impossible. It is therefore the government's obligation to meet international commitments and to be a globally responsible country. When we say, "Mayibuye Africa, come back Africa", we are not only calling for the return of a legal title, but also for restoration of the land, the forests and the atmosphere: the greening of our country is basic to its healing... There is a lot of healing to be done in South Africa (Sachs, in Cock & Koch, 1991:17).

The implementation of environmental law is part of the healing South Africa needs. The main thrust of environmental law is to manage the relationship between humankind and the earth. Although this will require interaction between members of the community, the main interaction will be between the citizens of the state and the state itself. Robinson (in Barnard, 1999:17) argues that "environmental law is at once part of and an active force in bringing about a metamorphosis through human society. Due to the fact that real world is rapidly changing and environmental law is quietly reshaping institutions daily, environmental law has emerged as the discipline that most clearly defines normatively and establishes a fundamental part of the coming elements of a new sustainable world community..."

Environmental law consist of provisions which either directly impose obligations or prohibitions upon individuals or which more frequently entrust the care of natural resources and control of pollution to administrative bodies, i.e. central government, departments, provincial administrations, local authorities, statutory and other public bodies, (Fuggle & Rabbie 1992:120). The successful implementation depends upon whether the exercise of such powers in fact furthers the public interest in environmental conservation.

It is the aim of the chapter to look at how environmental policies are implemented in trying to minimise air pollution, how the policies are managed to benefit both human beings and the environment. The chapter also compares the policies with EE as the one cornerstone of environmental protection due to the fact that EE must become an integral and essential part of every South African citizen's upbringing. It is necessary that EE and environmental policies come together in managing and controlling air pollution, as they will be targeting one thing, which is to minimise pollution and promote sustainability. Clear environmental policies have to be established for the sake of sustaining the environment. South , like any other country, needs to act on those policies as our guidelines of preventing and minimising air pollution. Full protection of the health and welfare of people and the environment may be the ultimate goal, but unless people understand what the sources of air pollution are and how they operate no significant progress will be made.

Knowledge of the nature, sources and effects of pollutants are essential if realistic goals and effective control strategies are to be employed. Understanding atmospheric pollutants and their undesirable effects on the environment and people's health would allow us to come up with acceptable environmental protection policies. Thus our degree of understanding atmospheric pollutants depends on our understanding of the aims and objectives of EE. For example one of the aims and objectives of EE is to familiarise people with EE, which calls for promoting skills in dealing with environmental problems.

4.2   DIFFERENT POLICIES OF ENVIRONMENTAL MANAGEMENT

In order to establish effective air pollution control strategies, it would be proper to develop clear objectives or policy goals based on a sound understanding of both causes of atmospheric pollution problems and the nature and effects of atmospheric pollutants. South Africa has a vast array of statutes and regulations affecting the environment directly or indirectly. The following are selected in the study, as they are relevant in managing air pollution and protecting the environment. They are the following:

- Constitution of the Republic of South Africa 1996 (Bill of   Rights).
- National Environmental Management Act, No 107 of 1998
- Atmospheric Pollution Prevention Act, No 45 of 1965
- White Paper on Environmental Education and Training (RSA, 1995)
- Tibilisi (UNESCO- UNEP 1977)

4.2.1   Constitution of the Republic of South Africa 1996 (Bill of Rights)

The constitution is the supreme law of the Republic; the obligations imposed by it must be fulfilled. The Bill of Rights applies to all laws and binds legislature, the executive judiciary and all organs of the state. People are protected by the Bill of Rights so that their rights are not contravened by any other means.

The purposes of the Bill of Rights as indicated in section 2(7) state that the Bill of Rights is the cornerstone of democracy in South Africa. It enshrines the rights of all people in our country and affirms the democratic values of human dignity, equality and freedom.

This is evident in the Bill of Rights, section 2(24) where it indicates that everyone has the right:
- to an environment that is not harmful to their health or well-being;
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
    - ❖ Prevent pollution and ecological degradation
    - ❖ Promote conservation
    - ❖ Secure ecologically sustainable development and the use of natural resources, promoting justifiable economic and social development.

It is the objective of the state according to the Bill of Rights to respect, promote and fulfill the rights of the individual. This is done when the constitution aims at reducing risks to human health and environment by trying to eliminate causes, rather than by treating symptoms of pollution. The Bill of Rights places human beings and the environment at the centre, whereby each must be protected for the sake of the other. It is true what Schulze (1998:3) says, "All things are connected, like the blood that

unites one family. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself".

4.2.2   National Environment Management Act 1998 No. 107

The National Environment Management Act 1998 is the forerunner of environmental protection, which co-ordinates with various organs of the state that are involved in environmental protection and management. Due to fact that it operates nationally, it ensures that the various departments co-operate, consult and support one another with the laws that govern, protect and promote the sustainability of the environment. Thus it ensures that the various departments propagate its purpose, which is to protect, restore and enhance inter alia the quality of air in the Republic.

This is evident in its principle of sustainable development where the Act stipulates in section 2(4) (a) that:

Sustainable development requires the consideration of all relevant factors including that pollution and degradation of the environment are avoided or, where they cannot be altogether avoided, they be minimised and remedied.

Sustainability can be attained through the involvement of the local people in dealing with their environmental problems. The Act accepts that it is not enough to merely introduce the right, but that right must be developed. It requires in section 2(4) (f) that:

> …(t)he participation of all interested and affected parties; in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation and participation by vulnerable and disadvantage persons must be achieved.

Again it is supported by the fact that the Act in principle must place people and their needs at the forefront of its concern and serve their physical, psychological cultural and social interests equitably.

The Act develops the right by pointing out in section 31(a) that every person is entitled to have access to information held by the State and organs of State which relates to the implementation of this Act, and any other law affecting the environment and the state of the environment and actual and future threats to the environment, including any emission to water, air, or soil and the production, handling transportation treatment, storage and disposal of hazardous waste and substances.

Therefore it should be accepted that in a democratic country like South Africa, democracy should be seen as an ideal way of ensuring the participation of all people in all forms of decision-making. Involvement of people in decision-making regarding the protection of their environment should be acceptable as successful planning by a democratic government. Barnard (1999:114) supports the idea by mentioning that the government seeks strategic success across government departments, levels of government and South Africa at large, but it firmly subscribes to the principle of local initiative. If people on the ground do not innovate and if they do not take ownership of development in their cities and towns, any strategy will fail.

4.2.3   Atmospheric Pollution Prevention Act 1965 No. 45

This Act provides for the prevention of the pollution of the atmosphere under the administration of the Department of National Health and Population. The National Air Pollution Advisory Committee, an Appeal Board and appointed air pollution control officers form the committee which advises the Minister of National Health and Population Development on matters pertaining to the control, abatement and prevention of air pollution as well as measures taken outside the Republic for the control of and any other matter relating to air pollution

The Minister and Committee work hand in glove with the local authorities, due to the fact that the environment operates as a vast complex of interlocking systems and sub-systems; it is therefore necessary that environmental problems be encountered collectively rather than individually. The Act in part 2, section 4 supports the idea of locals being involved in the prevention of air pollution, as it states that it is the duty of each local authority to ensure that its community lives in a safe and healthy environment.

The involvement of locals as indicated by the National Environment Management Act 1998 and the Atmospheric Pollution Act 1965 is essential in dealing with management. Barnard (1999:115) emphasises that saying power to make decisions, to plan and to govern is increasingly devoted to those people directly affected by the decisions of local authorities. It therefore implies that the delegated official may not make decisions on environmental issues based on the strength of his knowledge, own sight, own training or own experience. The committee must inform the public about air pollution and obtain their co-operation in combating it.

In the case of people who pollute the atmosphere, the Atmospheric Pollution Prevention Act, 1965, Part 3, section 15, subsection 6, supported by the Conservation Act No 73, of 1989 in 29(2)(b) and National Environmental Management: Air Quality Bill, 2003 in Chapter 7(45)(i) supports the polluters pay principle. The Atmospheric Pollution Prevention Act for example states that any person who contravenes the provisions of subsection (1) or (2) shall be guilty of an offence. The National Environmental Management Air Quality Bill states that a person convicted of an offence is liable to a fine or to imprisonment for a period not exceeding ten years or both such fine and imprisonment.

The principle should be critically analysed as it may create problems of giving offenders latitude to pollute and pay for their deeds. Instead of solving the problem, the principle could worsen matters if money is put ahead of people's health. People's health should be considered, no amount of money can exceed ones health. If the government deems it fit that the costs of controlling air pollution can amount to money, offenders may well be tempted to pollute as they will be getting more profit than the fine that must be paid. Polluters are habitual offenders who do not mind to pollute the environment and get away by paying the penalty. For example, Felix (in Cock & Koch, 1991:41) illustrates a case of an Asbestos Mine that was operating in the Mafefe area without any mining rights. When the Government Mining Engineer was called and declared the area a dust control area, the owners were found guilty.

According to Felix (in Cock & Koch, 1991: 41) the mine owners paid only 5% of the cost reclaiming the dumps and clean-up areas surrounding their operational mines; the state and the local authorities paid the rest. Therefore the principle of polluters paying

should discourage polluters to repeat the act by imposing a heavy penalty on a daily basis.

4.3   THE POSITION OF EE WITH REGARDS TO OTHER POLICIES

According to Van Rensburg (in Schulze, 1998:66) Environmental Education is a better education for all, as it is an agent for environmental problem solving. It is not a policy that enforces people to obey the regulations, but it is a long-life process aiming at developing a new way of living in harmony with one's environment.

Environmental Education is recognised as a very important aspect in the formal education of every country. This is also applicable in South Africa as a way of improving and promoting positive attitudes towards the environment even though in black schools is not yet the case. Hines in (Leeming, 1993:8) maintains this by indicating that Environmental Education encourages people to engage in more pro-environmental behaviours. By so doing it enhances our understanding to ensure a good quality of life and motivates everybody to become environmental protectors. Thus Environmental Education is one of the top current priorities of any country to reach new understanding in dealing with the environment.

This is supported by Tibilisi, UNESCO-UNEP 1977:49) by emphasising the fact that Environmental Education create awareness, transmits, information, teaches knowledge, develops habits and skills, promotes values, provide criteria and standards and present guidelines for problem-solving and decision-making. Thus Environmental Education is and will always advocate environmental sustainability.

Environmental Education discourages all actions that are negative towards the environment, but promote pro-environmental literate behaviours. It strives to instill in people the critical thinking skills, creative thinking skills and problem-solving skills so that people are able to deal with diverse environmental problems.

4.3.1   Polluter's Pay Principle, EE and the Kyoto Protocol

It must be remembered that fines and imprisonment as punitive measure, are from an air pollution control and EE point of view unsatisfactory since the damage to the environment is not thereby repaired further pollution will be prevented only if the

polluters are deterred from repeating their conduct. It should be noted that once the air has been polluted, it is impossible to clean it completely The danger of allowing economic factors to colour technical judgments is that an industry's arguments against incurring cleaning costs appear much more reasonable not to say forceful than the demand of those who have to breathe the air it pollutes, (Cock & Koch, 1991:247). Holte-Biddle (2002:32) supports the idea by indicating that when a miner dies in South Africa his lungs are examined to see if his alveoli walls are thicker than normal- a sign of pneumoconiosis or "miner's phthisis" caused by dust inhalation. His dependants are paid compensation relative to the thickness of the walls.

South African factories are allowed to operate under the pretext "scheduled factories" which are then lawfully protected to pollute. Holt-Biddle (2002:107) states that the "Atmospheric Pollution Prevention Act of 1965 nowhere obliges industry to be answerable to the public. The factories are better protected than people's well being as they can easily bribe by paying for their irresponsible acts. The Act represents more of a contract between industry and government than a piece of legislation designed to protect the public (Holte-Biddle 2002:108). The government also allows no tax incentives for industries to clean up. According to the Kyoto Protocol, the principle of introducing or removing taxes or subsidies can incorporate climate change concerns into prices; for example, a tax on the carbon content of oil, coal and gas would discourage fossil-fuel use and so reduce carbon emissions. The Kyoto Protocol was adopted in December 1997 and it required the developed countries to accept a legally binding commitment to reduce their collective emissions of six greenhouse gases by at least 5% compared to 1990 levels by the period 2008-2012.

The government, instead of expecting polluters to pay the cost for cleaning up their acts, must anticipate problems and prevent negative impacts on the environment and on people's environmental rights. It should be remembered that the fight against air pollution does not belong to the national government and the international organisations alone; it must be recognised that each individual must also become personally involved if the fight is to be won. Thus effective pollution prevention focuses not only on the installation of pollution abatement equipment in industry, but also on the shared responsibility of all sectors of society to protect South Africa's natural resources. UNESCO 1980 as stated by Palmer (1998:198) supports that by

outlining that the objective of Environmental Education should provide social groups and individuals with an opportunity to be actively involved at all levels working toward the resolution of environmental problems.

4.3.2   Sustainable Development

Environmental Education together with Tibilisi, UNESCO- UNEP1977, Agenda 21, the National Environmental Management Act and the Bill of Rights all advocate for sustainable development. Environmentally sustainable development and ultimately sustainable living is the key to human well-being and an improved quality of life for all our people now and in the future. South Africa as one of the global partners in sustainable development, reaffirmed at UNGASS through a statement by Deputy President Thabo Mbeki, that Agenda 21 remains the fundamental program of actions for achieving sustainable development and that the achievement of sustainable development requires the integration of the economic, social and environmental components. Gough (2002: 63) supports the statement with his models of sustainable development.
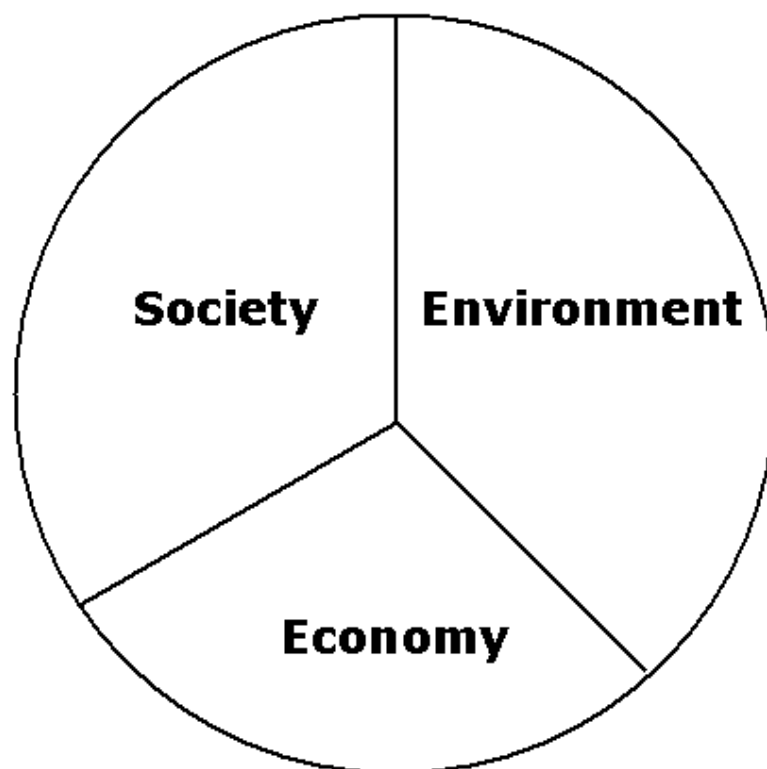
FIGURE 4.1: DIMENSIONS OF SUSTAINABLE DEVELOPMENT BY GOUGH

Gough explains that the usefulness of the three-part division of sustainable development lies in the fact that the segments correspond quite closely to other organisational divisions in society. The divisions also have to work together, inviting expertise from various sectors. Individuals from all sectors, for example the environmentalists, the local government body providing environmental services, the NGO's and economists with their specialties should be involved in attaining sustainability. The experts would then serve as the committee responsible for addressing sustainable development issues. Their collective efforts will achieve the required sustainable development as they work hand in hand.

Tibilisi, 1977 in principle supports the idea of the three divisions working hand in hand by emphasising that EE should be made an integral part of the entire educational process and aimed at every category of the population:

- The general public and non-specialists.
- The socio-occupational categories whose activities have a significant impact

on the environment.

- Scientists and technicians whose fields, whether in the natural or the social science concern the environment and who need to receive specialised training.

Agenda 21, section 1. 3. 7. emphasises that sustainable development must be achieved at every level of society. People's organisations, women's groups and non-governmental organisations are important sources of innovation and action at the local level and have a strong interest and proven ability to promote sustainable livelihoods. Governments in co-operation with appropriate international and non-governmental organisations should support a community-driven approach to sustainability. Holding World Summits on Sustainable Development like the Johannesburg 2002 and 2005 shows that there is progress towards accomplishing what started at the Rio de Janeiro Earth Summit in 1992. The Johannesburg World Summit 2002, which was a follow-up of the first Earth Summit held in Rio de Janeiro in 1992, is living proof that South Africa supports sustainable development. It focused on sustainable social and economic development within the context of environmental stewardship. There is the question of uneven development contributing towards environmental decay, with the intention of bridging the gap between the rich and the poor. The ecological instability of today's world is matched by the instability in human affairs that must be urgently addressed by all members of the community from their respective positions.

Furthermore, because EE is a form of educational practice attuned to the life of society, sustainability can be effective if all members of society, workers, students, specialists and decision-makers take part according to their abilities in the complex and manifold task of improving people's relationship with their environment.

4.3.3   Education in the Environment

Environmental Education will enable people to gain awareness of their environment and acquire the knowledge, values, skills, experiences and also the determination, which will enable them to act individually and collectively to solve present and future environmental problems. Tibilisi states that EE is more than just a particular aspect of the education process; rather it is a long-life process, an excellent basis on which to develop a new way of living with the environment, thus a new lifestyle. It further indicates in its principle that EE is viewed as a dimension of the subject matter and

practice of education directed towards the solution of practical environmental problems through an interdisciplinary approach and the active and responsible involvement of each individual of the community.

Agenda 21 supports this in chapter 36 when it highlights the importance of the following:

- *Basic Education*

   The path to sustainable development begins with greater access to basic education for many nations if not all. EE programs, which can provide greater access to basic education for all citizens, should be put in place.

- *Reorienting Education*

   An appropriately reoriented basic education embraces more principles, skills, perspectives and values related to sustainability than are currently included in most education systems. Reorienting education will also involve developing strategies to teach awareness, skills, perspectives and values that will guide and motivate people to pursue sustainable livelihoods, participate in a democratic society and live in a sustainable manner. This can be achieved by infusing EE into the formal curriculum.

- *Public Awareness and Understanding*

   The need for public understanding and awareness was also stressed. An informed voting citizenry can influence nations to develop sustainability plans, enact sustainable measures and contribute to attaining sustainability goals.

- *Training*

   To promote sustainability goals, specialised programme must be developed in all sectors thus business, industry, universities, government and non-governmental organisations and community organisations are to encourage the training of people for environmental management positions in addition to training employees at all levels in sustainability issues related to their jobs.

Thus formal education systems are encouraged to work closely with their local communities.

EE is emphasising that in dealing with air pollution we need to eradicate the causes rather than wait till it is too late when much money will be needed to cleanse the air. Its purpose is to instill in people the know-how of treating air pollution at its roots by inculcating in people the knowledge, skills and values that promote pro-environmental behaviour. EE supports the idea of the National Environmental Management Act, of people having access to information with regard to their environmental status, so as to come up with relevant solutions to their problems.

4.4   SHORTCOMINGS OF THE POLICIES

The mere existence of a body of environmental law, though essential in establishing a basis for action, does not in itself provide a solution to environmental problems, due to the fact that unlike EE, the policies do not define values and motivations conducive to behaviour patterns and measures that are instrumental in preserving and improving the environment. Environmental legislation may give the community a false impression that all is well; it addresses the problem in their favour whereas nothing is done. Failure to implement and monitor the legislation creates environmental crises.

The case of the asbestos mine in the Mafefe area as indicated in Cock and Koch (1991:47) will serve as our example to illustrate how legislation can be used to people's disadvantage. The mine was operating without any mining rights and it caused diseases to many people in the area. Cock and Koch (1991:47) maintain that the Atmospheric Pollution Prevention Act of 1965 is a key piece of legislation that should be applied to protect the environment of Mafefe. The Act stipulates that either the owner of the mine or the State is responsible in a dust control area to take the prescribed steps or adopt the best practicable means of preventing hazard. The Act was unsatisfactorily applied and the community that suffered from diseases paid the price. Felix (in Cock & Koch, 1991:43) says the consequences have been painful and tragic for thousands of families who have witnessed the different disease take hold of their loved ones.

Another example by Holte–Biddle (2002:25) is of Durban's industries, which are concentrated in the south and comprise 15 specialised chemical companies, two petro-chemical companies and paper industries. Only after the press and television had aired the story did the health authorities make funds available for an investigation and the oil refineries improved their anti-pollution measures. Yet people had been complaining about air pollution for years.

The Environment Conservation Act of 1989, section 21, states that the Minister may identify those activities which in his opinion may have a substantial detrimental effect on the environment. In section 22, the Act states that no person shall undertake an activity define in section 21, without written authorisation from the Minister or delegated official. But the mine owners got away with their evil acts and were protected by the Polluters Pay Principle. The act states that the penalty for carrying such activity without permission is a maximum fine of R100-000 and/or ten years in prison. Felix (in Cock & Koch, 1991:33) says since Lucas worked on asbestos mine as a young man; he is eligible for workers' compensation and has received a lump sum of R3 079, 00 an amount equal to four months' earnings. This indicates that in the eyes of the polluters people's health is nothing compared to what they get for profit.

The other problem is the inefficient operation of the departments with regards to environmental management. For example, before 1975 the mine operated without a license and without the knowledge of the Government Mining Engineer. Before the publicity about Mafefe broke in 1984, no attempt was made to control environment pollution there Felix (in Cock & Koch, 1991:41). This indicates a serious incompetence on the side of the department.

In attempting to overcome these shortcomings, it would be better if the various departments handling environmental issues placed Environmental Education as the top solution or objective as it aim at preventing the problem before it starts by inculcating people with skills, knowledge and values that will lead to pro-environmental behaviours. If all South African citizens are environmentally aware, we will automatically be environmental protectors who are guided by environmental

laws. Environmental laws should just come as a guide to what we have already been acquired in environmental education.

4.5   CONCLUSION

It is essential that environmental laws serve and protect the interest of the people. The implementation of these laws should incorporate Environmental Education as its cornerstone. Environmental Education strives for sustainability which has become prominent in most national and international discussions, policies and inter-governmental convections concerned with the environment.

In striving for this sustainability it is also essential that international governments be involved, as environmental problems are global. Their assistance together with the involvement of local people as local managers of their environment will enhance the effort of solving environmental problems. A collective effort is the only hope of minimising air pollution, as everybody will be concerned with the state of the environment, especially the learners who are to benefit from a sustainable healthy pollution free environment. It is the intention of chapter five to conduct an intensive questionnaire as a way of assessing learners' understanding and points of view with regard to this problem.

CHAPTER 5

APPLICATION OF DATA COLLECTION METHODS, CONTENT VALIDATION AND APPLICATION OF THE QUESTIONNAIRE

5.1   INTRODUCTION

The main research problem was stated in the previous chapters where an extensive literature review was conducted as a means of supporting the topic of learners' understanding of air pollution and the role of EE in contextualising the problem. The purpose of this chapter is to outline the data collection procedure. The research methods used to gather information are then explained, justified and motivated by looking at relevant literature.

The research was designed in such a manner that learners were drawn from Ga-Rankuwa and Brits areas, with the purpose of obtaining two different groups. The learners from Ga-Rankuwa area in Odi High School are township learners, whereas those from Botlhabelo High School in Brits live in informal settlements. The purpose of selecting two different groups of learners was to determine their opinions with regard to air pollution in their respective areas.

The fact that air pollution is an environmental problem affecting our daily lives prompted the researcher to be curious in finding out how the two groups of learners respond to the question of air pollution. Korhonen (2004:196) states that most young people in Africa do not have access to modern technology and their environmental opinions should be researched to gain better understanding of the environmental concepts those children and adolescents hold in some of the world's most ecologically diverse regions.

Environmental problems are basic problems worldwide. Kyburz-Graber et al. (1997:19) state that schools must be willing to face them, not because they should shoulder the social burden of finding political solutions, but because these problems actually affect the

everyday lives of the learners in some way. It is the purpose of this chapter to provide a description of the procedure followed when collecting data, the methods used in that regard and the validation of the content.

5.2   RESEARCH METHODS USED IN THE STUDY

The research commenced with a literature review as it allows a researcher to gain further insight into the study and build a body of acceptable knowledge used in the construction of the questionnaires. If carefully conducted and well presented, literature reviews add much to the understanding of the selected problem and help place the results of a study in a historical perspective. According to McMillan and Schumacher (2001:108) a literature review is usually a critique of the status of knowledge of a carefully defined topic.

Leedy and Ormrod (2001:70) highlight the numerous benefits of a literature review as follows:

1. It increases your topic's relevance if you find out that others have an interest in this topic and have invested effort and resources in studying it.
2. It can provide you with new ideas and approaches that may   not have occurred to you.
3. It can inform you about other researchers conducting work in this area, individuals whom you may wish to contact for advice or feedback.
4. It can show you how others have handled methodological and design issues in studies similar to your own.
5. It can reveal sources of data that you may not have known existed.
6. It can introduce you to measurement tools that other researchers have developed and used effectively.
7. It can reveal methods of dealing with problem situations that may be similar to difficulties you are facing.
8. It can help you interpret and make sense of your findings and, ultimately help you tie results to the work of those who have preceded you.

5.3   THE USE OF QUESTIONNAIRES IN THE QUANTITATIVE COLLECTION OF INFORMATION

The literature review is followed by a quantitative application of questionnaires whereby the opinions of learners were assessed in terms of the objectives envisaged in the investigation. Jacobs et al. (1991:253) define a questionnaire as a structured list containing relevant questions, statements or items on a specific subject that is submitted to a group of people or target group for their response or evaluation in order to obtain the required data.

In conducting a questionnaire it is imperative that a thorough investigation be conducted when one is involved in constructing a questionnaire, and again there should be a distinction between the purpose of the questionnaire and the purpose of the investigation. It is accepted that the purpose of the questionnaire is to acquire certain information either from individuals or a group.

5.3.1 The Advantages of Using Questionnaires in a
Quantitative Investigation

Questionnaires were used in this study due to their advantages as stipulated by Jerling (1997:10-11):

- They are probably the most convenient method of collecting data.
- They are accessible to the target population.
- They provide a substantial amount of information that can be quantified, summarised and reported.

5.4   CONTENT VALIDATION OF THE QUESTIONNAIRE

No matter what research methodology one chooses, one must consider the validity of one's approach. Graziano and Raulin (2000:63) explain validity as how well a study, a procedure or a measure does what it is supposed to do. They continue to say a valid

measure measures what it is supposed to measure, a valid research design tests what it is supposed to test.

McMillan and Schumacher (2001:181) refer to validity as a situation-specific concept: validity is independent of the purpose, population and situational factors in which measurement takes place. The results of a test, questionnaire or other measure can therefore be valid in one situation and invalid in another. Therefore to assure validity, the researcher needs to identify assumptions or make arguments to justify an inference or use a specific purpose and collect evidence to support assumptions.

The researcher strived for an instrument that would allow her to draw conclusions with regard to the understanding and knowledge of learners of air pollution. A variety of questionnaires were used to attain that purpose and they were grouped into various categories relying on the nature of information they were trying to draw from the respondents. (The questionnaires are available in the Appendix). The following applies:

Questions 1-7 are biographical questions intended to draw general information from the respondent, like gender, age, residential area, grade subjects allocation and the type of school attended.

These questions were asked by the researcher so as to gain the respondents' background. The biographical questions are necessary as they enable the researcher to have a clear direction in terms of conducting the research by knowing the number of male and female respondents, their age, their area of residence and their grades.

Questions 8 – 11 focus on learners' knowledge of air pollution. The researcher assessed learners' level of knowledge with the intention of determining their understanding of air pollution. The following items were included in the questionnaire:

8.   Do you know what air pollution is?

9.   Please choose the correct definition of air pollution.

10.   Do you know the causes of air pollution?

11.   Can you identify the causes of air pollution?

Questions 12-23 aimed at determining learners' concern about the environment and the impact of air pollution. This was done with the intention of measuring learner's love, devotion and appreciation of their environment. Chapter 3.3.5.1 and 3.5.5 highlight the lack of environmental concern and action and insensitive actions towards the environment as the cause of the problem. Realising that smoking is detrimental to the health of smokers and that smoking is a major issue being dealt with as serious health risk by government, the researcher decided to include question related to smoking in the questionnaire. The responses to these questions were used to crosscheck learners' understanding of the problem as well as the impact education has had on such habit. Here are the questions asked:

12.   How serious is air pollution in your area?

13.   Are you worried about the quality of air pollution in your area?

14.   Why are you worried/ not worried about air quality in your area?

15.   Do you think air pollution is harmful to the environment?

16.   If yes, what harm can be caused by air pollution to the
        environment?

17.   What harm is caused by air pollution on people?

18.   Does smoking contribute to air pollution?

19.   Why do you say smoking contributes/ does not contribute to air pollution?

20.   Is smoking endangering your health?

21.   If you do not smoke, do you allow people to smoke in your presence?

22.   Why do you allow/ don't you allow people to smoke in your presence?

23.   Are you afraid of any harm caused by air pollution?

Questions 24-33 assess learner's responsibility towards the environment. These questions try to determine who learners think is responsible for caring and protecting for the environment. Chapter 3 3.3.1 discusses the role of learners in the environment, what is expected of learners with regard to the environment through the assistance of EE.

24. Who is responsible for polluting the air?

25. Do you think those responsible are not concerned about the effects on people and the environment?

26. What forces people to pollute the environment?

27. Do you think their actions are friendly towards the environment?

28. Do they teach you about air pollution in your class?

29. In which subject?

30. Does the subject assist you in minimising the impact of air pollution?

31. What are you doing with respect to your answer in question 30 above?

32. What do you think should be done to encourage people to become friendly/positive towards the environment?

33. What should be done if people do not stop polluting?

Questions 34-36 assess learner's knowledge of environmental laws to determine how much they know about policies concerning their environment. Knowledge of policies channels a positive attitude and behaviour towards the environment. Chapter 3 in indicates no sense of ownership as a factor contributing to learners' level of knowledge about environmental matters. The following items were included in the questionnaire:

34. Do you know of any law that protects the environment?

35. Why do you think that the law protects/ does not protect the environment?

36. Who is responsible for protecting the environment?

Questions 37-42 are based on learner's knowledge of EE. These were specifically asked to assess learner's knowledge and understanding of EE as a way of determining if EE forms part of their curriculum or not. Chapter 3 3.5.4 stipulates a confined education as a root problem as it does not teach learners to address environmental problems but restricts them to education in class instead of allowing them to learn in and from the environment.

37.   Do you know anything about Environmental Education?

38.   Is Environmental Education part of your curriculum?

39.   If yes, is Environmental Education helpful in encouraging you to love/ care for your environment?

40.   Is Environmental Education necessary at your school?

41.   What do you think can be done to encourage the teaching of Environmental Education in your school?

42.   Can Environmental Education solve environmental problems?

5.5   POPULATION AND THE RESEARCH SAMPLE

A population is a group of elements or cases, whether individuals, objects or events, that conform to a specific criteria and to which we intend to generalize the results of the research (McMillan & Schumacher, 2001:169). Melville and Goddard (1996:29) refer to a population as any group that is the subject of the research interest.

In this study the accessible population used was drawn from two different schools. Respondents are from Ga-Rankuwa in Odi High School and from Botlhabelo High School in the Brits area. Both sets of learners were selected from Grade 10 and Grade 11. The purpose of selecting learners from two different schools is to elicit information from learners of different backgrounds, as Odi learners are township dwellers whereas learners from Botlhabelo are from an informal settlement (see also paragraph 6.2). This was done in an attempt to determine how both sets of learners from different areas are affected by the problem of air pollution in their various residential areas, and what they can do to solve the problem.

5.5.1   Compilation of the Research Sample

Samples are the subjects of a population and must be representative of the concern; otherwise no general observations about the population can be made from studying the sample. Leedy and Ormrod (2001:211) support the statement by mentioning that the sample should be so carefully chosen that the researcher is able to see all the characteristics of the total population in the sample.

In both the two schools stratified random sampling was used as it has the advantage of giving the researcher a manageable group. In this kind of sampling the population is divided into subgroups or strata on the basis of a variable chosen by the researcher, such as gender, age or level of education. This was also done in the study as both sets of learners were grouped into Grade 10 and Grade 11, gender, age and residential area (see also paragraph 6.2). Once the population was stratified, samples were drawn randomly from each subgroup. The advantage of stratified random sampling is a guarantee of equal representation of each of the identified strata. The sampling at Odi High School was done first on 12 and 13 October 2004 where the learners were given questionnaires to complete with the researcher being present. Then, after completion, the questionnaires were handed back to the researcher. The same procedure applied to Botlhabelo High School whereby the learners completed questionnaires in the presence of the researcher. Learners from Botlhabelo were given questionnaires on 14 October 2004 and these were returned on the same day. 399 learners responded, 199 learners were from Botlhabelo and 200 learners were from Odi High School.

5.6   DATA COLLECTION PROCEDURE AND APPLICATION OF QUESTIONNAIRES

After completing the construction questionnaires, the researcher conducted a pilot study in order to verify the questionnaires and to detect errors with the assistance of the supervisor, Professor WJ Fraser, and the research assistant. Questionnaires were distributed as follows:

- The researcher distributed a few questionnaires to the teachers and some selected learners to test whether the targeted group of learners would be able to respond to such questions. After completion the questionnaires were presented to the researcher.

- The researcher then asked permission from the two schools, Odi High and Botlhabelo High school to conduct a survey.

- The two schools allowed the researcher to select learners in Grade 10 and Grade 11. The researcher started with learners from Odi High School by handing over the questionnaires to 200 learners. The researcher explained the purpose of the questionnaires to the learners so as to set their minds at ease and to eliminate any misconceptions.

- The researcher then attended Botlhabelo High school at Brits on 14 October 2004 to distribute questionnaires and collect them after completion. The researcher spent the whole day at the school as learners were supposed to complete the questionnaires in the presence of the researcher. The researcher explained to the learners what the research is about and assured them of its anonymity.

- The researcher was able to collect the questionnaires given to the learners from both schools on time, as learners completed the questionnaires in the presence of the researcher to avoid delays. The researcher managed to collect all questionnaires except for one only that was missing at Botlhabelo High School.

5.7   CONCLUSION

The research was well conducted measured in terms of the number of questionnaires returned by the respondents. The researcher was then guided by the chosen methodology and decided to perform a quantitative analysis on the data. Leedy and Omrod (2003:6) state that the research methodology directs the whole endeavour: It controls the study, dictates how the data are acquired, arranges them in logical relationships, sets up an approach for refining and synthesising them and suggests a manner in which that which lies below the surface of the data becomes manifest, and finally yields a conclusion that leads to an expansion of knowledge. In chapter six the results are analysed and interpreted.

CHAPTER 6

ANALYSIS AND INTERPRETATION OF DATA

6.1   INTRODUCTION

Chapter five focused on the research methodology applied in the investigation. The chapter explains the validation of the questionnaires, the sampling procedures and the application of the questionnaires. Chapter six is based an analysing and interpreting the data collected in the previous chapter, with the intention of giving detailed feedback relating to the issues dealt with by the questionnaires.

6.2   STATISTICAL TECHNIQUES APPLIED TO THE DATA

After the completion of questionnaires the statistical technical support service of the University of Pretoria assisted with analysing the data and giving recommendations based on specific data analysis techniques. The chi-square test was used to analyse data as a way of calculating the significance of the differences between the groups that fell into different categories, for example gender, residential areas, and grades. The analysis was done on 399 completed questionnaires, thus 400 questionnaires were handed out but only one was not returned. The chi-square test used two sets of frequencies that are the observed frequencies, and the expected frequencies. Observed frequencies are the actual frequencies obtained by observation whereas expected frequencies are theoretical frequencies that are used for comparison.

The chi-square test was based on the level of significance, which was performed at a level of 0.05. Ary (1990:187) explains the "Level of significance as a predetermined level at which a null hypothesis would be rejected". This means in a case of 0.05 level of significance there is a 95% chance that the results are due to the influence of independent variables. The chi-square test is an example of a non-parametric test. The data can be used when the data are qualitative or discrete and they do not assume anything about the underlying distribution of the population.

For the purpose of the data analysis it was determined to record the biographical information under different groupings. Respondents were clustered under "gender" as

well as "location", referring specifically to respondents residing in informal settlements and those coming from townships.

6.3   REPORT ON THE FINDINGS OF THE EMPIRICAL INVESTIGATION

The results of the empirical investigation are clearly outlined in the following tables. The information in the tables is followed by a brief descriptive interpretation of the results analysed. "R" represents raw scores in the Tables.

6.3.1   Biographical Data of the Respondents

6.3.1.1   Gender, subject allocation and residential areas of the respondents

The researcher asked the respondents to specify their gender, subject allocation, the type of school they attend and their residential area. These biographical questions were used to give the researcher general information about the respondents and to set them at ease to be able to answer questions directed to them in the questionnaires.

Table 6.1   Gender representation of the respondents

GENDER	FREQUENCY	PERCENTAGE
Male	200	50.38%
Female	197	49.62%
Total	397	100%

Frequency missing = 2

Male respondents were 50.38% whereas female respondents were 49.62%.

Table 6.2   Learning areas of the respondents at Odi High School

Gender	N/S R	N/S %	H/S R	H/S %	M/C R	M/C %
Male	38	19.10%	37	18.59%	42	21.11%
Female	24	12.06%	13	6.53%	45	22.61%
Total	62	31.16%	50	25.12%	87	43.72%

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Table 6.2 illustrates the learning areas of the male and female learners of Odi High School. The male respondents were divided into different learning areas, like a relatively large number (21.11%) in the commercial stream, 19.10% in the natural sciences, while 18.59% are in human sciences. Of the female respondents 22.61% were doing commercial subjects, 12.06% natural sciences and 6.53% were in human sciences.

Table 6.3 Learning areas of the respondents at Botlhabelo High School

Gender	N/S R	N/S %	H/S R	H/S %	M/C R	M/C %
Male	35	17.86%	25	12.76	23	11.73
Female	45	22.96	29	14.80	39	19.90
Total	80	40.82	54	27.55	62	31.63

Male respondents at Botlhabelo High School were 42.35%. 17.86% were in natural sciences, 12.76% human sciences and 11. 73% were doing commercial subjects. A relatively large percentage (22.96%) of female learners were in natural sciences and 19.90% were in commercial stream while 14.80% were in human sciences.

Table 6.4:   Residential areas of the respondents

Residential Area	Frequency	Percentage
Township	211	52.88%
Informal settlement	188	47.12%
Total	399	100

A relatively large percentage (52.88%) of the respondents stay in townships and only 47.12% of learners live in informal settlements. Learners who are from informal settlements are those who are attending Botlhabelo High School.

6.3.1.2   Learners' knowledge of air pollution and their concern regarding the seriousness of air pollution in their areas

Table 6.5   The response of male and female learners regarding their knowledge of air pollution

Gender	Frequency		Percentage	
	Yes	No	Yes	No
Male	191	9	48.11%	2.27
Female	193	4	48.61%	1.01
Total	384	13	96.73	3.27

Chi-square Probability 0.1669

Frequency missing = 2

Table 6.5 illustrates the response of male and female learners regarding their knowledge of the concept of air pollution. The researcher asked the question as a way of detecting the understanding and knowledge of the concept between male and female respondents. Kollmuss and Agyman (2002:243) state that knowledge is essential as it enables learners to acquire basic understanding of the functioning of the natural environment and how our negative actions can affect these functions, and how we can work towards achieving harmony between human activities and the natural environment. 191 males (48.11%) indicated that they know what air pollution is while only 9 males (2.27%) said they do not know. Female respondents (193) which is 48.61% indicated that they also know what air pollution is, whereas 1.01%, that is 4 female respondents, answered in the negative. The estimated significance of the male and female response regarding their knowledge of air pollution is 0.1669 indicating that no association between gender and knowledge of air pollution could be established.

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Table 6.6   **Learner's rating of the seriousness of air pollution in their residential areas**

Residential Area	Frequency			Percentage		
	Serious	Less serious	Don't Know	Serious	Less serious	Don't Know
Township	76	98	34	19.19%	24.74%	8.59%
Informal Settlement	88	62	38	22.22%	15.66%	9.60%
Total	164	160	72	41.41%	40.40%	18.18%

Chi-Square Probability 0.0165

Frequency missing = 3

Table 6.6 illustrates the response of learners living in the townships and those from the informal settlements in terms of the seriousness of air pollution in their areas. Learners were asked to rate the seriousness of air pollution in their area. The purpose of the question was to find out how respondents from two different locations perceive the seriousness of air pollution in their area and the table draws a comparison between the opinions of the two groups. Bonnet and William (1998:160) have found that children rate distant global problems as more serious than local ones and they tend not to make connections between local actions and global effects. In Table 6.6 respondents from informal settlements responded by 22.22% indicating that air pollution is serious in their area and 15.66% less serious, while 9.60% said they do not know. Learners from the townships indicated the seriousness of air pollution in their area by 19.19%, a relatively large percentage (24.74%) indicated less serious whereas 8.59% said they do not know. According to the table, informal settlement learners regard air pollution to be more serious in their areas than township learners. The estimated significance of the township and informal settlement response regarding the rating of the seriousness of air pollution in their area is 0.0165 which indicates a clear association between residential area and the rating of the seriousness of air pollution in the area.

Table 67   Learners' concern for the state of air quality in their areas

Residential Area	Frequency		Percentage	
	Yes	**No**	**Yes**	**No**
Township	170	38	42.93%	9.60%
Informal Settlement	168	20	42.42%	5.05%
Total	338	58	85.35	14.65

CHI-SQUARE PROBABILITY 0.0320

Frequency missing = 3

Table 6.7 illustrates the concern of township and informal settlement learners regarding air quality in their areas. 170 respondents (42.93%) are from townships are concerned about the state of air quality in their area and 9.60% said they are not concerned. From the informal settlement 42.42% indicated that they are concerned about air quality in their area whereas only 5.05% said they are not concerned. Korhonen and Lappalainen (2004:196) point out that positive environmental experiences acquired in childhood will lead to environmental concern in adulthood. The estimated significance of township respondents and informal settlement respondents regarding their concern about the state of air quality in their areas was 0.0066 at the $p < 0,05$ level of significance, indicating clearly an association between residential area and their concern for the state of air quality in their areas. Thus, according to the table, informal settlement learners are more concerned about the state of air pollution in their area than learners from townships.

6.3.1.3 Harmful effect of air pollution on the environment and learner

Table 6.8   Learners' fear of the harm caused by air pollution to the environment

Gender	Frequency		Percentage	
	Yes	No	Yes	No
Male	183	16	46.56%	4.07%
Female	180	14	45.80%	3.56%
Total	363	30	92.37%	7.63%

Chi-Square Probability 0.7585

Frequency missing = 6

Table 6.8 illustrates how respondents feel about the harmful effects of air pollution on the environment. In table 6.8 female respondents (45.80%) indicated that they are afraid of any harm caused by air pollution with a mere 3.56% stating that they are not afraid. 46.56% male respondents showed that they are afraid of the impact of air pollution on the environment and only 4.07% indicated that they are not afraid. According to the Table more female learners are afraid of the harm caused by air pollution to the environment. The estimated significance of male and female response regarding the impact of air pollution on the environment as indicated in the Table is 0.7585 showing no clear relationship between gender and the impact of air pollution on the environment. Terblanche (1998:3) states that all forms of pollution are believed to have the most extensive and profound effect on human health and the environment

6.3.1.4 Teaching and learning of about pollution and EE forming part of the curriculum and solutions to environmental problems

Table 6.9   Harmful effects of air pollution on the environment

Gender	Frequency			Percentage:		
	Yes	No	Not Sure	Yes	No	Not Sure
Male	159	17	23	40.15%	4.29%	5.81%
Female	176	6	15	44.44%	1.52%	3.79%
Total	335	23	38	84.60	5.81	9.60

Chi-Square Probability 0.0203

Frequency missing = 3

Table 6.9 highlights respondents' opinions regarding the impact of air pollution on the environment. The majority of female respondents (44.44%) indicate that they think air pollution is harmful to the environment and 3.79% they are not sure, whereas only 1.52% indicated that it is not harmful. Male respondents indicated by 40.15% that they think air pollution is harmful to the environment while5.81% have shown that they are not sure and 4.29% indicated that they do not know. Polluted air speeds up the weathering of materials and buildings. In Pretoria some of the sandstone in the Palace of Justice and the old "Raadsaal" has already been replaced at great cost because of damage caused by sulphuric acid .It is believed that the harmful effects of air pollution on the environment are often more noticeable than on man's health (Department of Environmental Affairs Journal 2002:25). The table illustrates the estimated significance of male and female response regarding the harmful effects of air pollution on the environmentf 0.0203 indicates a clear statistical association between gender and the perception of the harmful effects of air pollution on the environment. The Table reflects that more female learners think that air pollution is harmful to the environment than males.

Table 6.10   Teaching and learning about air pollution in class

Gender	Frequency		Percentages	
	Yes	No	Yes	No
Male	157	42	39.65%	10.61%
Female	162	35	40.91%	8.64%
Total	319	77	80.56	19.44%

Chi –Square Probability 0.4012

Frequency missing = 3

Table 6.10 highlights the opinions of male and female learners regarding the teaching and learning about air pollution in class. 40.91% of female respondents indicated that they are taught about air pollution in class and only 8.64% said they are not taught. 39.65% of male learners also agreed that they are taught about air pollution in class whereas only10.61% of them disagreed. UNESCO (in Stiles, 1995:49) states that the environmental education should utilise diverse learning environments and a broad array of educational approaches to teaching/ learning about and from the environment with due stress on a practical activities and first-hand experiences. The estimated significance difference indicates male and female responses regarding the teaching and learning of air pollution in class as 0.4012 indicates that there is no statistical association between gender and the teaching and learning about air pollution in class.

Table 6.11   EE forming part of the curriculum

Residential Area	Frequency		Percentage	
	Yes	No	Yes	No
Township	182	29	45.61%	7.27%
Informal Settlement	145	43	36.34%	10.78
Total	327	72	81.95%	18.05%

Chi-Square Probability 0.0179

Table 6.11 illustrates the response of learners from the townships and informal settlement acknowledging whether EE is part of their curriculum or not. The purpose of the question was to determine how much they do know about EE. A relatively high percentage (45.61%) of township respondents indicated that EE is part of their curriculum while only 7.27% said it is not part of their curriculum. A mere 36.34% of informal settlement respondents indicated that EE also forms part of their curriculum whereas only 10.78% respondents have shown that EE is not part of their curriculum. Schulze (1998:86) mentions that EE is an agent for environmental problem-solving but has not yet produced anticipated results due to the problem of its implementation in schools, especially black schools and the lack of relevant Environmental Education by members of the community. A comparison between respondents living in townships and informal settlements indicates a significant difference of 0.0179. It is an indication that there is definitely a clear relationship as far as the acknowledgement by learners representing different residential areas and EE forming part of their curriculum. The Table reflects township learners supporting the fact that EE should form part of the school curriculum.

Table 6.12   EE as a solution to environmental problems

Gender	Frequency		Percentage	
	Yes	No	Yes	No
Male	179	19	45.66%	4.85%
Female	177	17	45.15%	4.34%
Total	356	36	90.83%	9.18%

Chi-Square Probability 0.7752

Frequency missing = 7

Table 6.12 highlights learners' opinion regarding the question whether EE could solve environmental problems or not. The purpose of asking such a question was to find out how EE as part of their curriculum could assist them in solving the environmental problems they encounter. The Table illustrates 45.15% of female respondents indicated that EE could be a solution to environmental problems as compared to

45.66% male respondents. Only 4.85% of males disagree that EE can solve environmental problems against 4.34% female respondents. Allers (1997:4) states that EE is basically a process that seeks to develop the necessary awareness, ethics, values, knowledge, skills and commitment to allow people to become environmentally literate in order to be pro-active in securing a properly functioning and healthy environment that is sustainable. The estimated level of significance is 0.7752, illustrating that there is no statistical association between EE as a solution to environmental problems and gender.

6.3.1.5 Learners' knowledge of environmental laws and those responsible for protecting the environment

6.13   Learners knowledge of environmental laws

Gender	Frequency		Percentage	
	Yes	No	Yes	No
Male	103	95	26.14%	24.11%
Female	107	89	27.16%	22.59%
Total	210	184	53.39%	46.70%

Chi Square Probability 0.6090

Frequency missing = 5

Table 6.13 illustrates learners' knowledge of environmental laws. 27.16% indicated that they know about environmental laws as compared to 26.14% of male respondents. While 22.59% of female respondents indicated that they do not know about environmental laws against 24.11% male respondents. The purpose of the question was to find out which group of respondents has knowledge regarding environmental laws. The National Environmental Management Act, No 107 of 1998, section 31(a) points out that every person is entitled to have access to information held by the state which relates to the implementation of this Act, and any other law affecting the environment, and the state of the environment and actual future threats to the environment. The Table indicates that only 53.39% of learners have knowledge of environmental laws against 46.70% who do not have any knowledge of environmental

laws. The estimated level of significance is 0.6090, indicating that there is no clear statistical relationship between the male and female respondents and knowledge of environmental laws.

Table 6 14   **Learners response as to who is responsible for the environment**

Learning areas	Frequency	Percentage
N/S	3	33.33%
H/S	2	22.22%
M/C	4	44.44%
Total	9	100

Table 6.14 highlights learners' opinions concerning who is responsible for the environment. Learners from various learning areas were asked who they think is responsible for protecting the environment; the purpose of the question was to assess the concern of learners for their environment according to their learning areas. The researcher wanted to find out whether their various learning areas contribute towards what is happening in their environment or not. Table 6.12 indicates that 3 responds from the natural sciences with 100%, 2 responded from human science with 100% and 4 also responded from commercial stream, also with 100%.

The other respondents indicated the other given options as being responsible for protecting the environment (see appendix). Those given options were:

- Government
- Individuals
- Community
- Nobody
- Others

The Department of Environmental Affairs Journal (2004:23) states that if every South African simply keeps the air in his immediate environment clean and considers the

rights of his fellow man he already contributes considerably to the fight against air pollution.

6.4   CONCLUSION

The use of the questionnaires in the study assisted the researcher in harnessing learners' knowledge and understanding of air pollution. The findings of the results show the following:

- Learners irrespective of gender indicate equal knowledge of air pollution and the same concern for the environment with regards to the impact of air pollution on the environment.
- Both male and female learners are not familiar with environmental laws.
- The difference in residential locations prove to influence learners' perceptions of their environment
- Learners agree that EE should be included in the curriculum.

It is imperative that learners in their schools be taught EE and become involved in the environmental activities that will allow them to gain knowledge of solving environmental problems that prevail in their areas. It is the responsibility of the government to ensure that EE is implemented effectively in schools especially black schools.

CHAPTER 7

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

7.1   INTRODUCTION

Chapter seven serves as a concluding chapter, reflecting on the entire study regarding its aims and objectives. It also presents a brief synthesis of the findings, steps to attaining solutions, recommendations, concluding remarks and implications.

7.2   AN OVERVIEW OF THE AIMS AND OBJECTIVES OF THE STUDY

The following are the aims and objectives reflected and drawn from chapter one, paragraph 3.1.1:

- To investigate and identify the causes as well as dangers of air pollution by means of a literature study.
- To look into the roles of people, especially the government, community, teachers and learners with regard to air pollution.
- To examine ways in which various policies and EE can be helpful in assisting to assess learners' understanding and perceptions about air pollution in their area of residence.
- To assess learners' understanding of air pollution as requirement for effective environmental decision practice.
- To propose guidelines that can be helpful in dealing with air pollution in the school curriculum and classroom.

7.3   THE MAIN FINDINGS OF THE LITERATURE STUDY

The following are the main findings of the literature study that have to be analysed briefly so as to comprehend learners' understanding of the impact of air pollution on the environment in rural communities.

7.3.1   Findings Regarding Learners' Rating of the Seriousness of Air Pollution

A significant finding from learners who are from informal settlement areas showed that they regard air pollution in their area to be more serious compared to learners

who stay in township areas (refer to Table 6.6). The problem is aggravated by the fact that learners tend to know little about their environment, as they are not taught about it. The problem stems from the fact mentioned by Robertson (1994:21) that little value is placed on learners' pre-instructional knowledge of environmental education curricula-environmental. Educators have little understanding of learners' perceptions of the environment and environmental issues.

7.3.2   Finding Regarding EE Forming Part of the Curriculum

The White Paper on Environmental Education (1989:6) supports EE to be part of the curriculum by stating "…an attempt will be made, in co-operation with responsible educational bodies, to ensure that the principles of Environmental Education are included in all appropriate educational curriculums". EE should definitely be part of every school curriculum as indicated by learners from both the township and informal settlement (see table 6.11 in chapter 6). Relatively high percentage township learners acknowledged the fact that they want EE to form part of their curriculum.

Literature on Environmental Education indicates that there is no need for the introduction of a new subject area in school in the form of Environmental Education due to the fact that environmental issues have a wide cross-curricular relevance. Chambers (1995:11) mentions that a programme for Environmental Education which draws on the curriculum will give learners the opportunity to consider environmental issues from the physical, geographical, biological, sociological, economical, political, technological, aesthetical ethical and spiritual perspective. Thus every subject is capable of exploring different aspects of human understanding and experience, and therefore each subject can be used to help learners develop insight into human behaviour and its effects on the environment.

7.3.3   Findings Regarding Learners' Perceptions of   Environmental Educators in Schools

Knapp (2000:34) states that by far the most frequent cause of curriculum failure is inadequate teacher training. None of the issues facing Environmental Education today are as important as the lack of quality educator training. Learners have highlighted the fact that Environmental Education is part of their curriculum (table 6.11). However EE does not reflect in their timetable nor are any environmental educators at school.

Many of the teachers have little experience of Environmental Education, mainly because they have never given special attention to Environmental Education before.

7.3.4   Findings regarding the Impact of the School in facilitating EE

The school is expected to be the relevant starting point for children to learn about Environmental Education whereby the teaching and management staff is able to evoke in learners the relevant skills to deal with environmental issues. Irwin (in Schulze, 1998:85) states that Environmental Education is an agent for problem-solving, but has not yet produced the anticipated results due to the problem of its implementation in schools, especially black schools and the lack of relevant environmental teachers lacking knowledge of Environmental Education. Teachers' actions and practices in school are important in shaping children's values and influencing their behaviour towards the environment for teachers are the role models.

7.3 5   Findings regarding EE as a Solution to Environmental   Problems

From the literature study it became evident that Environmental Education aims at educating people in and for the environment with the intention of attaining sustainability (refer to chapter 4, paragraph 4.3.2 and 4.3.3). The reason is Environmental Education focuses on familiarising people with the know-how of solving environmental problems that affect them. Knapp (2000:34) supports the above-mentioned statement by stating that an important goal of Environmental Education is to make individuals aware of actions necessary to resolve environmental problems. Male and female learners reflect the same sentiments with regards to EE as a solution to environmental problems (see table 6.12 in chapter 6). Therefore this emphasises the point that EE be included in their school curriculum so that it can be helpful in addressing the environmental problems that they encounter.

7.4   THE MAIN FINDINGS FROM THE EMPIRICAL INVESTIGATION

The following are the main findings obtained from the respondents who participated in the empirical investigation. These findings are to be addressed in order to ensure that learners' understand the impact of air pollution on the environment in rural communities.

7.4.1   Findings Regarding the Teaching and Learning of Air Pollution in the Classroom

As illustrated in table 6.10 teaching and learning of air pollution in the classroom seems to be low for male learners as compared to female learners. The literature study points out that learners' knowledge of environmental issues should stem from their sources of environmental information and the school is regarded as the most important source of environmental information. Rickinson (2001:246) suggests that learners' demographic characteristics can influence the kinds of environmental information sources that they hold important. The teaching of such environmental issues should clarify learners' knowledge and understanding of the causes and effects of such an environmental issue as it has been illustrated in chapter two, paragraphs 2.3, 2.4 and 2.5 so as to eliminate misconceptions and confusion.

7.4.2   Learners' Perceptions of the Impact of EE in Addressing Environmental Problems in the Classroom Situation

Chapter 3.3.3 mentions the importance of involving Environmental Education in addressing air pollution. From the findings it is obvious that many teachers have never given special attention to Environmental Education before. Kyburz-Graber et al (1997:23) indicates that Environmental Education is still being regarded as mainly a task for science teachers and most teachers of other subjects feel not responsible for it even though White Paper on Environment and Training stipulates the inclusion of EE in school curriculum. It is interesting to note that learners indicated that they are being subjected to EE theory and practices in the classroom (see table 6.11) but that no EE content is reflected in the school curriculum nor on the daily timetable.

Environmental Education has not yet made its mark in black schools because of the reasons as stated by Irwin in Schulze in paragraph 7.3.4. These reasons cause teachers together with learners not to know the roles that they should play in protecting their environment. Chapter 3, paragraphs 3.4.3 and 3.4.4 explain the roles the teachers and the learners should play with regard to EE in protecting the environment from further environmental problems.

7.4.3 Learners' Perception of the Harmful Effects of Air Pollution on the Environment

As illustrated in table 6.9 in chapter six the majority of respondents who participated in the investigation agree that air pollution is harmful to the environment and are also afraid of it. Terblanche (1998:3) states that of all forms of pollution, air pollution is believed to have the most extensive and profound effects on human and on the ecosystem.

According to the findings, even though learners are afraid of the impact of air pollution and acknowledge its harmful effect most of them do not feel responsible for it (refer to table 6.14). It is indicated in chapter 3 paragraph 3.5.3 that the environmental problems are aggravated by the fact that it is common property; it suffers due to the "tragedy of the commons". Due to the fact that the environment is common ground nobody takes it to be his or her responsibility to care and protect it.

7.5 RECOMMENDATIONS AND IMPLICATIONS

The findings obtained from this research together with the literature discussed in chapter three and four emphasis the necessity to familiarise learners with the teaching and learning of EE in order to understand the impact of air pollution on the environment in rural areas.

7.5.1 Recommendations regarding EE as Part of the Curriculum

It is highly recommended that EE should occupy its rightful place in the school-time table and curriculum. Stimpson and Wong (2001:101) state that Environmental Education is a component of school education. It is indispensable in improving the ethical and intellectual development of learners. All schools need to include Environmental Education in their school reform. It is important that teachers at school are familiar with EE so that they are able to instill in learners the ability to sustain their environment. Palmer (1998:16) highlights the fact that the promotion of environmental education in all sectors of education giving consideration to the basic aims of Environmental Education when drawing up curricula taking measures to develop teachers' knowledge of environmental matters in the context of their initial and in- service training.

Thus the successful implementation of EE in the school array of activities and in the design of the curriculum requires the involvement of the teaching and management staff. Therefore the environmental teacher should be in control of the teaching situation that will be conducive to effective learning and involvement by learners. Kyburz-Graber et al. (1997:230 state that teachers should know that applying Environmental Education in the curriculum requires managing the following:

- Developing the chosen theme as an interdisciplinary, problem-oriented project in cooperation between teachers and students.
- Reflecting on and negotiating the teacher/learner roles with the project work.
- Reflecting on the teacher/learning process in order to assess key learning experiences with regard to knowledge, attitudes and abilities.

7.5.2   Recommendations regarding EE as a Solution to the Problem

EE aims at equipping people with problem-solving skills and decision-making skills when dealing with their environment and also enables them to promote changes in their behaviour that will help them to solve existing problems relating to the environment and avoid the creation of new ones. It is the responsibility of the school to design an environmental ethic plan for its learners that is based on a responsible attitude towards the sustainable development of the environment.

Children should acquire education for the environment from the school, which strives to instill in them deeply held enduring environmental values and the capacity to analyse alternatives points of views on environmental issues. This can be attained when environmental consciousness in learners is awakened. Kyburz-Graber et al (1997:24) quotes UNESCO-UNEP's definition of environmental consciousness as a measure of a person's ability to understand the nature of environmental processes and problems, her or his degree of concern for environmental quality and the extent to which he or she is committed to positive behaviour in every day life.

The school should give children the opportunity to be skilful in dealing with environmental issues in their areas by involving them in environmental programme. Examples are the following:

- Developing skills in identifying causes of pollution in their areas.
- Developing and sharing ideas and planning action to reduce air pollution.
- Determining the impact of air pollution on people.
- Creating awareness of our roles to reduce air pollution.

The school should teach learners their roles as the citizens of this country and the future generations through actively participating at an early age in school and local community projects. Chambers (1995:15) mentions that citizenship is about helping learners develop knowledge and understanding of the nature of community roles and relationships in a democratic society and the nature and basis of duties, responsibilities and rights. Through understanding their roles as citizens of the country, children will then develop a sense of ownership of a place and understand that they can and have to improve their environment.

7.5.3   Recommendations regarding Learners' Perceptions of the Impact of Air Pollution on the Environment

The impact of air pollution on the environment is of serious concern and needs to be addressed locally, nationally and internationally if sustainability is to be achieved. It becomes necessary that educating for sustainable development is included into the curriculum for the benefit of promoting the quality of human life or sustainability of the ecosystem. Therefore it is important to educate for sustainable development as it provides children and other people with an understanding of environmental issues. Summers (2000:294) mention that the whole rationale underpinning arguments for sustainable development is the prevention of damage to the environment.

Improving the quality of our society's way of life needs the promotion of sustainable living. Sustainable living is the answer for every South African to attain the healthy, good quality life they deserve. In order to achieve sustainability we need to adopt the model of Responsible Environmental Behaviour of Hines et al (in Kollmuss & Agyeman, 2002:243), which were based on Ajzen and Fishbein's theory of planned behaviour. The model stipulates the following:

- **Knowledge of issues:** The person has to be familiar with environmental problems and their causes.

  - **Knowledge of action strategies:** The person has to know how he or she has to act to lower his or her impact on the environment.

  - **Locus of control:** This represents an individual's perception of whether he or she has the ability to bring about change through his or her own behaviour. People with a strong internal locus of control believe that their actions can bring about change. People with an external locus control, on the other hand, feel that their actions are insignificant and feel that change can only be brought about by powerful others.

  - **Attitudes:** People with strong pro-environmental attitudes have been found to be more likely to engage in pro-environmental behaviour; yet the relationship between attitudes and actions prove to be weak.

  - **Verbal commitment:** The communicated willingness to take action also has given some indication about the person's willingness to engage in pro-environmental behaviour.

Palmer (1998:78) states that children and adults should be schooled in the knowledge and values that will allow them to live sustainably. This requires Environmental Education to be linked to social education. The former helps people to understand the natural world and to live in harmony with it. The latter imparts an understanding of human behaviour and an appreciation of cultural diversity. Thus successful implementation of EE in addressing environmental problems relies on recognition and understanding by all members of the society. The school with its extended community of learners, parents, teachers, governors and NGO's are in a position to educate and influence the entire population.

7.6   LIMITATION OF THE STUDY

Some of the limitations of the investigation are the following:

- Some of the learners who stay in informal settlements were shy or uncomfortable to disclose their area of residence. It is therefore possible that the number of learners who stay in townships or informal settlements could be inaccurate.

- The fact that the learners from both types of school do not have the background of Environmental Education as it is not part of their curriculum should be considered as it may result in the possibility of the questions in the questionnaires being unclear to them.

- The researcher wished to include the Grade 12 learners but as a result of the large numbers of the Grade 10's and 11's it was impossible to handle all of them.

7.7   CONCLUSION

It is imperative that a large section of the South Africans especially black rural communities be educated in air pollution by a comprehensive awareness campaign from schools, churches and the mass media. Involving our children in the protection of the environment should be priority number one for South Africa as children are ideal agents of change. Children are the ambassadors of our country; instilling in them the ability to interact in a respectful manner with the environment will reduce environmental problems that are prevailing. The classroom is the ideal place to start the environmental campaign awareness through the teaching of EE. Knapp (2000:34) states that environmental educators must develop in learners the ability to learn about the environment and the problems associated with it and help those same individuals come to their own conclusion as to how or whether to act on a particular issue.

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THE PRINCIPAL
ODI HIGH SCHOOL
GA-RANKUWA 0208

SIR

APPLICATION FOR A PERMISSION TO CONDUCT A RESEARCH PROJECT AT ODI HIGH SCHOOL

I, VE. Malebye, student number 95202219 hereby request permission to conduct a research project at your school. I am a student at the University of Pretoria, doing a Master's in Environmental Education and my research topic is "Learners' understanding of the impact of air pollution on the environment in rural communities".

Thanking you in anticipation

Yours faithfully
VE Malebye

P.O.BOX 43007
THERESAPARK
0155
14 OCTOBER 2004

THE PRNCIPAL
BOTLHABELO HIGH SCHOOL
BRITS AREA

SIR

APPLICATION FOR A PERMISSION TO CONDUCT A RESEARCH PROJECT AT BOTLHABELO HIGH SCHOOL

I, VE Malebye, student number 95202219 hereby request permission to conduct a research project at your school. I am a student at the University of Pretoria doing aMaster's in Environmental Education and my research topic is "Learners' understanding of the impact of air pollution on the environment in rural communities".

Thanking you in anticipation

Yours faithfully
VE. Malebye

A QUESTIONNAIRE FOR GRADE TEN AND ELEVEN LEARNERS FROM ODI HIGH SCHOOL IN GA-RANKUWA AND BOTLHABELO HIGH SCHOOL IN BRITS

Respondents

QUESTIONNAIRE FOR A RESEARCH PROJECT TITLED:

LEARNERS' UNDERSTANDING OF THE IMPACT OF AIR POLLUTION ON THE ENVIRONMENT IN RURAL COMMUNITIES

The questionnaire seeks to determine the understanding and perceptions of learners about air pollution in their areas and the role of Environmental Education in dealing with it.

The information supplied will be treated as confidential and will be for the purpose of the research only. No name should be attached, so feel free to respond to all questions. Please return the completed questionnaires to the research coordinator.

Thank you for your cooperation

VE. Malebye

RESEARCH CO-OODINATOR

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MAN-MADE AIR POLLUTION

PHOTOGRAPH   2

COAL-USE AND WOOD USE

A QUESTIONAIRE FOR GRADE 10 & 11 ODI HIGH SCHOOL AND BOTLHABELO HIGH LEARNERS

Please answer each question by drawing neat circle(0) around a number in a box or by writing your answer in the space provided.

RESPONENT NUMBER

2. WHAT IS YOUR GENDER

MALE	1
FEMALE	2

3. PLEASE INDICATE YOUR AGE IN YEARS…?

4. IN WHICH RESIDENTIAL AREA DO YOU STAY?

TOWNSHIP	1
AQUATTER AREA	2

5. PLEASE INDICATE YOUR GRADE?

GRADE 10	1
GRADE 11	2

6. PLEASE INDICATE YOUR SUBJETS ALLOCATION.

NATURAL SCIENCE	1
SOCIAL SCIENCE	0
COMMERCIAL SCIENCE	3

7. WHICH TYPE OF SCHOOL DO YOU ATTEND?

COMBINED SCHOOL	1
SECONDARY SCHOOL	2

8. DO YOU KNOW WHAT AIR POLLUTION IS?

YES	1
NO	2

FOR OFFICE USE

V1   1-3

V2   4

V3   5-6

V4   7

V5   8

V6   9

V7   10

V8   11

9. PLEASE CHOOSE THE CORRECT DEFINATION OF AIR POLLUTION BELOW.

V9 [   ]   12

AIR POLLUTION IS THE PRESENCE OF HARMFUL SUBSTANCE IN THE ATMOSPHERE BY MAN.	1
AIR POLUTION IS THE INTRODUCTION OF DIFFERENT GASES INTO THE AIR	2

10. DO YOU KNOW THE CAUSES/SOURCES OF AIR POLLUTION?

V10 [   ]   13

YES	1
NO	2

11. CAN YOU IDENTIFY THE TYPE OF AIR POLLUTION IN YOUR OWN AREA?

V11 [   ]   14
V12 [   ]   15
V13 [   ]   16
V14 [   ]   17
V15 [   ]   18
V16 [   ]   19

SMOKING	1
MOTOR CARS	2
COAL BURNING	3
VELD FIRE	4
OTHERS (SPECIFY)	5

12. HOW SERIOUS IS AIR POLLUTION IN YOUR AREA?

SERIOUS	1
LESS SERIOUS	2
I DON'T KNOW	3

V17 [   ]   20

13. ARE YOU WORRIED ABOUT THE OF AIR QUALITY IN YOUR AREA?

V18 [   ]   21

YES	1
NO	2

14. WHY ARE YOU WORRIED/ NOT WORRIED ABOUT AIR QUALITY IN YOUR AREA?

V19 [   ]   22-23

V20 [   ]   24-25

15. DO YOU THINK AIR POLLUTION IS HARMFUL TO THE ENVIRONMENT ?

V21 [   ]   28

YES	1
NO	2
NOT SURE	3

16. IF YES WHAT HARM DO YOU KNOW THAT CAN BE CAUSED BY AIR POLLUTION ON THE ENVIRONMENT?

DAMAGE OZONE LAYER	1
DAMAGE VEGETATION	2
KILLING ANIMALS	3
OTHERS (SPECIFY)	4

17. WHAT HARM IS CAUSED BY AIR POLLUTION ON PEOPLE? CAN YOU IDENTIFY ONE FROM BELOW?

SKIN CANCER	1
ASTHMA	2
DIABETES	3
OTHERS (SPECIFY)	4

18. IS SMOKING CONTRIBUTING TO AIR POLLUTION?

YES	1
NO	2

19. WHY ARE YOU SAYING SMOKING CONTRIBUTES/ NOT CONTRIBUTES TO AIR POLLUTION?

It contributes cause if one smoke another one can also breath that small also.
And he/she can be affected.

20. IS SMOKING ENDANGERING YOUR HEALTH?

YES	1
NO	2

21. IF YOU DO NOT SMOKE, DO YOU ALLOW PEOPLE TO SMOKE IN YOUR PRESENCE?

YES	1
NO	2

22. WHY DO ALLOW/NOT ALLOW PEOPLE TO SMOKE IN YOUR PRESENCE?

Cause you can also breath that small. And it will fell as if you were smoking too. You can also be affected.

23. ARE YOU AFRAID OF ANY HARM CAUSED BY AIR POLLUTION?

YES	1
NO	2

24. WHO IS RESPONSIBLE FOR POLLUTING THE AIR?

INDIVIDUALS	1
COMMUNITY	2
COMPANIES	3
ALL	4

25. DO YOU THINK THOSE RESONSIBLE ARE NOT CONCERNED ABOUT THE AFFECTS ON PEOPLE AND THE ENVIRONMENT?

YES	1
NO	2

26. WHAT FORCES PEOPLE TO POLLUTE THE ATMOSPHERE?

POOR LIVING CONDITIONS	1
LACK OF ALTERNATIVE SOLUTIONS	2
CULTURAL BACKGROUND	3
LACK OF EDUCATION	4
IGNORANCE	5
OTHERS (SPECIFY)	6

27. DO YOU THINK THOSE RESPONSIBLE ARE NOT CONCERNED ABOUT THE EFFECTS ON PEOPLE AND THE ENVIRONMENT?

YES	1
NO	2

28. DO THEY TEACH YOU ABOUT AIR POLLUTION IN YOUR CLASS?

YES	1
NO	2

29. IN WHICH SUBJECT? CHOOSE FROM BELOW

GEOGRAPHY	1
BIOLOGY	2
AGRICULTURE	3
OTHERS (SPECIFY)	4

30. IS THE SUBJECT ASSISTING YOU IN MINIMISING THE IMPACT OF AIR POLLUTION?

YES	2
NO	2

31. WHAT IS THAT YOU THINK YOU ARE DOING WITH RESPECT TO YOUR ANSWER IN QUESTIONS 31 ABOVE.

USE LESS COAL	1
BE INVI\OLVED IN ENVIRONMENTAL AWARENESS PROJECTS	0
OTHERS (SPECIFY)	3

32. WHAT DO YOU THINK SHOULD BE DONE TO ENCOURAGE PEOPLE TO BECOME ENGAGED IN FRIENDLY/POSITIVE MANNER TOWARDS THE ENVIRONMENT?

EDUCATE THEM	0
ENFORCE ENVIRONMENTAL LAW	2
INSTILL LOVE FOR THEIR ENVIRONMENT	3
PROVIDE ALTERNATIVE MEASURES	4
OTHERS (SPECIFY)	5

33. WHAT SHOULD BE DONE IF THEY DON'T STOP?

BE JAILED	0
BE PENALISED	2
OTHERS (SPECIFY)	3

FOR OFFICE USE

34. DO YOU KNOW OF ANY LAWS THAT PROTECT THE ENVIRONMENT?

YES	0
NO	2

V75 [   ]   86

35. WHY DO YOU THINK THAT THE LAW PROTECT/NOT PROTECT THE ENVIRONMENT?

They don't protect anything about all of that cause the do nothing about them.

V76 [   ]   87-88

V77 [   ]   89-90

36. WHO IS RESPONSIBLE FOR PROTECTING THE ENVIRONMENT?

GOVERNMENT	1
INDIVIDUALS	2
COMMUNITY	3
ALL	4
NOBODY	5
OTHERS	6

V78 [   ]   91
V79 [   ]   92
V80 [   ]   93
V81 [   ]   94
V82 [   ]   95
V83 [   ]   96
V84 [   ]   97

37. DO YOU KNOW ANYTHING ABOUT ENVIRONMENTAL EDUCATION?

YES	1
NO	2

V85 [   ]   98

38. IS ENVIRONMENTAL EDUCATION PART OF YOUR CURRICULUM?

YES	1
NO	2

V86 [   ]   99

39. IF YES, IS ENVIRONMENTAL EDUCATION HELPFUL IN ENCOURING YOU TO LOVE/CARE FOR YOUR ENVIRONMENT?

YES	1
NO	2

V87 [   ]   100

40. IS ENVIRONMENTAL EDUCATION NECESSARY AT YOU SCHOOL?

YES	1
NO	2

V88 [   ]   101

41. WHAT DO YOU THINK CAN BE DONE ENCOURAGE THE TEACHING OF ENVIRONMENTAL EDUCATION IN YOUR SCHOOL

V89		102-103

There must be some groups to deal with all of those problems at school.

V90		104-105

42. CAN ENVIRONMENTAL EDUCATION SOLVE ENVIRONMETAL PROBLEMS?

YES	0
NO	2

V91		106