

**PUPILS' UNDERSTANDING OF THE
CONCEPT OF ENVIRONMENT:
A CASE STUDY OF STANDARD
SEVEN PUPILS IN NYANZA
PROVINCE, KENYA.**

BY

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(M. Ed)**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other

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DEDICATION

This study is dedicated to my family and the worldwide environment.

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ABSTRACT

The study, resulting into this thesis, was based on the awareness that humanity's survival and prosperity depend on the finite resources and life supporting systems (e.g. water, air and soil) all of which are rapidly deteriorating from the surface of the earth. This awareness was first echoed in 1972 at the International Conference on Human Environment at Stockholm and later incorporated into the school curriculum in the member states through the recommendation of Tbilisi Conference of 1977. In Kenya, formal infusion of environmental concepts into the school curriculum, from primary to tertiary levels, started in 1985. But, since environmental degradation has continued unabated, threatening the well being and sometimes the very survival of life on earth, there seemed to be a deficiency in the implementation process of such infused environmental concepts in the school system. In an attempt to investigate the causes of this deficiency, this study endeavoured to provide answers to the following questions: what prior knowledge did Standard Seven pupils have on the concept of environment before it was formally taught; and did the prior knowledge have effect on the pupils' understanding of the concept when it was formally taught as outlined in Standard Seven science course? The study focused on pupils' understanding of environmental principles, namely: meaning of environment; components of environment; pollution of environment and conservation of environment which are included in the topic "Our Environment" in Standard Seven science course. The study involved 288 Standard Seven pupils, eighteen head-teachers, eighteen Standard Seven science teachers and twelve cultural opinion leaders from Gusii and Luo communities. Various research instruments were used to investigate the target population's perception of the environment, including Environment Apperception Test (EAT) for pupils and Interview Schedule for cultural opinion leaders. The findings of the study were that: the pupils' prior knowledge of the concept of the environment was that environment is constituted by a single component of the wider environment, for example water, soil, air, plants or animals; the sources of the pupils' perception included the pupils' communities' perception of environment and the schools' presentation of environmental concepts in the school curriculum from Standard One to Six; and that the pupils' prior knowledge affected their understanding of the concept when it was formally taught to them under the unit "Our Environment" in Standard Seven science course. The Study therefore recommends that the curriculum development, the teaching and evaluation of environmental concepts in the school curriculum be systematic. This implies that different concepts of the environment are to be taught in different classes in the school system accordingly and the content be evaluated comprehensively so as to draw the attention of the examiners, the teachers and the learners on the concepts of environment infused in the school curriculum.

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LIST OF ABBREVIATIONS AND ACRONYMS

BERC	Basic Education Resource Center
COL	Cultural Opinion Leaders
EAT	Environment Apperception Test
EC	Environmental Conservation
GHC	Geography, History and Civics combined Course
IEEP	International Environmental Education Programme
IUCN	International Union for Conservation of Nature and Natural Resources
KCPE	Kenya Certificate of Primary Education
KIE	Kenya Institute of Education
KNEC	Kenya National Examination Council
LBDA	Lake Basin Development Authority
ME	Meaning of Environment
MEST	Ministry of Education, Science and Technology
NGO	Non Governmental Organization
PE	Pollution of Environment
PDE	Provincial Director of Education
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
WCED	World Commission on Environment and Development
WWF	World Wildlife Fund

CHAPTER ONE

INTRODUCTION

1.1 Background to the problem

In recent years, there has been a growing concern for the future of humankind in the face of a rapidly deteriorating environment. Attention has been focused on the effects of food shortage, population explosion, pollution and the depletion of natural resources such as forests. These environmental issues have produced an increasing awareness that humanity's survival and prosperity depend upon the finite natural resources and delicate life-supporting systems for example water, air and soil, of the spaceship earth (Richmond and Morgan, 1977, cited in Blum, 1987). The global nature of this awareness and concern was echoed by the United Nations when in 1972 it called the International Conference of Human Environment in Stockholm. This Conference charged its member states with defining precisely what should be done to maintain the earth as a place suitable for human life, not only for now, but also for future generations (Wards and Dubs, 1972:26).

Following the thought-provocation from Stockholm Conference, several other international conferences focussing on environmental concerns have since been held. These include the Tbilisi Conference of 1977 that initiated the resolution, which led to the formal incorporation of environmental concepts into the school curricula. Some of the Tbilisi recommendations included "The development of a school curriculum that is compatible with the needs of the environment at a local, national and international levels, and the provision of

Environmental Education for learners and teachers alike” (UNESCO, 1980:75-76).

The incorporation of environmental concepts into the school curriculum is an initiative with the realization that the wise management of environmental resources demands positive and realistic planning that balances human needs and the potential with which the environment can meet them. It is further observed that such planning can be developed through the school curriculum to create an environmental awareness among the youth as future managers of environmental resources for worldwide sustainable development (WCED, 1987: 50-51).

Researchers, namely, Driver and Oldham (1986: 106) assert that in learning curricular concepts, learners already have developed ideas about such concepts at home before the concepts are formally taught in a school situation. Such ideas that the learners carry from their home environment into the classroom situation constitute part of their prior knowledge on the concerned concepts that is gained through their experience within the home environment (Hamm, 1989:92-94). Such prior knowledge is often based on the learners' community's accumulated wealth of indigenous knowledge (Ohuche and Otaala, 1981: 70-81). Traditional forms of knowledge from the home environment have been established to be important for the sustenance and conservation of biodiversity as was echoed in Rio Earth Summit of 1992 (UN, 1992:1). Learners often use the prior knowledge to make links, in the learning situation, so as to construct meaning to the new ideas that are presented in the school curriculum.

Kenya, like many other UN member states, has made concerted attempts to infuse environmental topics into the school curriculum from primary to tertiary levels of education since 1985 (Abidha, 1987:8). In primary education the subjects that are involved include Geography, History and Civics (GHC) currently being referred to as Social Studies, Science, Agriculture, Art and Craft, and Home Science (Mang'uriu, 1987:69-70). The recent curriculum restructuring reduced these subjects to Science and GHC which are examinable at the end of Primary Education (MEST, 2000). In Primary Science, in particular, the following environmental concepts are infused at Standard Seven level under the topic "Our Environment": meaning of environment; pollution of environment, and conservation of environment (K.I.E, 1993:16; 1994:60). This infusion, which has taken over ten years, has hardly changed the attitude of people in the country (Okwemba, 2002:1) This seems to suggest a deficiency in the teaching and learning process of such concepts in the school curriculum.

1.2 The Statement of the Problem:

The understanding of curricular concept is very important for knowledge acquisition. Since the teaching of environmental concepts in Kenya's school curriculum has taken long and the environmental deterioration continues to mount, it is possible that the products (learners) of this curriculum have failed to comprehend the concept of environment (Kawa, 1991:58-60; Mang'uriu, 1987:70 – 75) This study is therefore designed to investigate the Standard Seven pupils' understanding of the concept of environmental as outlined in their science course.

1.3 The Research questions:

This study attempted to answer the following questions:

- a) What is environment in the indigenous knowledge of communities from which the target population is drawn?
- b) What prior knowledge do Standard Seven pupils have about the concept of environment before the concept is formally taught in Standard Seven Science Course?
- c) Is the prior knowledge Standard Seven pupils have on the concept of environment, before it is formally taught, based on their respective communities' indigenous knowledge or the school instruction encountered in the previous classes?
- d) Does the prior knowledge have effect on the understanding of the concept of environment among the Standard Seven pupils when the concept is formally taught?
- e) Is there any significant difference in Standard Seven pupils' understanding of the concept of environment on the basis of sex, residence status, agro-ecological zonation of their schools, community of origin and background of parents?

1.4 Objectives of Study:

In view of the above questions, the objectives of this study included, to:

- a) establish the environmental concept formation in the context of the indigenous knowledge of the respective communities considered in the study.

- b) determine the Standard Seven pupils' prior knowledge of the concept of environment before their exposition to the concept in the formally taught Standard Seven science course;
- c) find out whether the Standard Seven pupils' prior knowledge of the concept of environment is based on their respective communities' indigenous knowledge or as a result of formal school instruction encountered in the previous classes;
- d) investigate whether the Standard Seven pupils' prior knowledge of the concept of environment has had an effect on their understanding of the concept from the viewpoint of formal Standard Seven science course; and
- e) establish if there is any significant difference in the understanding of the concept of environment by Standard Seven pupils on the basis of sex, residence status, agro-ecological zonation of their schools, community of origin and the background of the parents.

1.5 Research Premises:

This study is based on the following premises, that:

- a) each of the considered communities, from where the target population is drawn, has a definite interpretation of the concept of environment in their indigenous knowledge;
- b) the Standard Seven pupils have prior knowledge about the concept of environment that is gained from their interactions within their communities before and outside the formal classroom presentation of the topic "Our Environment" in Standard Seven science course;

- c) the Standard Seven pupils' prior knowledge is based on their social construction of reality that is highly influenced by their respective communities' indigenous knowledge;
- d) the prior knowledge the Standard Seven pupils have, has effect in their understanding of the concept, when it is formally presented in the classroom situation; and
- e) there is significant difference in the understanding of the concept of the environment by Standard Seven pupils on the basis of sex, residence status (urban or rural), agro-ecological zonation of their schools, community of origin and the background of the parents.

1.6 Scope of the Study:

This study investigated the prior knowledge among Standard Seven pupils on the concept of environment before it was formally taught in Standard Seven science course. It further examined whether this knowledge was based on their communities' indigenous knowledge or the knowledge from previous classes in other subjects. Other sources of information included the cultural opinion leaders, school heads and Standard Seven science teachers. The cultural opinion leaders from Gusii and Luo communities were used to establish the communities' indigenous knowledge on environment. The school heads provided information on the school-community interactions on environmental issues. The Standard Seven science teachers indicated their general concern about the environment; awareness of the ideas pupils bring into classroom situation from their cultural background; and their commitment in teaching environmental concepts infused in

school curriculum. The study was conducted in four agro-ecological zones in the southern districts of Nyanza province, namely, Migori, Suba, Gucha, and Homa-bay. The zones cover two main ethnic communities of the Gusii and the Luo. It also involved eighteen primary schools, out of 3,455 primary schools in Nyanza province. The province constitutes about 20% of public primary schools in Kenya. Although the spatial coverage and hence the data quantity, with regard to the country, may look small, the results could be generalized to pupils and schools within the same cultures; and the process and approaches may be replicated in other cultures, since the study is qualitatively based.

1.7 Significance of the Study:

Learning about the environment is a process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among people, their culture and the biophysical surrounding (Baines, 1987:3; UNESCO, 1985:9). The interrelatedness between people and their total surrounding can mainly be appreciated if there is clear understanding of the concept of environment. Such understanding helps one to recognize the components of the environment, the interactions of such components with one another, the effects of such interactions on the sustainability of the quality of the environment and the place of humanity in the web of such environmental interactions. The findings of this study are significant to various people concerned with the school curriculum, for example, the curriculum developers, school teachers as the curriculum implementers, and the learners as the immediate beneficiaries of the school curriculum. Other recipients include the

non-governmental organizations that have activities based on the environment and any other researchers whose focus is on the environment.

The learners for whom Primary Education is the formal foundation of education, which is also terminal to many of them (Gachathi, 1976:50), often have direct influence on the environment. This is so because when their formal education ends at primary education cycle, some of them become peasants who rely on the physical environment for their food resources. This study is therefore significant to such learners because it outlines the components of the environment, the interactions of such components and the effects of such interactions on the quality of the environment. This assists them in understanding the nature of the environment and the gained skills make them depend on the environment and strive to maintain its quality for the provision of their continual needs.

Meaningful learning according to Ausubel (1968, cited in Lisowski and Disinger, 1992) is based on the fact that "the most important single factor that influences learning is what the learner already knows. Ascertain this and teach her/him accordingly." The teacher as the facilitator in the teaching-learning process must plan well for the meaningful learning on the part of the learner. She/He has to establish what the learner already knows (prior knowledge) before new concepts are introduced. The introduction of environmental concepts into traditional subjects such as Science, Agriculture and Geography, History, Civics (GHC) requires special teaching approaches of the concerned topics, different from the traditional approaches such as lecture methods in such subjects. The

teachers of such subjects need to establish what the learners already know with regard to the infused environmental concepts into their subjects, in order to adopt the effective methodology. This study is therefore significant because it lays out what the learners already know about the concept of environment and the teachers then would integrate well the infused environmental concepts and the content of the carrier subjects such as Science. The teaching methodology should take into account the learners' prior knowledge of the concerned topics.

The learners often enter into classroom situations with a cluster of ideas from their prior knowledge, which serve as their conceptual filter as they assimilate or accommodate the new information into such prior knowledge (Solomon, 1988, cited in Driver, Guesne and Tiberghien, 1985:159). This study is significant to the curriculum developers because it provides source of baseline information of the primary pupils' perception of the concept of environment. The curriculum developers would use such knowledge, as pre-requisite understanding, in planning the content of the topics that have infused environmental concepts, for example, "Our Environment" in Standard Seven science course. The proposed methodology for handling such topics should take care of the infused environmental concepts and hence the proposal for multi-disciplinary approaches that would be more appropriate.

Given the current general public concern for environmental issues, various non-governmental organizations (NGO) have developed interests in environment related activities. The findings from the study are significant because they provide the prior knowledge of the primary school pupils on the concept of environment

and also the indigenous environmental perception of the communities involved. This would provide the concerned non-governmental organizations with the related communities' indigenous perception of the environment. This would give them an insight of how to approach the environmental activities in such communities and where appropriate re-evaluate their techniques based on communities indigenous knowledge of the concept of environment.

1.8 Definition of Terms

It is common to use different terms related to environmental studies or any other specific study for different meanings. For the sake of clarity it is necessary to state the meaning of certain terms used in this study as follows:

1.8.1 Accommodation

Accommodation is a learning process by which a learner modifies her/his prior knowledge to take into account of the new information. The prior knowledge provides room for the learning/interpretation of the new information (Bruner, 1963:31; Driver and Bell, 1985:3).

1.8.2 Agro-ecological zones

These are agricultural regions that are characterized by temperature limits to which specific crops do flourish in Kenya (Jaetzold and Schmidt, 1982:136).

1.8.3 Assimilation

Assimilation is a learning process by which the learner interprets the new information in the light of her/his prior knowledge. The new information is therefore learnt/understood in the light of the prior knowledge (Bruner, 1963:31; Driver and Bell, 1985:3).

1.8.4 Biosphere

It is the part of the earth's surface and atmosphere that is inhabited by organisms.

1.8.5 Components of the Environment

These are the constituents that make up the environment such as living things (plants and animals), non-living things (e.g. air, soil, and water) and man-made entities (e.g. factories, schools and roads).

1.8.6 Constructivism

It is a viewpoint of learning theory, which holds that a learner actively constructs meaning individually in an attempt to make sense of what is presented in the classroom situation. Thus the sense made of a concept is seen to be dependent not only on the situation itself, but also on the learners: purpose and active construction of meaning (Driver and Oldham, 1986: 105-106). The educators holding this view are referred to as the constructivists and the view is often referred to as the constructivists' view of learning.

1.8.7 Cultural Opinion Leaders

These are respondents who were purposively sampled from the ethnic groups in the study area and were interviewed on their respective ethnic group's indigenous knowledge of the concept of environment.

1.8.8 Environment

It is the external surrounding in which an organism lives and that which influences its development and behavior. In this study however, environment is understood as an association between individual being and everything else within

its surrounding, for example living things, non living things and human made entities like factories, cultural and political activities. The home and school environments, therefore, reflect the above aspects within the home and the school settings.

1.8.9 Environmental Conservation

It is the management of human use of biosphere so that it may yield the greatest sustainable benefits to the present generation while maintaining its potential to meet the needs and aspirations of future generations (IUCN, 1980: 92). In this study, it is taken to be the process of preventing the loss of and maintaining the desired quality of the components of the environment such as plants, animals, air, water and soil for the good of all generations of organisms.

1.8.10 Environmental Education

It is an educational approach of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among humanity, her/his culture and biophysical surrounding (UNESCO, 1985:9).

1.8.11 Indigenous Knowledge

It is the established wisdom that is unique to a particular society (e.g. ethnic group) about a concept in nature.

1.8.12 Learning Situation

Learning is the comprehension and acceptance of concepts that are intelligible and rational all of which lead to a change in the meaning of experience for the learner (Gowin and Novak, 1984, cited in Brody and Koch, 1990).

Learning situation, therefore, refers to a formal interaction between the learner and the sources of instruction within the school environment, often co-ordinated by the teacher.

1.8.13 Misconception

It is an alternative understanding of publicly known concept by the learners (Driver et al., 1985). Misconception does not simply signify lack of knowledge, factual errors or incorrect definitions but it represents explanations of phenomena constructed by a learner in response to her/his prior knowledge and experience.

1.8.14 Pollution

It is any change in the physical, chemical or biological characteristics of air, soil or water that can affect health, survival or activities of humans or other forms of life in an undesirable way (Brody, 1991). In this study, it is taken to be contamination of any component of the environment such as air, soil or water by making it harmful to humans and other forms of life.

1.8.15 Prior Knowledge

The ideas the learners hold about a concept before the concept is formally taught in the school situation.

1.8.16 The School Curriculum

It is a means by which a school enables the learners to change their behaviours in the desired direction (Ondiek, 1983:5). In this study, it is regarded as the planned/unplanned and guided/unguided learning experiences and intended learning outcomes formulated through the systematic construction of knowledge

and experiences under the guidance of the school for the learners' continuous and willful growth in personal and social competence.

...

... (The following text is extremely faint and largely illegible due to low contrast and blurring. It appears to be a long paragraph of text, possibly a reflection or a report, discussing educational goals and the role of the school in fostering personal and social competence. The text is too light to transcribe accurately.)

... (This section contains a few more lines of faint text, continuing the narrative or report. The content is not discernible.)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Historically, education research approaches in knowledge acquisition have benefited from the epistemological and methodological perspectives that are used by science researchers. Scientific epistemology, for example, holds that “knowledge is that which has been approved or confirmed and which is acquired primarily by evidence of the senses, that is, through observation”(Robertson, 1994:22). This view is held by behaviourist researchers in education, given that they concentrate on observable behaviours which are readily quantifiable, allow for statistical analysis and have well defined generalizable conclusions. For example, Gage (1980, cited in Robertson, 1994) views education researches to be process-product based. This is where attempts are made by these researchers to discover, through intensive analysis and experimentation, relationships between specified teacher behaviours (processes) and student outcomes (products). The behaviourist researchers, in this context, take the product of the process as evidence of the process, “and one need not know how the process itself works as long as one has absolutely reliable expert judges” (Gowin, 1981, cited in Robertson, 1994:22).

Further, the behaviourist research approaches have tended to ignore the learners’ cognitive activity, that is, the process of acquiring knowledge. For example, from a behaviourist stand point, a learner who is thinking actively while motionless is not behaving in an academically acceptable manner. Yet, the most

common behaviour, found in schools-the listening of pupils, is not directly observable. On the other hand, the critics of the behaviourist approaches assert that the most significant concept of human behaviour is the ability to form concepts, label concepts with language symbols and manipulate such symbols. To research into how learners do these, the researcher may need to employ alternative approaches such as constructivism.

The constructivist approaches, at least in science education research, have used qualitative designs whose main objective has been to understand the meaning of an experience as expressed by an individual. Many of such approaches have used interviews as the mode of data collection, and since interview-based studies attempt to characterize the kind of beliefs or ideas that people give support to, such approaches are taken as qualitative in design. Given that in such studies, the researcher is understood to be the "primary instrument for gathering and analysing data," such approaches are explicitly interpretive (Howe and Eisenhart, 1990, cited in Robertson, 1994:24)

The review of literature in this study is discussed under the following categories: constructivist theory of knowledge acquisition and studies based on the constructivist theory in knowledge acquisition in school curriculum in general and in environmental education in particular.

2.2 Constructivist Theory of Knowledge Acquisition

Knowledge acquisition, that is, the process of learning, has had various theories in education. Before the establishment of constructivism, other theories depicted the part of the learner to be passive. For example, Vygotskian theory of

knowledge acquisition regarded the learner as a less mature member of society and that the knowledge is possessed by the teacher, who is a more mature member of the society (Giyoo,1992). According to this theory, the teacher holds knowledge in form of skills or strategies for solving target problems. The teacher is expected to instruct the learner on how to solve such target problems progressively. When the learner attains such capability of solving problems, the act of knowledge transmission is considered as successful. On the other hand, the human brain is regarded not as a passive receptor of information, instead it actively constructs its own interpretation of information and draws inferences from them. The brain ignores some information and selectively attends to others much more than a "blank slate" that passively receives and records the incoming information (Osborne and Wittrock, 1983:45). It has further been confirmed that since effort is required to construct meaning, ultimately the learner is responsible for his/her own learning (Driver and Bell, 1986). Such are the attributes of constructivism.

Piaget (1952: 49) is regarded as one of the founders of the theory of constructivism. He undertook many studies into children's acquisition of knowledge and affirmed that the acquisition of knowledge proceeds by both physical maturation of the learner's nervous system and interaction with the environment. He outlined the four stages that a learner undergoes in acquiring knowledge with notable characteristics as follows: Sensorimotor (0-2 years), in which the acquisition of the concept of object permanence is established. This means that the child understands that the object exists irrespective of whether it is

visible or out of sight. This marks the beginning of symbolic thinking, which is very important for the subsequent intellectual development of the child. The Pre-operational (2-7 years), in which the child makes conclusions on the basis of insufficient evidence, sees things only from his/her own point of view and treats inanimate objects as if they have life. The Concrete operational (7-12 years), in which the child is able to perform tasks successfully relating to the conservation of matter, the transitive form of reasoning and the classification of objects. Finally, the Formal operational (12 + years), in which the child is capable of engaging in a high level of thinking without basing it on concrete evidence, and hence a child is more abstract, more mobile and flexible in his/her operations (Mwamwenda, 1989: 68-71).

The age designations for various stages are approximate because each stage does not end suddenly but trails off, and Piaget's model stresses that the degree of understanding of any given concept is determined largely by the cognitive stage which the child has reached. For example, a concept which requires formal operational thought cannot be mastered by a child who has only reached the level of concrete operational thinking unless some intuitive thinking is involved (Okeke and Colinhood, 1980).

Despite Piaget's contribution to the constructivist approach to knowledge acquisition, he has heavily been criticised especially by the behaviourists for the speculation on the inner working of the mind as well as his attempt to generalise children's stages of logical structures of their thought (Robertson, 1994). From the point of view of the Vygotskian theorists, the Piagetian concept of knowledge

acquisition has a deficiency in emphasizing the individual construction of knowledge without paying attention to: the contribution of the knowledge of more capable members of the society; cultural artifacts that mediate interactions between individuals and their physical environment; and the large social-historical context of the teaching-learning process (Giyoo, 1992). Novak and Gowin (1984, cited in Robertson, 1994), further stress that, rather than Piaget's age dependent cognitive levels, what the learner already knows is the key to his/her subsequent learning. Indeed this is one of the basic principles of the constructivist viewpoint.

The constructivist theory of knowledge acquisition has its roots in the long-standing theory of interpretivist tradition that is concerned with the intents and the beliefs of individuals as well as their conceptualization. It recognizes the influence of prior knowledge (experience) in the manner phenomena are perceived and interpreted (Weber, 1949, cited in Driver and Oldham, 1986:106). It is also based on the importance of meaning as constructed by individuals in their attempt to make sense of the world. The term "construct" emphasizes the understanding that the learner establishes in his/her attempt to account for the world and theoretical entities of categories such as atoms or genes which in turn take on reality in his/her experience (Driver, 1987:6). Such categories exist in the learner's thinking frame because they have been framed in meaning from his/her previous experiences. The sense made of the world therefore is seen to be dependent on both the situation itself and the learner's purposes and active construction of meaning (Driver and Oldham, 1986: 107-110).

Basically, the constructivist theory of knowledge acquisition is established on two main premises, that: knowledge is actively constructed by the learner, not passively received from the surrounding and learning is an adaptive process that organises the learners experiential world, the learner does not necessarily discover an independent, pre-existing world outside his/her mind (Klein and Merrit, 1994:15). It is further affirmed that learners have experienced and thought about the world; they therefore enter into the learning situation with a complex cluster of ideals, beliefs, values and emotions. It is the potential match between the existing cognitive commitments (experience/prior knowledge) and the new information, which determines the learner's response to the instructional input from the teacher. Learning therefore involves the re-organization of the cognitive structure of the learner, which necessitates a change in meaning of his/her experience (Snively, 1986:20, cited in Robertson, 1994).

The learner's construction of knowledge is facilitated by both horizontal interactions (peer-peer) and the vertical interactions (teacher-learner). The horizontal interactions have proved to be more effective than the vertical because in the peer-peer interactions, members' motivation to disclose their ideas in a discussion tends to be more natural and strong since no authoritative correct answers are expected to come immediately (Giyoo, 1992).

Construction of knowledge therefore involves the interpretation that the learner places on what he/she hears, sees or reads, which depends on the learner's existing experience- "prior knowledge" and on his/her interpretation of the total context in which the propositions are encountered- "learning situation" (Forman,

Minick and Stone, 1993: 58-59). With time, the learner's knowledge about the world expands as a result of his/her construction efforts. Each step in the learner's constructive process involves the transaction in which what is already been known (prior knowledge) is brought to bear on the new information. It is this marriage that creates new meaning and enhances understanding and control on the part of the learner in his/her surrounding.

From the foregoing discussion, it is observed that most of the researches in education have taken the part of the learner in knowledge acquisition as being passive. Some have adopted that knowledge acquisition is based on the age of the learner. Many of the researchers have tended to look into what the learners acquire after presentation of contents by the teachers. Constructivist approach, on the other hand, looks at what the learner has constructed before formal teaching is presented to him/her. This study, based on the constructivist theory of knowledge acquisition tries to establish what learners have constructed on their perception of the concept of environment as outlined in Standard Seven science course. The study, therefore, appreciates the active participation of the learner in knowledge acquisition.

2.3 Studies based on the Constructivist Theory of Knowledge Acquisition in the School Curriculum

Studies based on the constructivist approach to knowledge acquisition involve researchers that endeavour to: uncover the learner's frame of reference on the ideas he/she has on curriculum concepts; investigate the reactions and responses the learner expresses as instructional contacts are shared with him/her

by teachers, and utilize the knowledge gained to develop the teaching-learning programmes that would be appropriate and usable to the learner (Robertson, 1994:28).

Studies on the learner's perception of concepts that are taught in the school curriculum have mainly been undertaken in science subjects such as biology, chemistry and physics at the secondary school level. Researchers have focused on different concepts, for example, in biology, Okeke and Colinwood (1980) studied the Nigerian students' understanding of biological concepts such as reproduction, transport and growth; Bell and Barker (1982) considered the scientific concept of "animal"; Adeniyi (1985) focused on the misconceptions in concepts such as ecosystem, population, biotic community and habitat; and Munson (1994) focused on the misconception in concepts such as food web, carrying capacity, ecological adaptation, ecosystem and niche. In chemistry, Nassbaum and Norvick (1981: 23) studied the pupils' understanding of the particulate nature of the matter, and in physics, Osborne (1981:19) researched on the children's ideas about electric current.

In the said study by Okeke and Colinwood (1980), this involved 120 secondary school students whose ages ranged between sixteen and eighteen years. The students were individually interviewed to assess their level of understanding of the biological concepts of reproduction, transport and growth. The students' common misconceptions were identified, for example, 40% were unable to distinguish between reproduction and the act of copulation in animals; and 37% maintained that diffusion and osmosis were opposite processes in the concept of

transport. The concept of growth was generally conceived in an observational way and the students appeared unable to conceptualize it in terms of increasing length, mass and volume or in other parameters. Munson (1994) also reported misconceptions held by students on the concept of food web that organisms higher in the food-web eat everything that is lower in the food web. On the other hand, organisms higher in the food web only feed on some organisms lower in the food web.

The current research attempts in science education are framed within the constructivist theory of knowledge acquisition. Researchers have taken this direction because views have changed from focusing on the input-output trend, that is, input by teachers and the output by learners, to cognition where they concentrate on how learners acquire the knowledge. Environmental Education researchers should equally concentrate on how the learners construct the knowledge during the teaching-learning process (Robertson, 1994)

This study therefore, based on constructivist approach, is designed to investigate into the learner's perception of the concept of environment before formal presentation of the same in the classroom situation, as planned in Standard Seven science programme. This is an attempt in environmental education to explore on how learners construct knowledge in the teaching-learning process of the infused environmental topics in the School curriculum.

The contribution of the school situation to the prior-knowledge of the Standard Seven pupils on the concept of environment could be reflected on the topics the pupils covered in the school curriculum in the previous classes and in

subjects such as GHC, Agriculture and Science. The analysis of Primary School Syllabus and the available text books on the same revealed that the concept of environment had been introduced in lower classes in topics such as soil erosion, soil conservation, conservation of forests in Standard Five GHC (Makokha, 1989: 20, 79 and 83 Ondieki and Wegulo, 2000: 23 and 122) and soil erosion and water conservation in Standard Five and Six Agriculture (KIE 1994:60). The concept of pollution of environment, the second content principle under study, is first introduced in Standard Seven Science under the topic "Our Environment" with sub-topics such as pollution of air, water, and soil (KIE, 1994: 171; 1993:16; Patel and Vashista, 1989: 29-33 and Macharia and Nyoro, 2001: 63-71). The concept of environmental conservation, the third content principle under study, is first introduced in Standard Five GHC under the topics conservation of soil, conservation of soil, conservation of forest and conservation of wildlife (Makokha, 1989: 79; Ondieki and Wegulo, 2000: 122) and in Agriculture under the topic Conservation of Water (KIE, 1994:60).

The classroom presentation of environmental concepts, namely, pollution of air and conservation of soil in both school syllabus and test books, in carrier subjects such as Agriculture, GHC and Science (KIE, 1994:60 – 61; and Berluti and Njenga, 2001: 28 – 32), stresses the individual components of environment (e.g. water, air and soil).

2.4 Studies based on Constructivist Theory of Knowledge Acquisition in Environmental Education

In many curriculum programmes, the curriculum developers often offer a basic set of knowledge and skills to be covered with little consideration of the learner's past experience on the same (Richmond and Morgan, cited in Blum, 1987). Despite the current global environmental awareness and concern, the question of experiential baseline knowledge of the learners on the concept of environment has not received much attention from researchers. On the other hand, it has widely been recognized in Africa that incorporation of environmental concepts into the school curriculum focuses on topics that relate to land, river, forests, deserts and to agriculture and health, all of which are deemed to be most suitable to the children (UNESCO-UNICEF, 1974:61).

The background of African children is rich in environmental issues because they are often involved in fetching firewood and water, and sometimes they passively participate in family decisions, like making environmental decisions in clearing a nearby bush for agriculture (Knamiller, 1981:16). Despite such a rich background of the African child, Knamiller and Obeng-Asamoah (1979:21) noted that there is little documented information about the African children's perception of their environment.

Ohuche and Otaala (1981:70-86) carried a study on the African child and his environment. However, the study focused more on the psychological environment with little emphasis on the biophysical environment. On the other hand, Knamiller and Obeng-Asamoah (1979:21) studied the perception of the

Ghanaian children on local water and fuel resources and consumption. The study specifically investigated what Ghanaian children knew and thought about local water and fuel resources and how the use and continuing supply of such resources related to the local development issues then. The students were interviewed in their respective schools. The findings revealed that environmental awareness in terms of water and fuel resources that the rural children had was different in kind and extent from that of the urban children. The rural children knew more about water and fuel resources, while the urban children knew more about the marketing of fuel resources such as charcoal. All the children involved could not relate the concept of conservation to the idea of depleting natural resources. To these children conservation meant saving money and reducing the workload.

Most studies in environmental education have tended to place more emphasis on “environmentalness than educationness” (Robottom, 1987: 200). This means that research in environmental education focuses on environmental context and much inquiry has been done in environmental system in the name of environmental education but very few incidents have focused on the educational situation in the name of environmental education. Unless environmental education researchers attend to the educative aspects of their practice, in terms of both underlying theories of knowledge and learning, one may be at a loss to frame a study within a particular epistemology (Robertson, 1994)

Studies that provide a strong empirical support for a constructivist interpretation of learning as well as rich descriptions of learner’s understanding of concepts have mainly been done in science education. Again, studies in

environmental education have received remarkably little attention of constructivism as theoretical research foundation. Between 1989 and 1994 less than five research reports published in *the Journal of Environmental Education* were based on constructivism except Wals' (1992) that reported on the young adolescents' perception on environmental issues which was explicitly constructivist based (Robertson, 1994).

In the Kenyan context, Mang'uriu (1987:70-75) assessed the incorporation and teaching of environmental concepts in primary schools in Muranga district. He found that incorporation of environmental concepts had been done mainly in subjects such as GHE, Science, Agriculture, and Home Science and teachers faced socio-economic problems in teaching such concepts in the school system. Kawa (1991:58-60) also surveyed the approaches used in teaching environmental concepts in Upper Primary classes in Kisumu Municipality, and found that most teachers used question – answer and lecture method approaches. This showed lack of adjustment on the part of the teachers to suit the needs of environmental education. Keiru (1991:12-13; 69-71) focused on the basic awareness of what Standard Seven pupils had already acquired in common environmental issues such as soil, water, trees, population and wildlife after taking the courses involving the same concepts. She found that a majority of pupils had problems of applying the acquired knowledge about the environment to everyday life.

From all these, it is evident that little value has been placed by environmental education researchers on learner's pre-instructional knowledge of the concept of "environment as a single whole" in environmental education as

part of the school curriculum. This study, therefore, attempts to use constructivist approach to interpret knowledge acquisition process among learners and to document the experiential baseline knowledge of learners on the concept of environment before formal instruction as outlined in Standard Seven Science course.

2.5 The Theoretical Framework

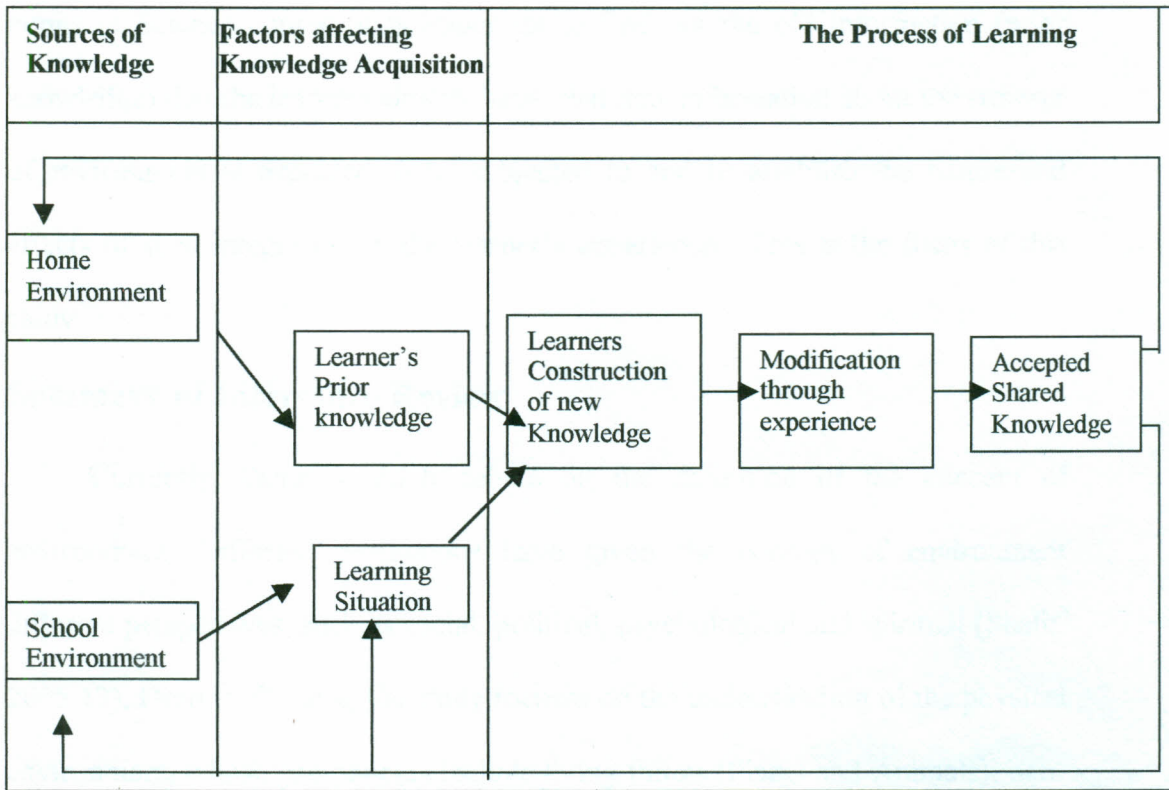
This study is based on the constructivist theory of knowledge acquisition. The constructivist approach to learning may be summarized in terms of the following propositions (Driver and Oldham, 1986: 10; Klein and Merritt, 1994:15; and Robertson 1994:23):

- learning does not occur by the learner responding in a passive way to the learning situation but actively interacting in it;
- what a person learns depends not only on the learning situation but also on what the learner brings to the situation (prior knowledge);
- the construction of meaning by the learner in making links with the prior knowledge occurs in situations involving texts, listening to someone talking and observing or manipulating the physical phenomena;
- knowledge is constructed by the individual through social interactions and experience with the physical environment; and
- learning of curricular concepts involves not only adding to and extending on existing conceptual structure but may also involve reorganizing it radically.

Figure 2.1 below represents the constructivist learning model in an attempt to conceptualize learning process in children. It is adapted from Driver and Oldham's (1986:113) constructivist model for curriculum development and teaching of Science. The model is divided into three compartments: sources of knowledge, factors affecting knowledge acquisition, and the learning process. The sources of knowledge are the home and the school environments. The factors affecting learning are varied, but psychologists have grouped them into organic and physical maturation of the learners; experiential background (i.e. people learn better when they are exposed to ideas with which they are brought up); motivation level and the attitudinal set of the learners (Mwamwenda, 1989:70-73). In this model, all these factors are reduced into two: the learners' prior knowledge from the home environment and the learning situation constituted by the school environment. The learning process begins with the learner's construction of new knowledge that is perceived as tentative version, which is continually tested against the learner's life experiences and where necessary modified to suit the accepted shared knowledge (Driver and Oldham, 1986:113).

The accepted shared knowledge by the experts influences teachers in the school environment in their preparation of the learning situation. It equally influences the knowledge held in the home environment through books and the impact of learner's constructed knowledge. This, then proportionately shows the influence of school environment activities on the home environment.

Fig. 2.1 Constructivist Theoretical Learning Model:



Source: Modified constructivist model for curriculum development and science teaching by Driver and Oldham, 1986.

—————▶ The arrow indicates the direction of influence

Based on this model, it has been observed that when information is received by the learner, it does not drop into an empty pigeonhole but comes up against what is there

already. Thereafter a process has to occur of integrating the new and the old information. The new may be interpreted in the light of the old (prior knowledge) “assimilation” or the old may be modified to take into account the new information “accommodation” (Bruner, 1963:31; and Driver and Bell, 1985:3).

Therefore in presenting a concept such as 'Environment' to the Standard Seven pupils in Science course, it is important to find out the old information (prior knowledge) that the learners already have, that new information about the concept of environment is expected to be subjected to and to establish the nature and effects of such integration in the learner's experience. This is the focus of this study.

2.6 Summary of Literature Review

Currently, there is much debate on the definition of the concept of environment. Different professions have given the concept of environment different perspectives, such as social, political, psychological and spiritual (Shalit, 2005:13). Despite all these, the study focuses on the understanding of the physical environment, whose components include living things (Plants and Animals); non-living things (water, air and soil) and man-made things (factories and buildings).

Much of current literature defines the environment as the surrounding of an organism (Wright, P.D.; Wright, H.D. and Flemming, P. 2004:16) which makes the humanity to perceive themselves as the owners and not part of the environment. On the other hand, Shalit (2005:2) defines environment as a description of relationships, and this study therefore understands the environment as the association of an organism with other environmental components within its surroundings. Each environmental component has a unique relationship with one another for the good of all; and such an association maintains the quality of the wider environment, hence the holistic nature of the environment.

Although various studies have been carried out on children's perception of school curricular concepts, mainly in Science Education and at secondary education level, it is evident that much focus has been on children's general awareness on different environmental issues such as water and energy sources but very little has been done on children's perception of the concept of environment in totality, that is, the environment taken as a single unit. There is, therefore, little research literature to inform the environmental stakeholders' understanding of how others such as the pupils, students and colleagues conceptualize Human-Environment relationships (Alaimo and Doran, 1980).

The environmental knowledge learners have from home experience has not been much studied especially in Kenya, yet being a society where customs and traditions are still salient forces, it would be important to find out the extent to which the learners carry such traditional beliefs/knowledge about the environment into the formal school system and what possible effects such beliefs/knowledge would have in their understanding of the environmental concepts infused in the school curriculum. The constructivist theory of knowledge acquisition has not been employed by many researchers in the field of Environmental Education, yet from its point of view "Environment" is not something that can be separated from humanity and its surrounding. Instead, constructivism considers environment to be understood as the interactions within the mind between the biophysical surroundings and the social, political and economic forces that organize humanity in the context of these surroundings (Robertson, 1994:29).

From the identified gaps in the current research practices in Environmental Education, this study endeavours to emphasize on the educational situation of environmental education studies that would guide the stakeholders to adjust their approaches that are appropriate to the teaching of infused environmental concepts in various subjects in the school curriculum. The learners would in turn, improve their understanding of the concept of environment for better environmental sustainability strategies.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter focuses on the research design and the methodology adopted. It begins by outlining the samples used and the criteria for their selection. It describes the research instruments that were used and the procedures for their administration to the target population. Finally, it briefly outlines the methods adopted in the analysis of data.

3.2 Sample Description and Selection Criteria

The research samples' description and their selection criteria are based on the sampling of the content of study, the study area, the schools involved and the target population.

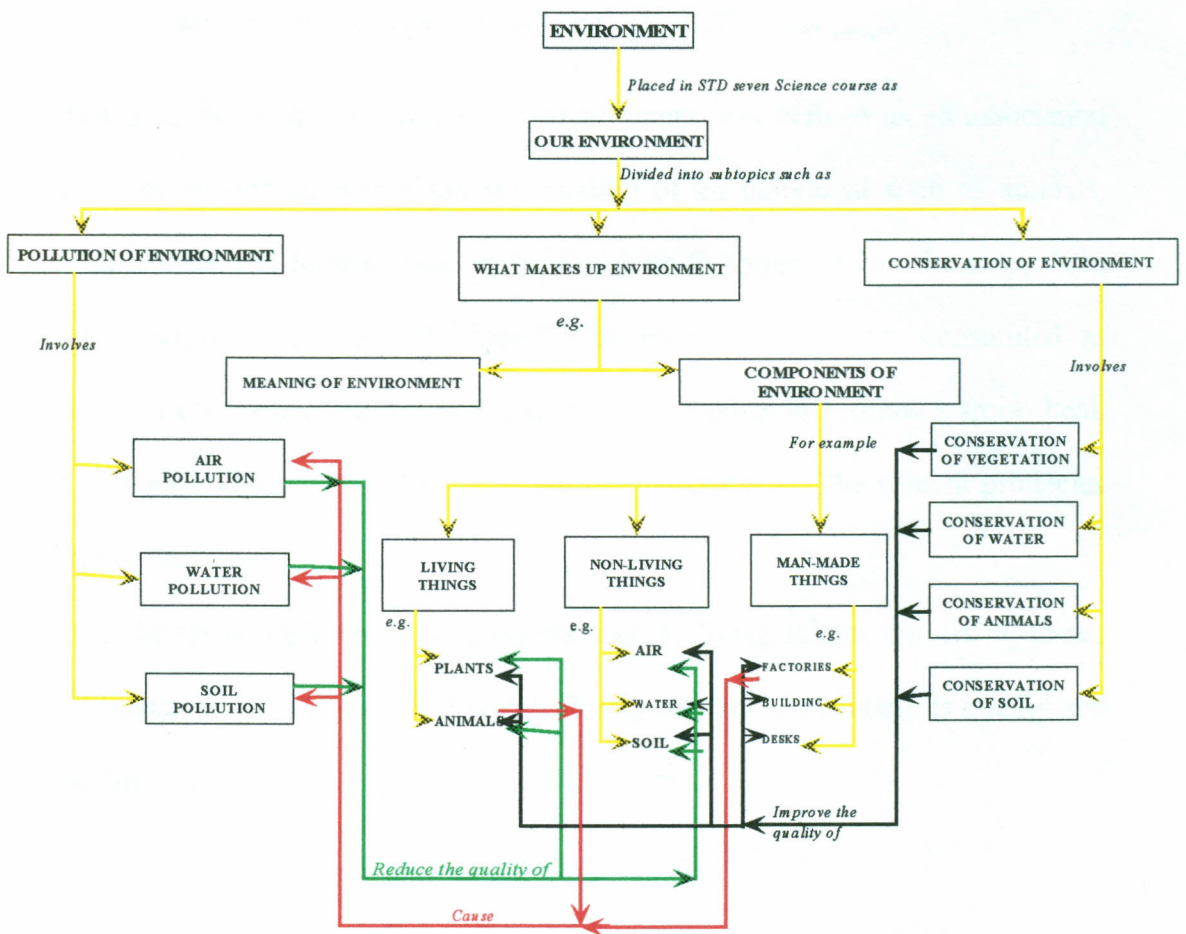
3.2.1 The content of study

The content of study was based on unit three "Our Environment" in the Standard Seven Science Course (KIE, 1993:16). The topic "Our Environment" is broadly divided into four areas: meaning of environment, components of environment, pollution of environment and conservation of environment. Six members of the Primary Science panel of Rongo Division and three Primary Science tutors from Asumbi, Kamagambo and Migori Teachers' colleges were chosen to assist in the study, on the Primary Science issues. This team was chosen because of their experience in Primary Science course, for example, the Primary Science tutors from colleges train the teachers who teach the course in primary schools and the panel




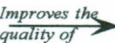



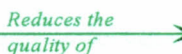
members of Primary Science are experienced teachers who have taught the course for at least seven years.

The team reviewed the topic “Our Environment” in the Standard Seven science syllabus and listed the key ideas that are reflected in the topic. Such ideas were later modified through discussion on the intended focus of the syllabus until a more inclusive concept description was agreed upon. Multiple concept maps were drawn to indicate the relationship of various ideas on the concept of environment as outlined in the Standard Seven science syllabus. The final concept map is shown in Figure 3.1.

Figure 3.1: The Concept Map of the Environment as outlined in Standard Seven Science course.



Key:

1.  Association of ideas within the concept of environment, for example.
 A B Idea B is an example of broad idea 'A'. An example in the above figure 3.1 is Components of environment (A) has such an example like living things (B).
2.  Association of ideas between the conservation of environment and the components of the environment, for example conservation of water
 *Improves the quality of* animals.
3.  Association of pollution of the environment and the components of the environment, for example factories  *cause* water pollution .
4.  Association of pollution of the environment and the components of the environment, for example soil pollution  *Reduces the quality of* plants.

Based on this map, the concept of environment was defined as an association that involves everything within the surrounding of an individual such as animals, plants, air, water and human-made entities such as factories. From the map, three content principles concerning the topic "Our Environment" were constituted as guidelines to conducting pupils' investigations and analyzing responses from them, based on their understanding of the concept of environment. The content principles are summarized thus:

- Environment is made up of components such as living things, non-living things and human made entities, all of which closely interact to maintain its quality and stability.

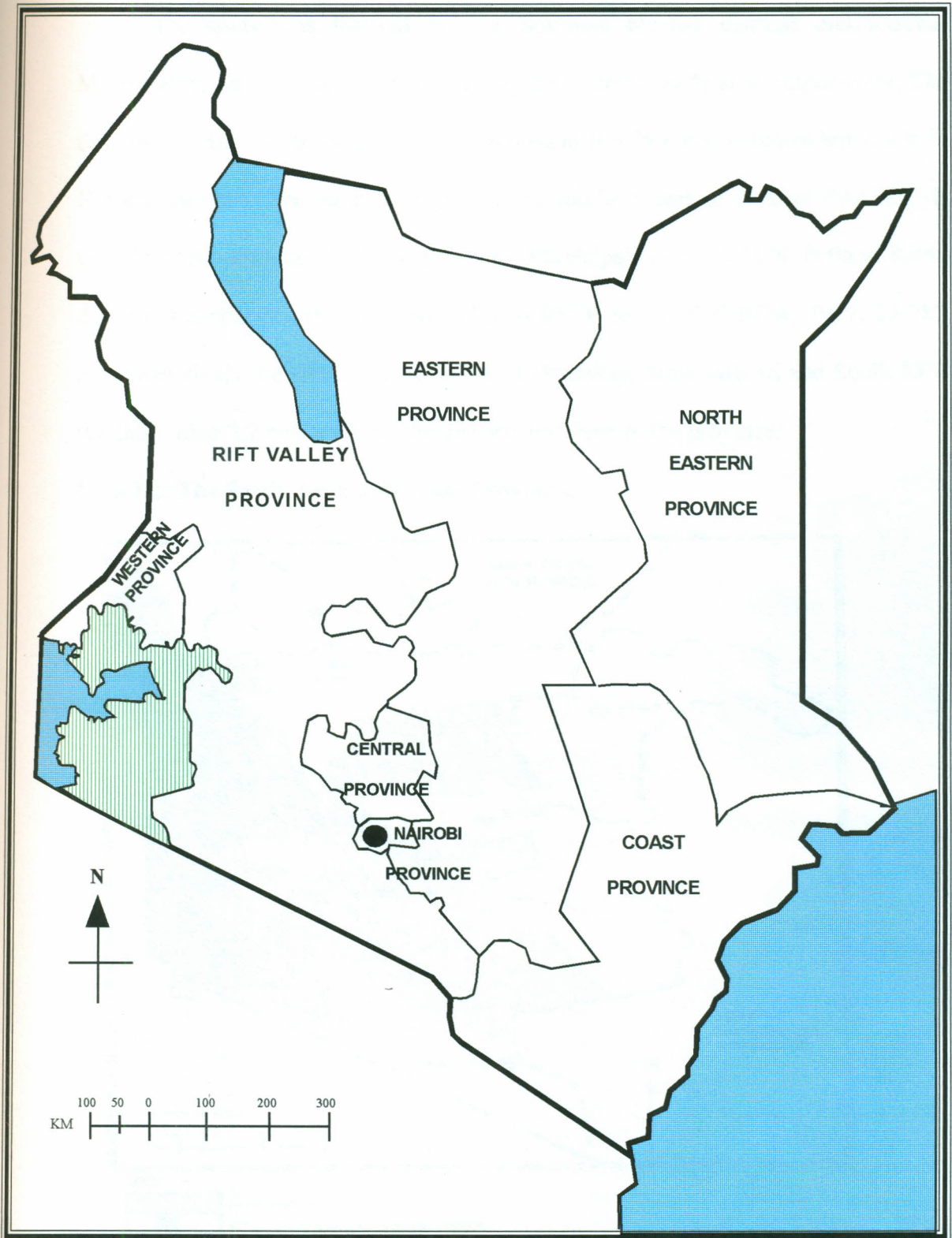
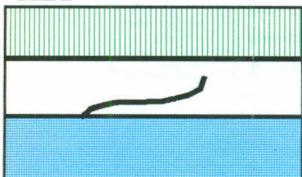
- The quality and stability of the environment can be altered when some components (e.g. animals such as Human beings) cause pollution or any disruption in the state of their association.
- The stability of the environment's quality can be maintained (or restored, if already been interfered with) by the process of conservation of the affected components such as plants, animals, water, air and soil.

The topic "Our Environment" was chosen because it is the only one in the Primary School Curriculum that describes the environment as a holistic concept. This author, was involved in the development of population and family life education curriculum in late nineteen eighties, where several workshops with Primary and Secondary school teachers were held. One striking observation made was that many teachers perceived environmental destruction as an activity that takes place far away from their homes and schools. Some understood it to be taking place in big forests (e.g. Kakamega and Mt. Kenya), where trees are cut for timber; and in big farms especially in drier parts of the country. Over ten years now, it has remained a motivating force that has led the author to investigate what the pupils understand by the concept of environment. Since this content "Our Environment" is placed in science course in Standard Seven, it was also the basis of the choice and focus on Standard Seven pupils.

3.2.2 The Study Area

This study was based in Nyanza Province that is located in the Western part of Kenya, as shown in Map 3.1 below. Nyanza Province was chosen because it has varied ecological zones, which represent geographical variations in Kenya.

Map 3.1: The Provinces of Kenya.

**KEY**

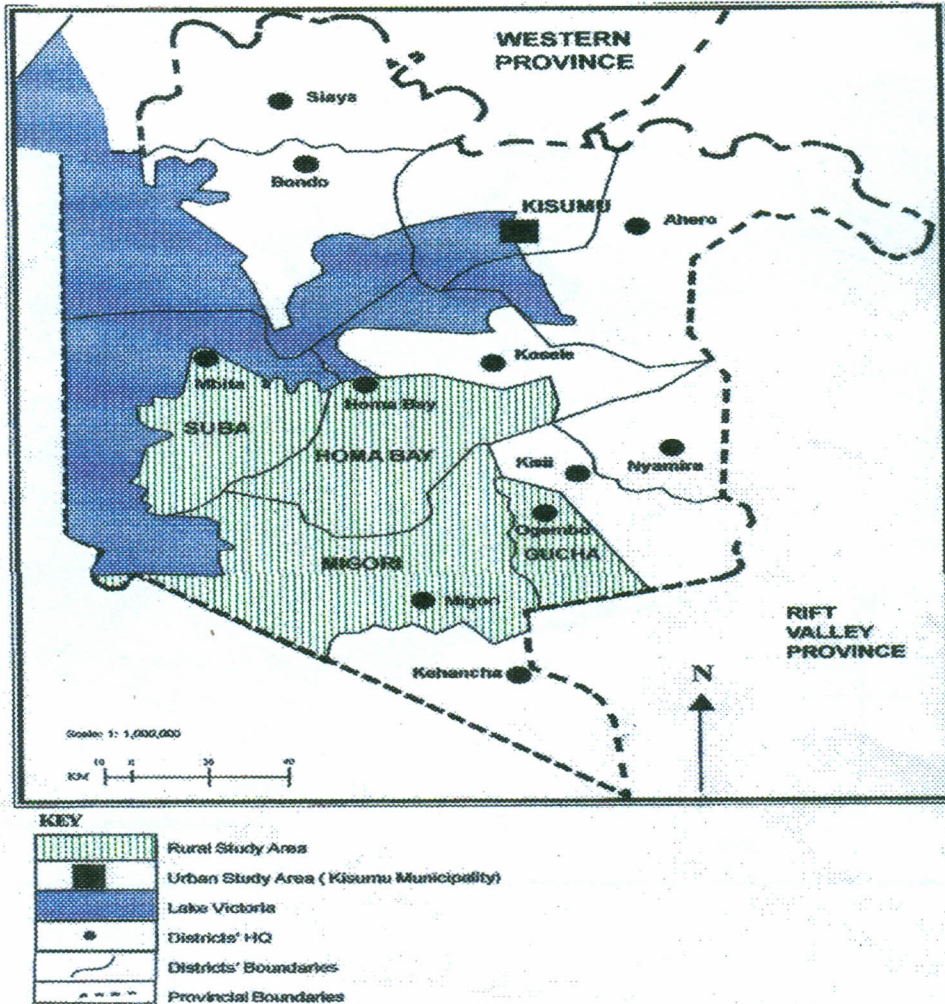
Nyanza Province

Provincial Boundaries

Water Masses in Lakes and Ocean

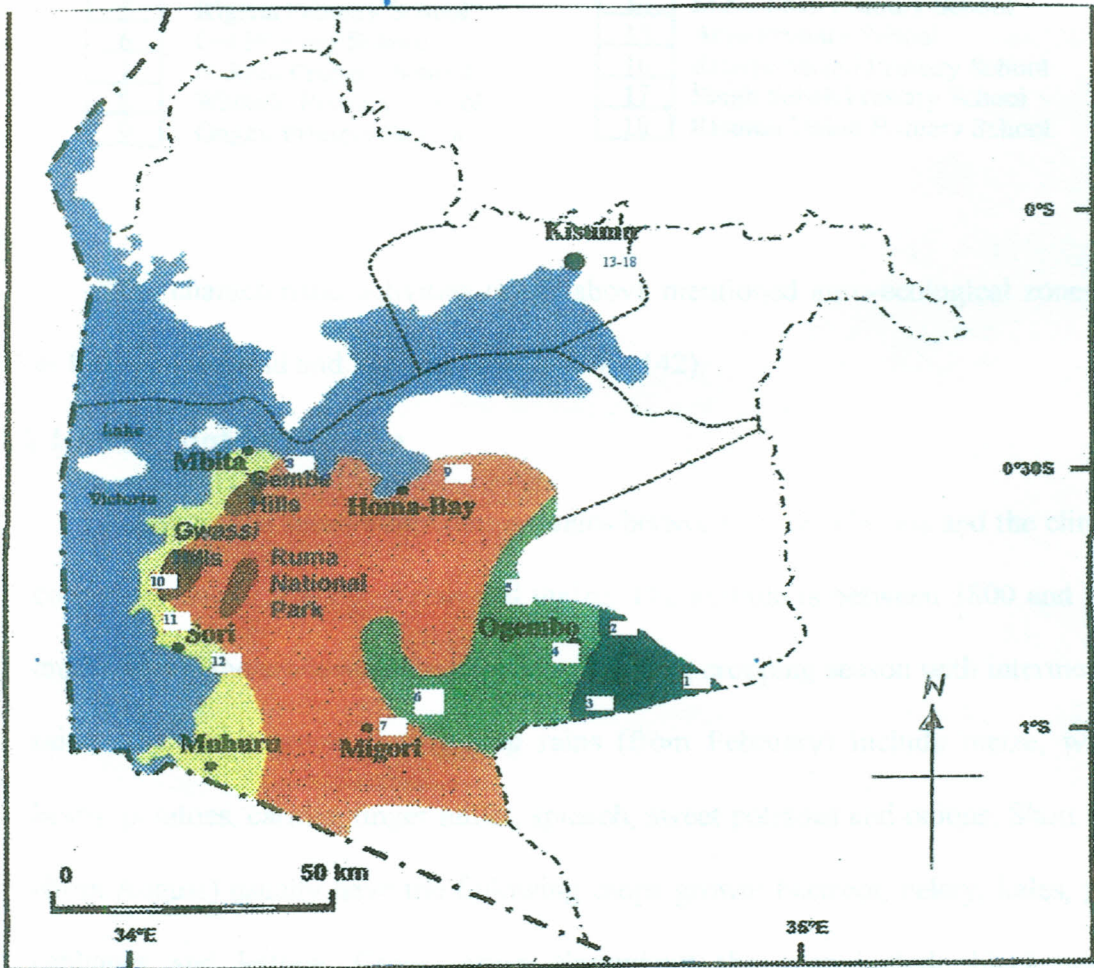
The study was focused in four Southern Nyanza districts and Kisumu Municipality, representing the rural study area and urban study area, respectively. The four chosen districts from the province represent the four major ecological zones in Nyanza province. The study area lies in the southern part of Nyanza Province. It extends from latitude 0.15° S (Kisumu Municipality) to 1.18° S (Migori-Kuria districts' boundary) and from longitudes 34.05° E to 35° E (LBDA, 1987: 23-28). Administratively the area covers districts of Homabay, Suba, Migori and South Kisii (Gucha) .Map 3.2 below shows the districts involved in the province.

Map 3.2: The Study Area in Nyanza Province:







The study area has four main agro-ecological zones: lower highland, upper midland, and lower midland-semi humid and lower midland-semi arid (Jaetzold and Schmidt, 1982: 134-142). Such zone groups are temperature belts defined according to the maximum temperature limits within which main crops in Kenya do flourish. For example, tea does better in lower highlands, arabica coffee in upper midland, and sugar cane in lower midland zones. The Agro-ecological zones are shown in Map 3.3 below.

Map 3.3 The agro-ecological zones in the study area: Nyanza province



Key to Map 3.3 on Page 40

	Lower Highland Zones
	Upper Midland Zones
	Lower Midland (Semi Humid) Zones
	Lower Midland (Semi Arid) Zones

1 - 18	Schools involved in the study
1	Magena Primary School
2	Kemoreko Primary School
3	Omobera Primary School
4	Tendere Primary School
5	Rigena Primary School
6	Get Primary School
7	Kakrao Primary School
8	Waondo Primary School
9	Ongeti Primary School

10	Nyatambe Primary School
11	Sori Lakeland Academy
12	Sori Primary School
13	Aga Khan Primary School
14	M.M. Shah Primary School
15	Arya Primary School
16	Kibuye Mixed Primary School
17	Singh Sahah Primary School
18	Kisumu Union Primary School

The characteristic activities in the above mentioned agro-ecological zones are as follows (Jaetzold and Schmidt, 1982: 134 - 142).

3.2.2.1 Lower Highland Zone

The annual mean temperature ranges between 15-18° Celsius and the climatic conditions favour tea, pyrethrum and maize. The altitude is between 1800 and 2300 meters above the sea level. The zone has very long cropping season with intermediate rains. The crops grown during long rains (from February) include maize, wheat, beans, potatoes, carrots, finger millet, spinach, sweet potatoes and onions. Short rains (from August) usually have the following crops grown: beetroot, celery, kales, peas, cabbages and lettuce. Crops grown throughout the year include black wattle, pyrethrum, tea, passion fruits, strawberries and avocados. Dairy cows are fed on

Kikuyu grass, tufted grass and Louisiana. In the study zone this area covers Mugonga, Nyamache and Kenyenya regions of South Kisii (Gucha) district.

3.2.2.2 Upper Midland Zone

The annual mean temperature is between 18-21° Celsius and the climatic conditions favour the growth of tea, arabica coffee and maize. The altitude is between 1300 and 1800 meters above the sea level. The zone has both long cropping and medium seasons. Crops grown during long rains include: sweet potatoes, cabbages, kale, "Rinagu", finger millet, sorghum, onions, spinach, tomatoes, and carrots. Short rainy seasons have crops such as sunflower, beans, soya beans, kales, onions, tomatoes and finger millet. Crops grown throughout the year include: arabica coffee, tea, citrus, bananas, eggplant, passion fruits, liquats, pawpaw, guava and avocado. Dairy cows are fed on star grass, napier and banana leaves. In the study area, this zone embraces the rest of South Kisii (Gucha) district, Rongo, Awendo and Uriri regions of Migori district and Gwasi hills, Gembe hills and Ruma National Park-Forest reserve in Suba District.

3.2.2.3 Lower Midland-Semi Humid

The annual mean temperature is between 21-24° Celsius and the climatic conditions are good for maize, cotton and sugarcane. The altitude is between 800 – 1300 meters above the sea level. The long rains have the following crops grown: maize, sorghum, finger millet, beans, pigeon peas, groundnuts, sunflower, tomatoes, onions, tobacco, cotton, sweet potatoes, Soya beans and millet. During the short rains the crops grown include: cassava, pawpaw, bananas, sugarcane, pineapple, sisal, citrus, mangoes and cabbages near swamps. Dairy cows are fed on savanna zebra

grass, napier grass and banana leaves. In the study area this zone is located in Homabay district and parts of Suba and Migori districts.

3.2.2.4 Lower Midland-Semi Arid

The annual mean temperature is between 21-24° Celsius and the climatic conditions favour millet, cowpeas and sisal. It is generally regarded as the livestock-millet zone for it has low-density traditional grazing livestock especially in Muhuru, Sori and Sindo region. The altitude is below 800 meters above the sea level. It has only one rainy season (from March) and crops grown include: sorghum, bulrush-millet, foxtail millet, tepary beans, green grams, chickpeas, soya beans, sunflower, groundnuts, cowpeas, pigeon peas, sweet potatoes, tomatoes, onions and katumani maize. Crops grown throughout the year include: jojopa buffalo guards, marambe beans, cassava and vegetables along the Lake Victoria shores by irrigation. For pasture, there are trees and shrubs for browsers (goats) and scattered grass for semi-arid livestock conditions. In the study area this zone covers the Lake Victoria shores from Muhuru Bay in the South to Mbita point to North West, through the Karungu Bay (Sori).

3.2.3 Schools Involved in the Study

In the year 2000 when the study was conducted in Nyanza province, the province had 3,455 primary schools with classes one to eight. The four districts of interest and Kisumu Municipality had 1,237 primary schools of the same level, out of which a sample of the eighteen schools was selected by use of the stratified random procedure based on the 1998 Kenya Certificate of Primary Education (KCPE) results from the four districts' merit lists. (PDE Statistical Report, Nyanza, 2000) This was

so because it was the most recent mass grading of all schools in the districts. The merit list of schools in each district was sub-divided into three, that is, the first third set, the second third set, and the last third set of schools, based on the schools' performance in 1998 KCPE.

From each agro-ecological zone in the rural study area, three schools were sampled. One school, of the three, was sampled from each set of schools as outlined above. This was done to include all categories of schools, in terms of their performance, in the study. A total of twelve schools were involved in the study area. From Kisumu Municipality, a total of six schools were sampled based on their performance and exposure to the immediate rural community. The sampled schools showed little influence from the immediate rural community as observed by the Municipal Education Department. This was aimed at using urban influenced pupils only. The distribution of involved schools in the study is shown in Map. 3.3 on pages 40 and 41.

3.2.4 The Pupils' Involved in the Study

The eighteen schools in which the study was carried out had an enrolment of 536 Standard Seven pupils, out of which 288 pupils were involved in the study. From each school sixteen Standard Seven pupils, eight boys and eight girls were sampled by the stratified procedure. This was to ensure an equal representation of the ability range in the respective schools, as it was based on each school's list of merit that was used for the pupils' promotion from Standard Six to Standard Seven. Although girls and boys were not equal in number in all schools, sampling procedure selected equal

numbers from each school because gender was one of the independent variables in the study.

3.2.5 Other Respondents Involved in the Study

Other respondents in this study included the head-teachers, Standard Seven science teachers and the cultural opinion leaders from the Gusii and Luo communities. The head-teachers and the Standard Seven science teachers were sampled from the involved schools, and the study therefore involved eighteen head-teachers and eighteen Standard Seven science teachers respectively.

The sampling of the cultural opinion leaders started from one that the researcher was introduced to by the local chief. The rest were selected purposively through the introduction by the other to the researcher during the fieldwork. From each community, Gusii and Luo, six cultural opinion leaders were identified. Special preference was given to those whom the community knew about their contribution in the local area, and to those who were once teachers, chiefs and agricultural extension officers. Such were believed to be able to reflect back on how their communities interacted with the environment in their traditional lifestyles.

From the above sample description the study involved 288 Standard Seven pupils; twelve cultural opinion leaders from the two rural communities; eighteen Standard Seven science teachers and eighteen head teachers of the involved schools. The study had a total of 336 respondents as shown in Table 3.1 below.

Table3.1: Number of Respondents involved in the Study by Agro-Ecological Zones/Districts:

Agro-Ecological zone/ District	Lower Highland (Gucha or South Kisii District)	Upper Midland (Gucha, Migori And Suba Districts)	Lower- Midland (Semi- Humid) (Migori, Homa-bay and Suba Districts)	Lower- Midland (Semi- Arid) (Migori and Suba Districts)	Kisumu Municipality	Total
Number of Head- Teachers	3	3	3	3	6	18
Number of Standard Seven Science Teachers	3	3	3	3	6	18
Number of Cultural Opinion Leaders	3	3	3	3		12
Number of Standard Seven Pupils	48	48	48	48	96	288
Total	57	57	57	57	108	336

3.3 Research Instruments

The study involved the use of four research instruments for different respondents. These included: questionnaires for the school head-teachers and Standard Seven science teachers; interview schedules for the communities' cultural opinion leaders; multiple choice Science test for all the pupils involved in the study, and

Environment Apperception Test (EAT) accompanied with Clinical Interview for half of all pupils involved.

3.3.1 Questionnaires

The questionnaire for the head-teachers sought information about the professional qualifications and experiences of the Standard Seven science teachers in their schools, including the interaction between their schools and the immediate community with regard to environmental management.

The questionnaire for the Standard Seven science teachers sought to establish their general concern about the environment; awareness of the content of Standard Seven science syllabus, especially the coverage of the topic "Our Environment" in various books; awareness of the ideas that the pupils bring from their home backgrounds to their classroom situation; and concern and commitment in the teaching of environmental concepts in the curricular carrier subject that is Primary Science. The team of primary science teachers and tutors was involved in the development of the questionnaire.

3.3.2 Interview Schedules

Interviews were conducted to seek the views of the cultural opinion leaders among the Gusii and the Luo communities in the rural study area. The interviews were to establish the indigenous meaning these communities have about the concept of environment. In particular, the interviews were to bring out the communities' cultural viewpoint on the concepts of the components of environment, the environmental management principles and the place of human race in the web of environmental interactions.

Again the development of the interview schedules involved the participation of the team of primary science teachers and tutors in the study. Further, review was done after the pilot study carried out in four schools in both Nyamarambe Division of Gucha District and Rongo Division of Migori District. The team assisted to reword and reform a number of questions after the pilot exercise. The final questionnaire for the head-teachers is attached as (Appendix I); the questionnaire to the Standard Seven science teachers is attached as (Appendix II) and the interview schedule for the communities' cultural opinion leaders is attached as (Appendix III).

3.3.3 The Science Test

The multiple choice Science test was set by the researcher and the question items were drawn from several trial tests from various districts across the country. The test items were based on the content of the topic "Our Environment" in Standard Seven science course. Specifically, they focused on the meaning of environment; components of the environment; and the conservation of the environment. This test was administered before the EAT – Clinical Interview combination. This was to enable the researcher to map out areas where the pupils had difficulty in understanding the concepts included in the topic "Our Environment" in the Standard Seven Science course. After the science test the researcher had the advantage of probing further during the interview, the identified areas of difficulty in the science test. Through the assistance of the team of science teachers, the original number of thirty questions was reviewed and in turn reduced to seventeen. The instrument is attached as (Appendix IV).

3.3.4 The Environment Apperception Test

The Environment Apperception Test (EAT) is an instrument that is used for obtaining responses from individuals along specific areas that are investigated, for example, how learners perceive curricular activities presented to them in the classroom.

The EAT instrument is commonly used by researchers in environmental perception studies. Its principles were adapted from the Children's Learning in Science project, where the children's cognitive structure was probed, in Leeds University, England. In this study, The EAT principles have been adapted to probe the Standard Seven pupils' understanding of the concept of environment. EAT instrument involves the use of pictures or photographs which are often used to show local scenes and events that appear to evoke responses that relate to people's roles, and behaviour directly (Whyte, 1977:53). Usually the photographs are used in sets of between three and six, and when taken together they show a range of scenes common to a particular issue, for example, the quality of a given environment.

The presentation of the photographs to the respondent is concurrently supplemented by the use of a Clinical Interview. A Clinical Interview involves the interviewer and one respondent at a time. The use of Clinical Interview as a supplement to EAT is preferred because during the interview the pupils' initial answers to the presented questions are probed further. This is important because the purpose of a Clinical Interview is to establish the reasoning the respondent uses to reach a solution. Further more it allows the interviewer to give the respondent a chance to provide an explanation to the answers given.

The assessment of the learner's knowledge through a combination of EAT and Clinical Interview provides a more comprehensive picture of the learners' understanding of concepts and conceptual relationships than frequently used techniques such as questionnaires and multiple choice tests (Brody and Koch, 1990: 24). This combination of assessment techniques has been used with success in assessing pupils' knowledge where the focus is to probe their cognitive structure in a narrowly circumscribed area of study (Adeniyi, 1985:313).

The content validity of the photographs used was established through the involvement of the team of primary science teachers. Each member of the team was given twelve photographs, with four of the twelve focusing on each of the following content principles: the components of the environment; pollution of the environment and conservation of the environment. The team members were asked to rate each photograph on such criteria as: ability to illustrate the issues defined, how obvious the depicted issue was, and the degree of aesthetic appeal.

While the first of the three criteria was most important, the second was used to eliminate photographs, which were too obvious and hence, might reduce disparity in pupils' responses. The third criterion was used to eliminate wayward responses related to form, contrast, colour or composition. The original twelve photographs were finally reduced to three by totaling the scores for all the photographs on the three criteria and selecting those with the highest scores on the first criterion and more moderate scores on criteria two and three. The three photographs used in this instrument, therefore, represented the most suitable of the twelve in illustrating the

desired environmental issues as pertains to the topic "Our Environment" within urban and rural school settings. The EAT instrument is attached as (Appendix V).

3.4 The Administration of the Research Instruments

Prior to the data collection process, the study area was visited to establish the schools, respondents in the schools and the communities' cultural opinion leaders. This was followed by a pilot study. All these activities were to familiarize the researcher with the modes of instruments' administration and to sharpen the instruments. The researcher administered all the instruments to the respondents personally. It was during the interview of the communities' cultural opinion leaders who could neither speak English, Kiswahili nor the researcher's mother tongue, that a research assistant was used as an interpreter.

The questionnaires to the head teachers and Standard Seven science teachers were administered in their respective schools during school visits. The questionnaires were handed to the concerned, followed by a brief explanation on how to answer the questions. The respondents were requested to respond to the questionnaires at their pace while the researcher was interviewing the pupils in the same school. At the end of the school's visit, the questionnaires were collected from the respondents. It was only in five schools, where the school head teachers had commitments and had to send their responses by post later.

The interview schedules to the cultural opinion leaders among the Gusii and the Luo communities were conducted in the respondents' homes. Appointments were made with the respondents prior to visiting them. On the visiting day, a quiet place was identified and the researcher and the respondent spent about forty-five minutes

discussing the issues in the interview schedule. During this period the respondents were asked questions such as: state the synonymous words or phrases to the concept of environment in your mother-tongue; what environmental conditions were looked for when one wanted to establish a homestead in your traditional community? and how were environmental components such as forests (on hills) water sources (e.g. rivers) and land (e.g. pasture) conserved in your traditional community? Each question item in the interview schedule had spaces in which the responses were written and the interviewer filled for each respondent as the interview progressed.

The science test to the pupils involved in the study was administered in their respective schools. The school's science teacher and the researcher explained to the pupils the reasons for the test. The pupils, seated in a classroom, were given a question paper in which they were to tick what they considered were the correct answers. The researcher invigilated the exercise and later collected the papers for scoring. The researcher later marked the papers.

The Environment Apperception Test (EAT)- Clinical Interview combination was conducted on 144 pupils who represented half the total number of pupils involved in the study. This was because the exercise was very involving and would involve repeated responses from the pupils and the 50% of repetitions was considered sufficient. Appointments were further made with the school administration prior to the visiting the school for this activity. A comparatively quiet and isolated site was identified in each school for the activity. The pupils were interviewed in turns. The pupil was seated on the same side of the table as the interviewer and the tape recorder was placed between them.

The existence of tape recorder and the purpose of the activity were explained to the pupils since the deliberations were to be tape recorded for later transcription. Each pupil was presented with three different photographs, each depicting one of the following scenes:

- A school environment with features such as school buildings, latrines, pupils weeding flowers, trees, flag post and teachers.
- Sewage wastes being poured into a flowing river.
- Pupils planting and watering paw-paw seedlings on a bare ground in a school compound, being supervised by two teachers.

Every time, for each photograph, the pupil was asked to explain what was presented in the photograph. The details of the question items are given in Appendix V. Further questions were asked based on the ideas that arose from the pupils' responses. The activity took averagely forty minutes with each pupil.

At the end of the exercise in each school, the researcher completed a transcription sheet for each pupil based on the pupils' taped responses, through the audiotape. The transcription sheet was divided into three parts corresponding to the three major content principles on the topic "Our Environment." Within each content principle, the pertinent ideas were identified and scored on the transcription sheet. The scoring was based on a five-point scale, where the score of five denoted the highest level of understanding and the score of one the lowest, Table 3.2 on page 52. On the scoring sheet, the score of the pupils' understanding on each of the content principles was supported by the pupils' direct responses, statements or assertions. In addition to the pupils' score on the content principles and the supporting evidence on

the sheet, space was provided under “deduction” for the interviewer to include notes on specific conclusive remarks on the pupils’ understanding of the concept of environment. The Transcription sheet is attached as (Appendix X).

The administration of Environmental Apperception Test-cum-Clinical Interview was repeated on the same pupils, six months later. This was after the topic “Our Environment” in Standard Seven science course had been formally taught to the pupils. This was to establish the increased knowledge of the pupils on the concept of environment as well as to establish if there was any effect of the pupils’ prior knowledge on the concept of environment in their understanding of the environmental ideas as taught under the topic “Our Environment” in Standard Seven science course.

The team of science teachers checked on the teaching materials such as schemes of work, lesson plans and record of work, for the involved Standard Seven science teachers. This was to establish the degree of content coverage by the teachers. The team further analyzed the Kenya Certificate of Primary Education (KCPE) past papers, between 1985 to 2000, on primary science question items. This was aimed at assessing the extent of evaluation of the infused environmental concepts in science course, in the national examination.

3.5 Analysis of Data

The analysis of data was based on the objectives of the study as outlined in Chapter One. Data analysis was done with reference to selected independent variables such as sex, residence status (urban or rural), the agro- ecological zonation of the pupils’ schools, education and economic status of the parents of the pupils. Any

relationships that could be useful to the pupils, teachers, educational planners and any other stakeholders were outlined.

The responses from the head-teachers and the Standard Seven science teachers were analyzed to establish the pupils' learning situation. The responses from the interviews with the community cultural opinion leaders were analyzed to establish the respective communities' indigenous meaning of the concept of environment. All these were to establish the background of the pupils' learning situation and the sources of their prior-knowledge as the contributing factors in their teaching-learning process as earlier spelt out in the theoretical framework of the study in Chapter Two.

The taped responses of the pupils in EAT and Clinical Interview were transcribed and analyzed as follows: For each question a separate master-list of responses was compiled; each question's master list was further scrutinized to establish the responses which had the same meaning or most nearly the same; a short list including all different answers that were given by the pupil was built for each question; from the master-list of each question a tally was made of the number of times each response was given; a table showing the variety of responses to each question as well as the number of respondents making them was constructed; and a bar graph was plotted for each question to show the distribution of pupils' responses. The sections of the responses relevant to each of the content principles: components of environment; pollution of the environment; and conservation of the environment as outlined in the topic "Our Environment" for Standard Seven Science course, were examined and scored on a five-point scale as shown in Table 3.2 below.

Table 3.2: The Scale of Pupils' Responses Scores in EAT Instrument:

Pupils' Responses	Scores
i. Responses in which pupils recognized and expressed between 76-100% of ideas in the content principle appropriate at Kenya Certificate of Primary Education (KCPE) Level.	5
ii. Responses in which pupils recognized and expressed between 51-75% of ideas in the content principle appropriate at KCPE level.	4
iii. Responses in which pupils recognized and expressed between 26-50% of ideas in the content principle appropriate at KCPE level	3
iv. Responses in which pupils recognized and expressed between 1-25% of ideas in the content principle appropriate at KCPE level.	2
v. Responses in which pupils showed no grasp of any idea in the content principle appropriate at KCPE level or "I don't know" answers.	1

Prior to the scoring, the team of primary science teachers and tutors; and the researcher evaluated and scored several sample EAT- Clinical Interview responses from the pilot study. In addition, randomly selected responses from the live samples were evaluated and scored by individual team members. The scorers' ratings were compared to determine the consistence in scoring of the pupil's responses and hence the reliability of the scorers' ratings. In addition to raw scores, the mean scores of the pupils on each question item of the three content principles were calculated. The percentage of pupils who scored four or five and those who scored one or two were established.

This study used both qualitative and quantitative data. The qualitative data addressed the notification of pupils' correct concepts and the missing concepts for each concept principle, whereas the quantitative dealt with scoring of pupils' responses for statistical inferences. This approach provided two complementary perspectives of the pupils' understanding of the concept of environment. All the tabulations and the analyzed data are presented in the next chapter.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter is concerned with the results obtained from the investigation in the form of data presentation and analysis. These are then discussed in the context of the objectives earlier stated in Chapter One. Presentation, analysis and discussion of the findings are organized under the following subtitles: the concept of environment in the indigenous knowledge of the Gusii and the Luo communities in Nyanza province; the prior knowledge of Standard Seven pupils on the concept of environment; the sources of Standard Seven pupils' prior knowledge on the concept of environment; the effects of Standard Seven pupils' prior knowledge in their understanding of the concept of environment when it is formally taught; and differential understanding of the concept of environment among Standard Seven pupils of different backgrounds. After data presentation and discussion, a summary of the findings is provided, highlighting the major results, the details of which are given in the following paragraphs.

4.2 The Communities' Indigenous Knowledge on the concept of Environment

The communities' indigenous knowledge on the concept of environment was investigated among the Gusii and the Luo of Nyanza province. The overall objective in this area of study was to establish: the communities' understanding of the concept of environment in their indigenous knowledge; the environmental conditions that were looked into for one to establish a homestead; the environmental conditions that could make people migrate from one place to another; and how human beings' traditional

lifestyles related to the environment based on interview schedule in appendix iii on page 161. From each community (Gusii and Luo) six Cultural Opinion Leaders "COL" were contacted, interviewed personally and the findings are summarized below: -

4.2.1 The Gusii Community

The Gusii Community occupies the Kisii highlands in Eastern part of Nyanza province. It covers the highest altitude areas in the province. The community has words that depict the concept of environment, for example "*Orogongo*" which refers to a region that encompasses location of about five square kilometres in area; and "*Ekenyoro*" that alludes to a surrounding such as a school community. "*Orogongo*" is wider than "*Ekenyoro*" in area coverage but both words are used to describe what the community understands to be an environment.

Among the traditional society of the Gusii community, the establishment of a homestead was a culturally held event that involved consultation with the elders. Such consultation was based on the belief that the elders had knowledge or information about the conditions of weather, soil fertility and social security of the surroundings in which they lived. The environmental conditions that the Gusii community members looked into for the establishment of a new homestead included; the security from the warring neighbours such as the Masai and the wildlife; availability of water and firewood for domestic usage and the agricultural productivity of the surrounding land.

The Gusii community is neighboured by the Masai to the East, the Kuria to the South, the Luos to the West and the Kipsigis to the Northeast. Of all these neighbours the traditional Gusii community had had incidences of cattle stealing from either side. On the other hand, the Masai had a notable warlike invasions on the Abagusii and

therefore were considered as warring neighbours. Most of the Cultural Opinion Leaders, interviewed, narrated the incidences in which the Masai invaded the Gusii community for their cattle and many people lost their lives. Such incidences have recurred upto very recently in the name of tribal clashes between the Gusii and the neighbours such as the Masai, the Kipsigis, the Luos and the Kuria.

The wildlife that had negative contacts with the Gusii community included lions, hyenas, elephants and hippopotamuses. The lions and hyenas invaded the Gusii for their domestic animals and since traditional Gusii community members were herders any interference with their animals could not be taken for granted. The Gusii community therefore preferred to establish new homestead in locations where minimal contact with warring Masai community and wild animals could be achieved.

Gusii community, living on hilly Kisii highlands, resides generally far from major water sources such as Lake Victoria and major rivers in the region namely Kuja, Miriu, Mara and Migori. On the other hand, some of the above rivers, for example, river Kuja have their sources in Kisii highland. In the highlands it is referred to as river Gucha and it traverses from Nyamira, Central Kisii and South Kisii (Gucha) districts. Water is a necessary resource for both human needs and watering of the domestic animals. The Gusii community desired to live in regions that had streams that formed the sources of major rivers in Nyanza province, for example, rivers Gucha and Omogonga.

Firewood was the source of energy in traditional Gusii community for both cooking and keeping houses warm in cold nights. The community relied on natural vegetation, some of which could be cut down to clear new areas for agricultural practices. The harvested firewood could be taken home by the women and stored for future use.

The community preferred the slopes of Kisii hills, where such firewood could be got in plenty.

The community members are basically farmers and their basic requirements include fertile and productive land for growing crops such as bananas, finger-millet and traditional "rinagu" and "chinsaga" vegetables. The coming of missionaries brought in other crops such as maize, tea and coffee. (Neigus, 1971: 58-80). Farming has remained the practice of Gusii community and therefore the members preferred localities that would allow them do effective farming.

Since almost all parts of Kisii highlands is of productive volcanic soil and the community's requirement of productive farm land could easily be achieved, the traditional Gusii community members found it very difficult to move outside their ancestral land for settlement. This continued until the area was over-populated in the mid of 20th Century, forcing them to move out in search for farming lands elsewhere. (Neigus, 1971: 62 - 80).

In addition to the above conditions, the Gusii community preferred localities that had low known prevailing diseases. This could make them avoid the disturbances from diseases outbreaks as they had not established methods of controlling or preventing them.

The relationship between the members of the Gusii community and environment is based on the understanding that the male human beings are the leaders in all aspects of the socio-cultural operations of the community. To the traditional Gusii community the word 'people' refers to men (male human beings). Men are regarded as the owners of all other things within the surrounding, including the women. The women are brought into the community's homesteads in exchange with cows in marriage covenants. They are

therefore perceived as men's property since they are "bought" into the homes through the exchange with cows. The men are to loose property in form of cows to get women. The men therefore own the community's properties such as land, domestic animals and households.

Since the Gusii traditional community understood the environmental components such as land, vegetation and water bases (e.g. rivers) as the properties of a community, especially of men (male), it therefore follows that men have direct control over the environment. On the other hand, both men and women have direct contact with the physical world. For example, the women till the land for food, fetch water and firewood while men take care of other aspects of the environment. The humanity therefore has direct interaction with nature and yet the Gusii community only stresses the part of men as the caretakers of the environment which is considered as their property.

4.2.2 The Luo Community

The Luo community inhabits the Lake Victoria shores to the West, North and Central parts of Nyanza province. The community occupies about 75% of the province, stretching from the lowest altitude around the Lake Victoria shores to higher altitudes of Gwasi hills in Suba district and Kabondo division in Rachuonyo district.

The community has two basic words that are used in reference to the concept of environment. These words include "*Gweng*" which refers to an area of about two square kilometres or an equivalent of a sub-location. The other is "*Aluor*" that refers to the surrounding of a homestead. "*Gweng*" is wider than "*Aluor*" in area coverage.

Among the traditional Luo community the environmental conditions that are looked into for the establishment of a new homestead and the conditions that would make

families to migrate from one area to the other tend to be the same. Such conditions include the availability of land for various purposes, such as pasture, crop production and shelter construction; the availability of water for domestic usage and watering of animals; and the presence of warlike enemies within.

The environmental conditions that are looked for in the establishment of a new homestead, among the traditional Luo community, include the availability of land. Land is evaluated based on its suitability for pasture, crop growing and shelter construction. Traditional Luos were both pastoralists and farmers and therefore they preferred locations where their animals could graze and at the same time, they could practice farming. When constructing shelters, they avoided the swampy areas because they built sketchy structures for shelter and such required solid grounds for strong foundation.

The environmental conditions that would dictate the family migration from one locality to another included lack of land for pasture and crop production; drought or lack of water and warlike enemies within. When the Luo arrived in South Nyanza, they were predominantly a cattle keeping people and they cultivated sorghum and finger-millet. Being a reverine people, they established themselves along the lakeshore savanna which closely resembled their original habitats in Sudan (Ochieng, 1972: 7). The preference of living along the lakeshores exposed the traditional Luo community to some harsh environmental conditions such as periodical drought. Drought made them lack land for both pasture and crop production and at the same time water for their domestic needs, especially for those who lived far away from the lake. This led to the migration of people from the current Gwasi region in Suba district to Tanzania. The warlike enemies that the traditional Luos fought with were the tsetse flies. The tsetse flies invasion made many

people migrate away from Wiga in Gwasi hills, which was agriculturally productive into comparatively drier hinterland.

Among the traditional Luo community, human beings were regarded as outsiders. Hence, if the members of a locality were invaded by the natural calamities such as tsetse flies, they (human beings) had to move away with their herds to other safer areas. This was because, they believed that they had no power over such situations. Since these were the days when science of spraying bushes with insecticides had not reached them. On the other hand, the Luos used to domesticate wild trees and other environmental structures whenever they established homesteads around them. Wherever a homestead was set up, an extended fence was put around it depending on the available space and all enclosed environmental structures such as an anthill – source of soil for smearing and landmark trees became the property of the owner of the homestead.

Since the Gusii and the Luo communities have indigenous vernacular words that are used to describe the concept of environment, it can be inferred that the communities have indigenous knowledge about the same concept. On the other hand, the communities' vernacular words for environment give the descriptive reference to the surrounding. For example, "*Aluor*" among the Luos implies the surrounding, and this therefore fails to bring humanity to the picture wherever the concept of environment is in reference. According to these communities, therefore, humanity is not part of the environment. This observation is similar to Mwesigye's (1996) findings on his study of Language and Grassroot Environmental Indicators among the Runyankore of Uganda. The Runyankore's vernacular expression of the concept of environment "*ebintu ebitwe hingurize*" literally refers to things that surround us. Humanity is again outside the realm

of the environment, instead the environment includes the structures that surround the humanity. Equally, Fiedeldey (1998) acknowledges this perception of the environment in his study on Cybernetic analysis on trans-cultural data on human perceptions of environmental change. He notes that many cultural perceptions of environment indicate the physical aspects of the environment such as the trees, soil, water and out rightly excludes the humanity. This is the same view among the Gusii and the Luo, which makes them fail to perceive the holistic nature of the environment with units such as trees, land, humanity and water as its components. Despite this limitation, the communities demonstrated their awareness of the concept of environment, through the relevant vernacular words on the same. It therefore, follows that the members of the communities are able to express in specified words their understanding of the concept of environment even before formal school instruction on the same begins.

From the foregoing findings, it was evident that both the Gusii and the Luo communities had a lot in common in their traditional socio-cultural interactions within their respective surroundings. Each community understood the concept of environment as a distant source of basic human needs, and to them, it is distant from the human personality as humanity is not part of the environment. In expanding this further, land is understood as an "environment" that provides food for humanity (crop production) and livestock (pasture); hills and forests provide herbs for medical requirements; trees for shelter construction; and rivers and wells provide water for domestic usage and watering of livestock. These distinct components of the environment (land, plants and water) are understood to be independent and separate "environments" that provide human race with

specific resources. The different units of an environment are implied to be different individual environments.

The findings on the understanding of the concept of environment by both the Gusii and the Luo communities in this study is similar to those made by Whitely (1960, cited in Ochieng, (1972) in his study of the Gusii language, where he established that the Gusii and the Luo share over fifty vernacular words. For example "Kwach" (Leopard), "Nyasae" (God) and "Ruoth" (Chief). Ochieng (1972) asserts that this close cultural connections between the Gusii and the Luo dates back to about A.D. 1560. The cultural connections between the two communities started through trade in the 19th century and have continued through their interactions along the current stretch of neighbourhood from Sondu in Rachuonyo district to Harambee in Migori district (Ochieng, 1972: 3-10; Neigus, 1971: 56-80). While the Gusii and the Luo co-operated in matters of trade and close neighbourliness, culturally there was a lot of exchange of ideas. People do not interact for over a century without influencing one another and therefore, it is observed here that they influenced one another in their understanding of the concept of environment.

The two communities, on the other hand, do not perceive the holistic point of view of the environment with land, plants and water as some of its constituents, in their traditional operations within nature. Equally, the two communities do not regard humanity as part of the environment, instead it is considered as the owner of the environmental structures within its residential locality. Humanity is further perceived as an outsider or helpless in the environmental interactions that pose negative effects on its existence, for example, the traditional Luos could not relate the existence of their herds in

a locality as an attraction to the tsetse flies invasion in such areas, just like the Gusii could not associate the existence of the herds and their attack by the neighbouring Masai for the same.

4.3 The Prior Knowledge of the Standard Seven Pupils on the Concept of Environment

The Standard Seven pupils' prior knowledge on the concept of environment was investigated among the 144 Standard Seven pupils. This was done before the pupils were formally taught the concept in science course, from the analysis of the pupils' responses to the questions raised in the Environment Apperception Test (EAT) Instrument. The pupils' responses were expressed in absolute numbers and percentages as shown in the following tables and bar-graphs for each question on the referred content principles, in the Environment Apperception Test Instrument. Both the tables and bar graphs are used to enrich the data presentation.

4.3.1 Definition of Environment

In this area of investigation, the pupils were expected to give the meaning that they attach to the word "environment." The responses to the question are outlined in Table 4.1 and Figure 4.1 below:

Table 4.1: Pupils' Responses on the Definition of the Concept of Environment:

Pupils' Responses	Number of Pupils	
	Absolute	Percentage (%)
i) Association of an organism with its surrounding that affects its life	5	3
ii) Mentioning words such as "surrounding" or "area"	21	15
iii) Mentioning a specific component of an environment, for example, trees, water, air, soil, or building	76	53
iv) I don't know	39	27
v) No Response	3	2
Total	144	100

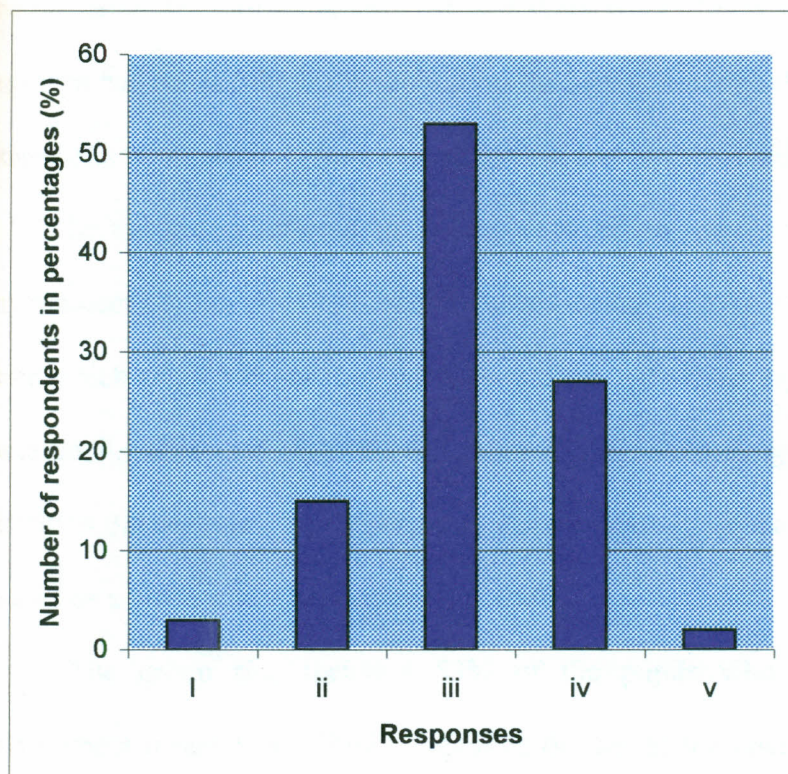


Figure 4.1: Bar-graph indicating Pupils' Responses in the Definition of the Concept of Environment.

The pupils responded in five different ways to the question on the definition of environment as follows: the association of an organism with its surrounding that affects its life; surrounding or an area in which an organism lives; trees, water, soil or building; I don't know and no response at all. It was observed further, from Table 4.1 and Figure 4.1 that there were two groups of respondents. One group expressed some idea about its understanding of the meaning of the concept of environment, while the other had members that either gave "I don't know responses or had no response at all.

The group that articulated its opinion included 3% of the pupils that defined the term environment as the association of an organism with its surrounding that affects its life. This definition expressed a relationship between the surrounding of the organism

and the organism's life and asserted that there were effects that the surrounding of an organism had on its life. It therefore gave the impression that the concept of environment expresses a relationship between the organism and other structures within its surrounding.

In the group referred to above, 15% of the pupils described the concept of environment by use of words such as "surrounding" and "area." The words reflected a place which often did not take into account the individual organisms within. Some of these pupils expressed that "Environment is the surrounding of an individual." Such definition did not relate the organism to its surrounding, instead it gave the impression of an area or a place where the organism is found.

The group also included 53% of the pupils who expressed that the term environment meant a specified component or unit of the environment, namely air, soil, trees, building or water. In their specific assertions some had the following definitions: "Environment is the soil where crops are grown; trees where people get timber or air we breath." Such definitions restricted the concept of environment to a specified constituent of the same and therefore lacked the wholesomeness of the environment which incorporates all its units such as land, air, water, plants and animals. Such definitions only magnified one specified component of the environment but failed to express the characteristic diversified nature of the environment.

The group that did not express its opinion on the meaning of environment included 27% of the pupils that indicated that they did not know the meaning of environment and therefore could not define the term 'environment.' It also included 2% of the pupils who did not express their mind, that is, they had no response to the question that focused on the definition of the environment.

4.3.2 Definition of Pollution of Environment

In Standard Seven science course, the topic of environmental pollution deals with the ways and means by which the environment is abused, misused or mismanaged with special reference to environmental components such as soil, water and air (KIE, 1994: 60 and 171). The question that was based on this topic, expected the pupils to define or give meaning to the concept of environmental pollution (Appendix V) on page 172. The pupils' responses to the question are summarized in Table 4.2 and Figure 4.2 below:

Table 4.2: Pupils' Responses on the Definition of Pollution of Environment

Pupils' Responses	Number of Pupils	
	Absolute	Percentage (%)
i) Making the environment dirty or impure	40	28
ii) Making a specified unit of the environment, namely air, water or soil dirty or impure.	55	38
iii) Naming substances such as smoke or dust that make the environment dirty.	8	5
iv) I don't know	37	26
v) No response	4	3
Total	144	100

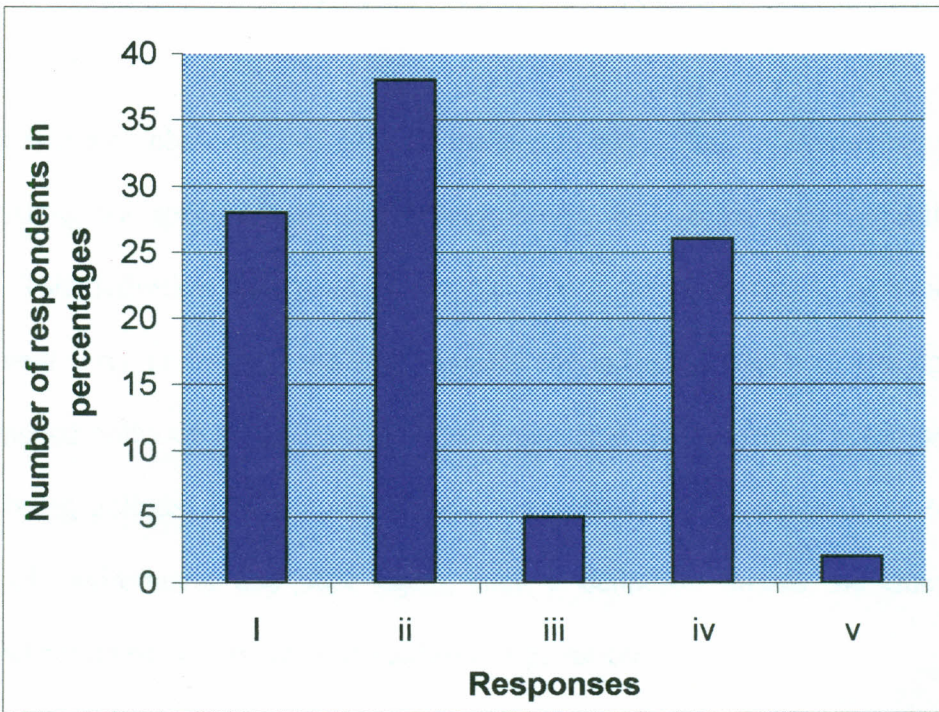


Figure 4.2: Bar-graph indicating the Pupils' Responses on The Definition of Pollution of Environment.

The pupils gave five different responses to the question on environmental pollution. Some pupils expressed that it is the process of making the environment dirty or impure; others stated that it is the making of a specified component of the environment, namely, air, water, or soil, dirty or impure; others asserted that it is the substances that make the environment dirty, for example, smoke, dust or pollen grains; some simply said that they did not know what it meant; and a few did not respond to the question at all.

From both Table 4.2 and Figure 4.2 it was observed that 28% of the pupils articulated that environmental pollution meant making the environment dirty or impure. This definition was acceptable at this level because most of the text books that are recommended for this course, for example, Primary Science, Teachers Guide for

Standard Seven (KIE, 1993: 16) give similar explanation on the concept of environmental pollution.

It was also observed that 38% of the pupils stated that environmental pollution meant making one specified unit of the environment such as air, water or soil dirty or impure. This definition was based on the fact that it involves making an aspect of an environment dirty or impure and that captures the accepted notion of the concept of environmental pollution at this level. On the other hand, the subject of pollution, that is, what is being polluted is narrowed to mere components of the wholesomeness of the concept of environment and once again, such a definition misses the characteristic diversified nature of environment, the subject of pollution.

Both Table 4.2 and Figure 4.2 also indicated that 5% of the pupils asserted that environmental pollution refers to the substances that make the environment dirty, for example smoke from factories, dust from roads, sewage wastes from residential homes and the pollen grains from flowers. The substances referred to are the pollutants and therefore the concerned pupils must have confused the concept of "pollution" and "pollutants." The Standard Seven Science textbooks, especially the one by Berluti and Njenga (2001: 24-31), outline the environmental pollutants, for instance smoke and dust in the air and sewage wastes in the water. Describing pollution as a substance was equally observed by Brody, (1991) when he studied the understanding of pollution among the 8th grade learners in United States of America. His respondents asserted that "pollution is a stuff that people don't want and so it is thrown on the ground; air moves pollution around and water pollution travels down rivers into the ocean." (Brody, 1991: 29).

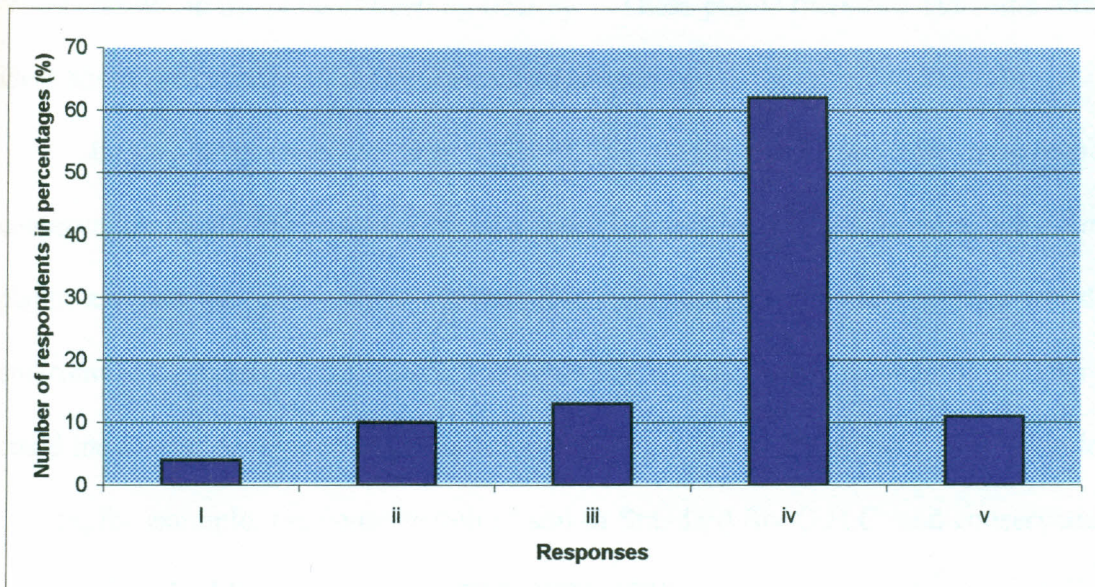
In this study 26% of the pupils did not know the definition of environmental pollution. This figure is more than a quarter of the pupils involved in the study and analysis of the Primary Education subjects' syllabi revealed that the concept of "pollution" is first introduced at Standard Seven in Science course and under the topic of environmental pollution. This therefore implies that environmental pollution is a new concept to the pupils at this level. The science teachers who were involved in the study, 89% of whom, expressed that the teaching of environmental concepts such as pollution requires different approaches from the traditional ones even in science course; and that high percentage of pupils (26%) possibly had had no exposure to the concept of pollution in lower classes and at home and so they did not know the meaning of environmental pollution. This group also included 3% of the pupils who did not give any response at all to the question on environmental pollution. This percentage, 3%, added to those who expressed that they did not know the meaning of environmental pollution, gives an overall percentage of pupils who could not give meaning of environmental pollution to be 29%.

4. 3. 3 Definition of Environmental Conservation

Environmental conservation, according to Standard Seven science course, deals with methods by which the abused environment may be improved or means by which the quality of the environment may be maintained for the benefit of all its dependants. The pupils were expected to define or provide the meaning of environmental conservation. The pupils' responses are summarized in Table 4.3 and Figure 4.3 below:

Table 4.3: Pupils' Responses on the Definition of Environmental Conservation:

Pupils' Responses	Number of Pupils	
	Absolute	Percentage (%)
i) To spare the environment for future use	6	4
ii) Keeping the Environment healthy	15	10
iii) Conserving a specified unit of the environment, for example soil, living things and water	18	13
iv) I don't know	89	62
v) No Response	16	11
Total	144	100

**Figure 4. 3: Bar-graph indicating Pupils' Responses on the Definition of the Concept of Environmental Conservation.**

From Table 4.3 and Figure 4.3 above, it can be observed that 4% of the pupils asserted that environmental conservation meant sparing the environment for future use. In the Standard Seven science course the word 'spare' used in the text books (Berluti and Njenga, 2001) in reference to the concept of environmental conservation is understood to mean the use of resources available and taking into account the state of the same for the future demands. It appears to be a more accepted word for the concept of 'conservation' at this level in the subject of reference. Out of 144 pupils who were involved, in this exercise, only six were able to give such a definition of the concept of environmental conservation before they were formally taught on the concept.

It was also observed that 10% of the pupils stated that environmental conservation implied keeping the environment healthy. To keep the environment healthy may infer reduction of abusive or mismanagement activities or it could also mean improvement of destroyed (unhealthy) environment. Based on such understanding, there is an element of 'conservation' in the phrase "keeping healthy." These pupils therefore had some relevant ideas about the concept of environmental conservation.

It was also observed that 13% of the pupils expressed that environmental conservation meant the preservation of a specified unit of the environment, for example, plants, animals, air, soil or water. In their specific expressions, quite a number stated that environmental conservation meant "conservation of soil, water or wildlife." This idea could have been developed from the reference on certain topics already covered in lower classes, for example, the conservation of soil in Standard Six G.H.C. and conservation of water in Standard Five Agriculture (KIE, 1994: 171).

It is evident from the Table 4.3 and Figure 4.3 that eighty nine out of 144 pupils did not know the meaning of environmental conservation as it is applied in Standard Seven science course. Analysis of Primary Education Syllabus revealed that the word "Conservation" had been introduced to these pupils earlier in topics such as 'conservation of water in Standard Five Agriculture in unit Six (KIE, 1994: 171). It was therefore expected that they ought to have understood the concept of conservation. On the other hand, the concept of 'environment' as a course of study is first introduced in Standard Seven science course under the unit "Our Environment." For 62% of the pupils to express that they did not know the meaning of environmental conservation, it is therefore only possible that their reasoning is based on the fact that the concept of 'environment', was new to them and this made them fail to grasp the concept of 'environmental conservation.' 11% of the pupils did not respond at all to the question on environmental conservation. In summary a total of 73% of the pupils, therefore, did not have an opinion on this question.

4.3.4 Assertion on whether Humanity is Part or the Owner of the Environment:

Some human activities on the face of the Earth, especially those related to the destruction of natural environment, may make one to wonder whether humanity sees itself as part or the owner of the environment. The pupils were asked to indicate whether humanity is part or the owner of the environment and they were to give reasons for their choice. The pupils' responses to the question are shown in Table 4.4 and Figure 4.4 below:

Table 4.4: Pupils' Assertion on whether Humanity is Part or the Owner of the Environment

Pupils' Responses	Number of Pupils	
	Absolute	Percentage (%)
i) Humanity is part of the Environment	35	24
ii) Humanity is the owner of the Environment	79	55
iii) I don't know	2	1
iv) No Response	28	20
Total	144	100

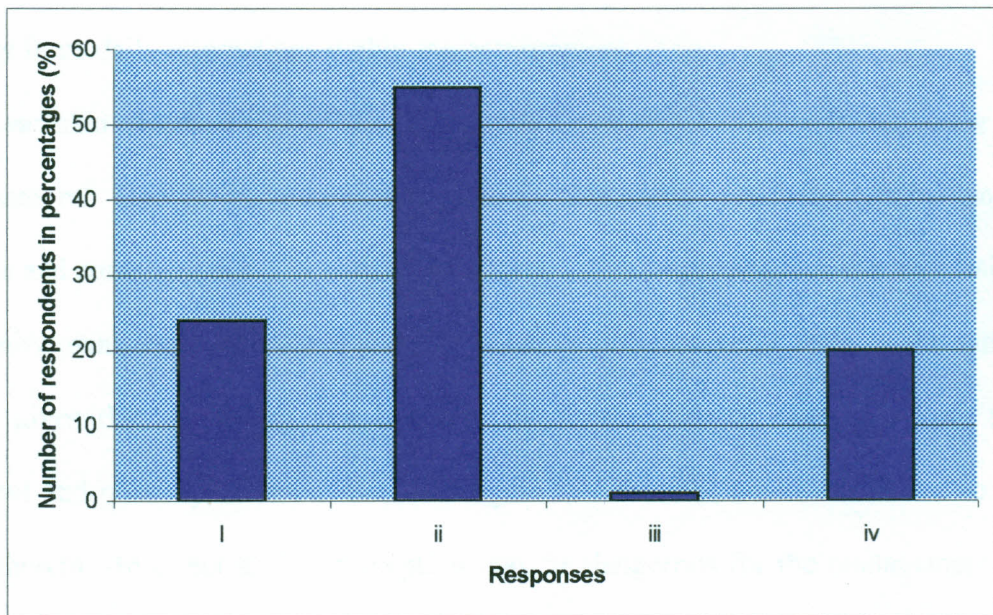


Figure 4.4: Bar-graph showing the Pupils' Responses in their Assertion on Whether Humanity is Part or the Owner of the Environment:

The pupils responded in four different ways to the question that required them to indicate whether humanity is part or the owner of the environment as follows: humanity is part of the environment, humanity is the owner of the environment; I don't know and those who did not respond at all.

From both Table 4.4 and Figure 4.4, it was shown that 24% of the pupils expressed that humanity is part of the environment, just like other components, namely, trees, soil or water. Some of them asserted that though humanity is part of the environment, it differs from other components because it has a duty of managing others such as plants. Some of the pupils with this response, qualified their answer by asserting that humanity is just a part of the environment because it is God who is the owner of the environment. This response gives the impression that humanity is part and parcel of the total environment. This further implies that any danger that the environment suffers from, directly or indirectly, affects humanity. Humanity, with this awareness, would act responsibly in its daily interactions within the environment.

It was also observed that 55% of the pupils stated that humanity is the owner of the environment. One of the reasons expressed by this group was that since humanity plants trees and cuts them down at will, it owns them. This response gives the impression that humanity owns the environment and can therefore do whatever it feels on the same. It equally gives the impression that humanity is distant from or separated from the environment and possibly, it can avoid the dangers that face the environment due to its activities therein. In effect such a perception may be dangerous for the management of the environment.

It was further observed that 21% of the pupils did not express their opinion on this question. Some indicated that they did not know while some did not respond at all. It therefore follows that these pupils had no idea whether humanity is part or the owner of the environment.

The three primary content principles in this study, namely, meaning of environment, pollution of environment, and conservation of environment, were further broken down into 4, 3, and 3 respectively, these basic ideas were considered fundamental in the understanding of the concept of environment as outlined in Standard Seven science course as follows:

a) Meaning of Environment (ME)

The following basic ideas were investigated from this content principle:

- i) ME 1 - Definition of the term "environment"
- ii) ME 2 – Structures that make up an environment as the
One shown in the photograph used in the study
(See Photograph 1 in Appendix VI).
- iii) ME 3 – The word that specifically describes the
structures that make up the environment as explained in
Standard Seven science course.
- iv) ME 4 - The pupils' assertion whether humanity is part
or the owner of the environment.

b) Pollution of the environment (PE)

From this content principle, the following basic ideas were investigated:

- i) PE 1 – The effects of sewage wastes when mixed

with flowing river.

- ii) PE 2 – Component of the environment that is being polluted as shown in the photograph used in the study (see Photograph 2 in Appendix VI).
- iii) PE 3 - Definition of Pollution of environment as outlined in Standard Seven science course.

c) Environmental Conservation (EC)

The following basic ideas were investigated under this content principle:

- i) EC 1 - The causes of loss of grass cover in the school compound shown in the photograph used in the study (see Photograph 3 in Appendix VI)
- ii) EC 2 - The changes on the bareness of the school compound with the planting of the trees as shown in the photograph used in the study (see Photograph 3 in Appendix VI).
- iii) EC 3 - Definition of environmental conservation.

In addition to the frequency distribution of the pupils' responses shown in tables and bar-graphs above, sections of the pupils' responses relevant to each of the content principles under study, observed in the ten basic ideas investigated, were examined and scored on a five point scale in Table 3.2, in Chapter Three

Table 3.2 provides the marking scheme for the pupils' responses on the content principles and the scoring column (scores) indicates the possible marks a given set of

responses is awarded. From the pupils' marked responses, their mean score on each of the above mentioned ten basic ideas were calculated from the frequency distribution as shown in Table 4.5 below, that is based on the pupils' responses on the definition of environment (ME 1).

Table 4.5: Calculation of Mean Score from Frequency Distribution, based on Pupils' Scores on the Definition of Environment (ME 1)

Score (X)	Frequency (f)	FX
5	4	20
4	14	56
3	15	45
2	48	96
1	63	63
	144	280

$$\text{Mean} = \frac{\sum fX}{\sum f}$$

$$= \frac{280}{144}$$

$$= 1.9 = 2.0$$

In addition to the mean scores on the basic ideas referred to above, the pupils' raw scores on the same were calculated. The number of pupils who scored four or five points and those who scored one or two points on the basic ideas were noted. The number of pupils scoring four or five points would show the proportion of those that have good understanding of the basic ideas referred to and those scoring one or two points would

indicate poor understanding of these ideas. The pupils who scored three are understood to have an average understanding of the ideas referred to in the study. All these are shown in Table 4.6 below: -

Table 4.6: Performance of Pupils on the Basic Ideas

Basic Ideas	Frequency of Pupils getting the indicated raw scores					Pupils' Mean Score	Percentage of Pupils Scoring 4 and 5	Percentage of Pupils Scoring 1 and 2
	1	2	3	4	5			
a) Meaning of Environment								
i) ME 1	63	48	15	14	4	1.9	13	77
ii) ME 2	13	19	99	12	1	2.8	9	22
iii) ME 3	61	51	29	3	0	1.8	2	78
iv) ME 4	30	82	27	4	1	2.1	3	78
b) Pollution of Environment								
i) PE 1	13	24	27	27	53	3.4	56	26
ii) PE 2	25	34	52	23	10	2.7	16	41
iii) PE 3	67	22	32	5	18	1.7	16	62
c) Environmental Conservation								
i) EC 1	19	35	51	32	7	2.8	27	38
ii) EC 2	28	32	42	38	4	2.7	29	42
iii) EC 3	62	47	19	11	5	2.0	11	76
Total	381	399	393	169	103		19	54

In Table 4.6 where the pupils' performance on the basic ideas, based on the three content principles is displayed, it was observed that on the content principle 'meaning of environment' (ME 1), 13% of the pupils scored four and five. This indicated the number of pupils who had good understanding of the said content principle. On the other hand, 77% of the pupils scored one and two points, indicating that over three quarters of the pupils had a poor understanding of the said principle. With regard to the second content principle, 'definition of pollution of environment' (PE 3), 16% of the pupils scored four and five points while 62% scored one and two points. In the third content principle, 'environmental conservation' (EC 3), 11% of the pupils scored four and five while 76% of them scored one and two points. On the whole, it was observed that 19% of the pupils scored four and five points in the basic ideas while 54% scored one and two points. This indicates that over half of all the pupils involved in the study had poor understanding of content principles under study.

From the qualitative analysis perspective of the above described data, when the mode was used to show the group characteristics, it was observed that 53% of the pupils understood the concept of environment to mean any one cited environmental component (Table 4.1 and Figure 4.1). Regarding the responses to the definition of environmental pollution, 38% of the pupils asserted that environmental pollution meant making a particular unit of the environment dirty or impure (Table 4.2 and Figure 4.2). On the other hand, 73%, in response to definition of environmental conservation, indicated that they did not know the meaning of environmental conservation, while 13% stated that it meant conserving a specified component of environment (Table 4.3 and Figure 4.3).

In the quantitative analysis of the same data, when the mean was used to show the group characteristics, it was found that the pupils' mean score in their definition of each of the following concepts: environment, pollution of environment and environmental conservation was about 2.0 (Table 4.7). The numerical value two (2) in the scoring scheme (also see Appendix VII) corresponds to the options of "one of the structures in the environment such as air" for the definition of environment; "a process of making any one component of environment such as water or air bad" for the definition of pollution of environment; and "a process of conserving any one of the environmental components, namely soil or air" for the definition of environmental conservation.

From all these observations it was demonstrated that most pupils understood the concept of environment to mean one specified unit of the environment. The pupils therefore showed lack of the notion that such units of the environment, namely, living things (animals and plants); non-living things (water, soil and air); human-made entities (e.g. buildings, desks and books) and their respective interactions constitute the environment. The pupils' definitions of the content principles referred to failed to express the holistic and diversified nature of the concept of environment, as it is understood in today's world. Therefore the prior knowledge the Standard Seven pupils had about the concept of environment, before they were formally taught the topic "Our Environment" in science course, was that 'the environment is made up of one cited component', that is, the environment can be either a tree, a building, water or soil.

4.4 The Sources of Standard Seven Pupils' Prior Knowledge on the Concept of Environment

The constructivists' Theoretical Learning Model, on which this study was based outlined in Chapter Two, summarizes the sources of knowledge in learning exercise as home and school situations. The sources of Standard Seven pupils' prior knowledge in this context would either be the home or school conditions, or both. The home conditions alluded to the activities and interactions the pupil undergoes that are not school programmed, for example, playing with toys at home. The school conditions, on the other hand, referred to activities and interactions that the pupil experiences in a school situation which are based on the school curriculum and guided by school teachers.

It was observed, in literature review that, the school system introduced the concept of environment through discrete environmental issues to the target population in lower classes in the subjects such as GHC and Agriculture. Additionally, the teaching of such issues, namely, Pollution of Water, Conservation of Soil and Conservation of Wildlife on isolation made the pupils to perceive concepts such as soil, water and wildlife to be independent "environments." This was because the teacher discussed concepts of conservation and pollution in reference to soil, water, forests, and animals. When such pupils were confronted with the task of defining environment, environmental pollution, and environmental conservation, they would get tempted to take the concept of environment to mean soil, water, forest and animals. The school situation therefore contributed to the observed pupils' prior knowledge of the concept of environment.

The home situation included the pupils' interactions with parents, siblings and associates outside the school realm. The possible source of information on the concept of

environment within the home influence would depend on the home people's perception of the same. The perception of the home members would be reflected in their indigenous knowledge of the concept of environment. This study was done within two communities (Gusii and Luo) in Nyanza province.

The findings revealed that the two communities had a common perception, in their traditional socio-cultural interactions within their respective surroundings, of the concept of environment as observed on pages 60 – 61 of this report. Each one of them understood the concept of environment from resources-provision perspective. Land was understood to be the provider of food; hills and forests provided herbs for medical needs and trees for construction of shelter; and water bases (e.g. rivers, lakes and wells) provided water for various uses. The providers of such natural resources, like water, were taken as environment. The communities therefore, perceived land, river and forests as independent environments that provided for their needs in their respective localities. The perception of the home members appeared to have had an influence on what the pupils' prior knowledge on the concept of environment was.

The foregoing findings ratify that the sources of pupils' prior knowledge on the concept of environment are both the perception of the environment, by the indigenous knowledge of the communities they come from (home influence) and the mode of teaching environmental covered issues covered in lower classes in subjects such as GHC, Agriculture and Science (school influence). Both sources understood the concept of environment to mean a particular designated component such as forests, just like the observed prior knowledge of Standard Seven pupils in the study.

4.5 The Effects of Standard Seven Pupils' Prior Knowledge on their Understanding of the concept of Environment.

The Environment Apperception Test-cum-Clinical Interview was administered to the same pupils, six months later. This was done after the topic "Our Environment" in Standard Seven science course had been formally taught to the pupils. This was aimed at establishing any effects of the pupils' prior knowledge on their understanding of the concept when it was formally taught in classroom situation. The following tables and bar-graphs represent the pupils' responses on questions that were based on the three content principles; meaning of environment, pollution of environment and environmental conservation, after the formal teaching of the same.

4.5.1 Definition of Environment

The investigation was based on the pupils' definition of the word "environment". The Pupils' responses are summarized in Table 4.7 and Figure 4.5 below.

Table 4.7: Pupils' Responses on the Definition of Environment before and after their instruction on "Our Environment."

Pupils' Responses	Number of Pupils			
	Before instruction		After instruction	
	Absolute	Percentages (%)	Absolute	Percentages (%)
i) Association of an organism with its surrounding that affects its life	5	3	23	16
ii) Mentioning words such as "surrounding" or "area"	21	15	38	26
iii) Mentioning specific component of the environment, for example trees, animals, air or water.	76	53	65	45
iv) I don't know	39	27	17	12
v) No response	3	2	1	1

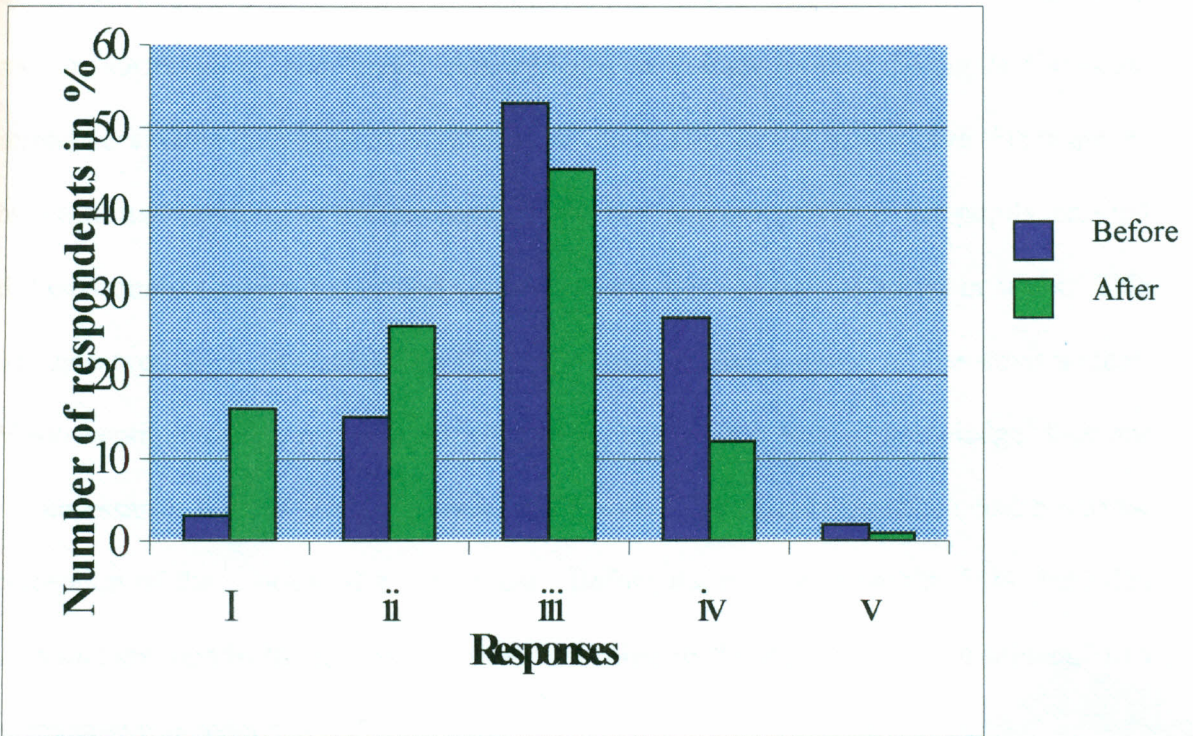


Figure 4.5: Bar-graph indicating the Pupils' Responses on the Definition Of Environment before and after their instruction on "Our Environment."

The pupils' responses were organized in the same manner as they were in Section 4.3 of this study, where the findings on their prior knowledge was analyzed. From Table 4.7 and Figure 4.5, it was observed that not all pupils expressed their minds on the posed question. Some instead indicated that they did not know the meaning of environment while others never responded to the questions at all.

The pupils that expressed their opinions included 16% of them who asserted that environment is the association of an organism with its surrounding that affects its life. This is the most acceptable definition at this level and that 16% of these pupils got it right unlike the 3% of the same pupils before the course was taught (Table 4.1) on page 68

above. Twenty six percent (26 %) of the pupils defined environment by the use of words such as “surrounding” and “area.” According to the literacy level of the pupils, this is the second acceptable definition of environment. Only 15% of the pupils gave this response before formal teaching of the concept. Forty five percent (45%) of the pupils asserted that environment meant a specified unit of the environment such as forest or water. This was observed as a misconception the pupils had on the concept of the environment. Misconceptions reflect a partial understanding, based on a lack of knowledge, they are not necessarily formed from incorrect information. The pupils therefore had a narrow perception of the concept of environment. Before the topic was taught, 53% held this view and six months later, after the formal teaching of the topic “Our Environment,” this percentage was reduced to 45%.

Table 4.7 and Figure 4.5 also show the number of pupils who did not express their opinion on the question even after instruction, 12% indicated that they did not know the meaning of the environment and 1% did not respond at all, despite the fact that they had been taught the topic concerned. This overall percentage of (13%) is lower than what it was (29%) prior to the topic being taught.

With the understanding that the quality rank of pupils’ responses decreases from (i) to (v) in Tables 4.1 and 4.7, it was observed that the frequency distribution in Figure 4.5 tended to skew towards the left, unlike the case in Figure 4.1. This demonstrated that more pupils expressed their mind on what they thought the term “environment” meant. Further, the observations made indicated that, after the formal teaching of the topic “Our Environment,” the pupils improved their knowledge about the meaning of environment.

Although frequency distribution skewed to the left and observations demonstrated improvement in knowledge on the meaning of environment, the pattern of the distribution remained the same (Figure 4.5). Majority of the pupils 53% and 45% indicated that the term environment meant specified component of the environment, such as water, animals or plants. The word “majority” is used to reflect the comparative number of pupils giving a particular response. The response referred to was given by more pupils than any other category as shown in Table 4.7. This implies that majority of pupils, before and after the teaching of the concept still had the same understanding of the term environment. This further, indicates the influence of pupils’ prior knowledge on their understanding of the concept, despite the formal teaching of the unit “Our Environment.”

4.5.2 Definition of Pollution of Environment:

Here, the posed question expected the pupils to give meaning to the concept of pollution of environment. The pupils’ responses are outlined in Table 4.8 and Figure 4.6 below.

Table 4.8: Pupils Responses on the Definition of Pollution of Environment before and after their instruction on “Our Environment.”

Pupils' Responses	Number Of Pupils			
	Before instruction		After instruction	
	Absolute	Percentage (%)	Absolute	Percentage (%)
i) Making the Environment dirty or impure	40	28	47	33
ii) Making a specified component of the Environment such as air, water or forest, dirty or impure	55	38	54	37
iii) Naming substances such as smoke or dust that make the environment dirty	8	5	27	19
iv) I don't know	37	26	14	10
v) No response	4	2	2	1
Total	144	100	144	100

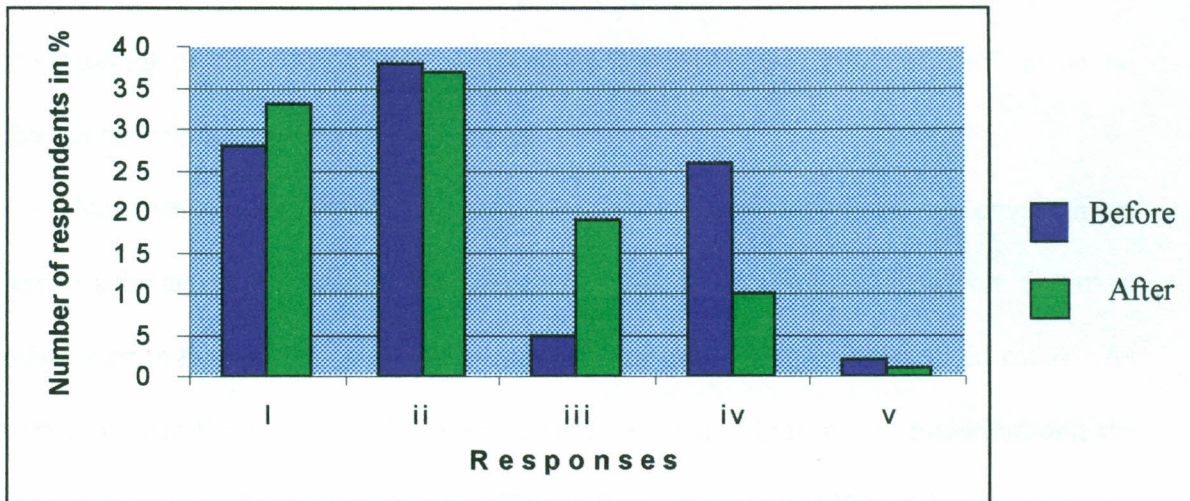


Figure 4.6: Bar-graph indicating Pupils' Responses on the Definition Of Pollution of Environment, before and after their Instruction on “Our Environment.”

From Table 4.8 and Figure 4.6, it was observed that 33% of the pupils expressed that pollution of the environment meant making the environment dirty or impure, a slight increase compared to 28%, who expressed the same view before the topic was formally taught. This is the acceptable definition of the word pollution as applied to the environment at this level (KIE, 1993: 16).

It was also observed that 37% of the pupils indicated that pollution of the environment meant making one specified unit of the environment such as water, dirty or impure. Some pupils specifically expressed that pollution of environment implied "causing soil erosion; producing bad air in class or pouring oil on the water in a well." This was a mistaken belief in the meaning of this concept that remained unchanged, that is, before and after the teaching of the topic "Our Environment." It appeared to be the most popular response, and that the percentage of the pupils holding it remained almost the same before and after the formal teaching of the topic, as was 38% and 37%, respectively. This indicated that the pupils' prior knowledge impacted on their understanding of the concept that teaching of the topic "Our Environment" made no effect on their understanding of the concept.

Nineteen percent (19%) of the pupils expressed that pollution of environment refers to substances that make the environment dirty, for example, smoke from factories, sewage wastes from residential homes and dust particles from un-tarmacked roads. As observed earlier the response of this nature conveys some kind of confusion among the pupils. Various textbooks of Standard Seven Science clearly differentiate between the terms 'pollutants' and 'pollution' (Macharia and Nyoro, 2001: 63; Patel and Vashista, 1989: 30 Berluti and Njenga, 2001: 24-26; and KIE, 1993:16). The fact that these terms

had been taught in this topic confirms that the concerned pupils confused them. In addition, the percentage of pupils that gave this response before was 5% while after the teaching of the topic this percentage increased to 19%. This indicated that the confusion of the terms became even worse after the formal teaching of the topic in class.

Both Table 4.8 and Figure 4.6 also show the number of pupils who did not express their opinion on the content principle; 10% of the pupils indicated that they did not know the meaning of pollution of environment and 1% of the pupils had no response at all despite the fact that they had been taught the topic. On the other hand, this percentage is lower than what it was before the teaching of the topic, when 26% of the pupils indicated that they did not know the meaning of pollution of environment and 3% of them had no response at all. It was apparent that more pupils appeared to have expressed their mind, after teaching the topic.

The frequency distribution of the pupils' responses as shown in Figure 4.6 manifested a pattern of skewing to the left because 87% of the pupils expressed their minds, (responses iii to i) on the meaning of pollution of environment after they had been taught.

4.5.3 Definition of Environmental Conservation

In this area of investigation, the pupils were expected to define or provide meaning of environmental conservation. The pupils' responses are summarized in Table 4.9 and Figure 4.7 below:

**Table 4.9: Pupils Responses on the Definition of Environmental Conservation
Before and after their instruction on “Our Environment.”**

Pupils' Responses	Number of Pupils			
	Before instruction		After instruction	
	Absolute	Percentage (%)	Absolute	Percentage (%)
i) To spare the environment for future use	6	4	31	22
ii) Keeping the environment healthy	15	10	28	19
iii) Conserving a specified component of environment, namely soil, air, water or living things	18	13	53	37
iv) I don't know	89	62	30	21
v) No Response	16	11	2	1
Total	144	100	144	100

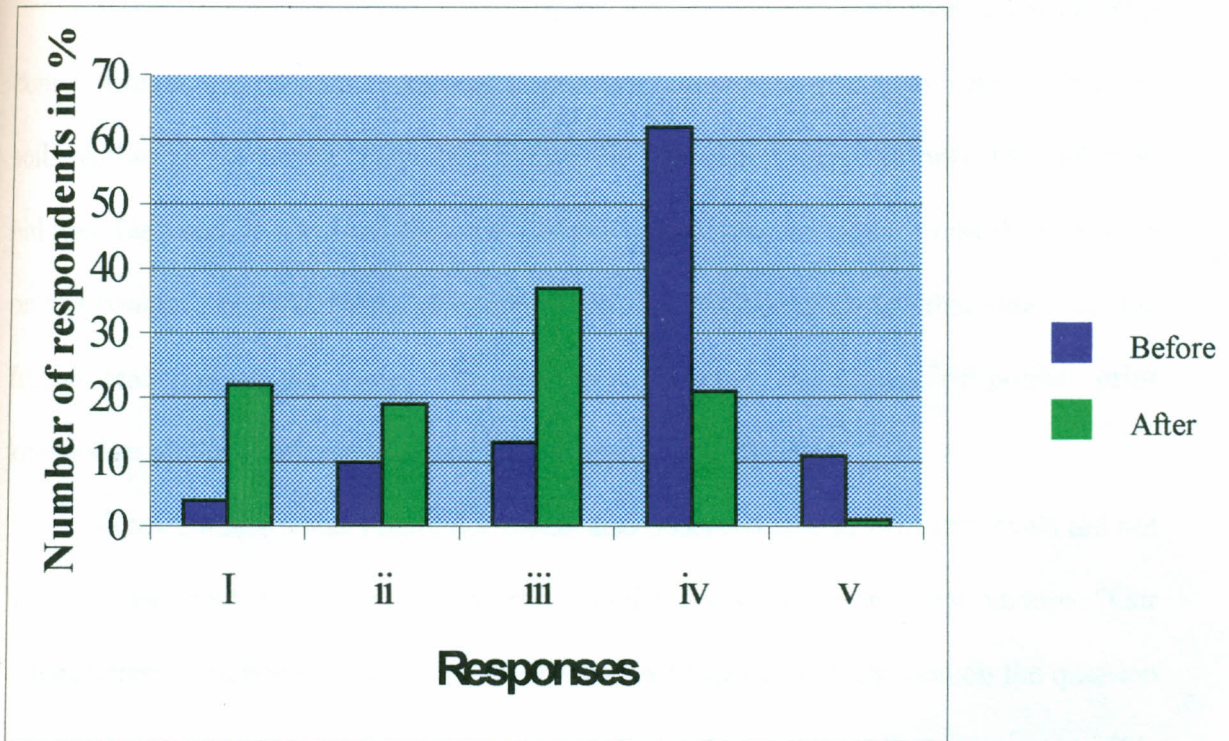


Figure 4.7: Bar-graph indicating Pupils' Responses on the Definition of Environment Conservation before and after their instruction On "Our Environment."

Table 4.9 and Figure 4.7 show that 22% of the pupils stated that environmental conservation is a process of sparing the environment for future use. This is a more acceptable definition of the concept as explained in the textbooks for Standard Seven Science (KIE, 1993: 16). The pupils' understanding here, was better than their experience before the topic was formally taught. This is because, then, only 4% of them did express this idea. It was further observed that 19% of the pupils indicated that environmental conservation meant keeping the environment healthy. From these observations, it can be stated that this response is the second most accepted notion of

environmental conservation, and it shows an improvement from the previously observed response.

It was further observed that 37% of the pupils indicated that environmental conservation is a means of conserving a specified component of the environment such as soil. Although the pupils' responses before the formal teaching had only 13% of them holding this view, it appeared that many of the pupils who did not express their opinion on this content principle, then, did express their mind and conceded to this view after the formal teaching of the topic. This therefore reflected the effects of pupils' prior knowledge on their understanding of the concept after instruction.

From Table 4.9 and Figure 4.7 it was also observed that 21% of the pupils did not have an idea about the meaning of environmental conservation even when the topic "Our Environment" had been taught. Equally, 1% did not express their opinion on the question at all and this brings the total number of pupils that did not express their opinion to 22%. Despite the observed high percentage of this group of pupils, after the teaching of the topic, the pupils' understanding appeared to have improved because earlier, a total of 73% expressed no idea about their understanding of the meaning of environmental conservation.

In contrast, Table 4.9 shows a striking difference between the pupils' responses before and after the teaching of the topic "Our Environment." It indicates that 73% either failed to express their opinion or registered that they did not know the meaning of environmental conservation before instruction. This number reduced to 22% after the formal teaching of the topic. This showed that some knowledge was gained that

developed the confidence in the pupils to express their opinion on the presented task after the formal teaching of the topic in Standard Seven science course.

Table 4.9 and Figure 4.7 further display the fact that most of the pupils (37%) stated that environmental conservation meant conserving a specified unit of an environment such as air, water, soil and living things. This observation is similar to what was experienced with the pupils' responses on the same question, before the formal teaching of the topic. Despite the improved confidence in the pupils to express their opinion on this content principle, their mistaken belief that environmental conservation meant conserving a designated component of the environment, as explained above, remained unchallenged by the formal teaching of the unit "Our Environment." This is an indication of the impact of prior knowledge on pupils' learning process.

4.5.4 Humanity: as Part or the Owner of the Environment

The pupils were asked to indicate whether humanity is part or the owner of the environment, and each pupil was to give reasons for the choice made. The pupils' responses are shown in Table 4.10 and Figure 4.8 below.

Table 4.10: Pupils' Assertion on whether humanity is Part or the Owner of the Environment, before and after their instruction on "Our Environment."

Pupils' Responses	Number of Pupils			
	Before instruction		After instruction	
	Absolute	Percentage (%)	Absolute	Percentage (%)
i) Humanity is part of the environment	35	24	62	43
ii) Humanity is the owner of the environment	79	55	78	54
iii) I don't know	2	1	3	2
iv) No Response	28	20	1	1
Total	144	100	144	100

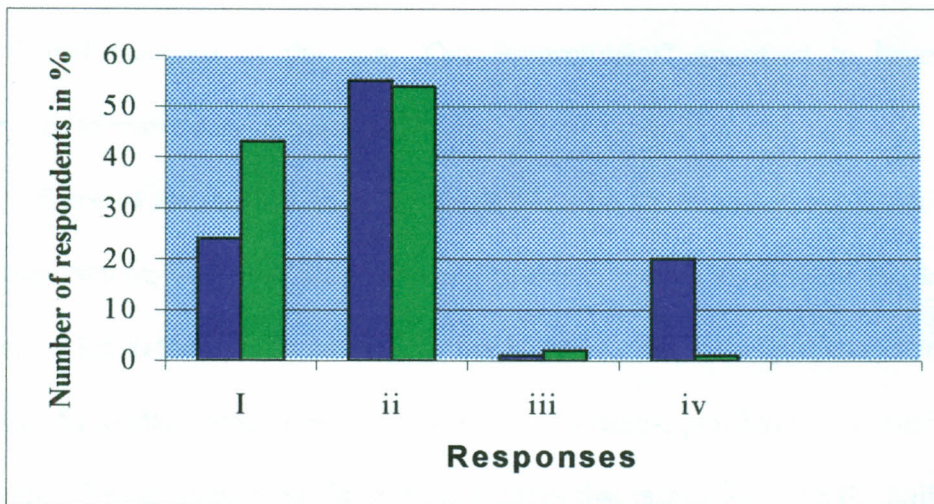


Figure 4.8 Bar graph indicating Pupils' Responses in their Assertion on whether Humanity is part or the owner of the Environment before and after their instruction on "Our Environment."

Table 4.10 and Figure 4.8 give two groups of respondents to the question on whether humanity is part or the owner of the environment. One group gave its opinion on the question while the other did not express its mind on the same. The group that gave its mind included 43% of the pupils that asserted that humanity is part of the environment just like other components namely trees, soil and water. Some of the pupils specifically expressed that "Humanity is part of the environment because God is the owner of everything". Additionally included in the group were 54% of the pupils who stated that humanity is the owner of the environment. Some of the pupils in the group reasoned that since humanity builds houses and grows crops it therefore owns them.

Since Table 4.10 and Figure 4.8 show that higher percentage of pupils (97%) expressed some ideas on what they thought about whether humanity is part or the owner of the environment, compared to, 79% before the formal teaching of the topic, indicating an improvement in knowledge about the concept of Environment-Humanity relationship. The formal teaching of the unit "Our Environment" appeared to have caused the difference in knowledge acquisition.

Some of the reasons given by the pupils who stated that humanity is the owner of the environment, included "that humanity grows crops, harvests them and keeps them in stores." This to them is an indication that humanity owns the gardens, stores and crops therein. Secondly, "that humanity constructs buildings, purchases households and cares for such." These, to such pupils, were evidences that humanity owns the buildings.

From the above reasons, it can be deduced that the entities such as buildings and gardens constitute separate and independent environments as perceived by the pupils. This is because, if humanity is the owner of environment and it owns buildings and

gardens, it then follows that buildings and gardens are taken to be environments that are owned by the humanity.

The second group of the respondents included 2% of the pupils who indicated that they did not know whether humanity is part or the owner of the environment, a figure close to the one before the teaching of the topic. This group also included 1%, that gave no response to the question that required them to indicate whether humanity is part or the owner of the environment. Before the topic was taught, there were 20% of the pupils who did not respond to this question. This difference of 19% shows that the teaching of the topic made the pupils gain the confidence in their response hence the teaching of the topic seemed to have created an impact.

In the observation of content coverage on the unit "Our Environment," it was noted that most of the science teachers were sketchy and brief. Some of them remarked that the content on environmental concepts infused in various carrier subjects such as science was not popular in Kenya Certificate of Primary Education (KCPE). It was discovered that since 1985, Primary Science curriculum has been examined in a joint paper with Agriculture at KCPE, upto 2000. In that joint paper of sixty question items, science comprised of thirty of them. From 2001 examinations, science has been examined as a full paper comprising of fifty question items, set across the science topics including Living Things (plants and animals), Soil, Environment, Health Education, Weather and Astronomy, Making Work Easier (Machines) Matter and its Properties and Energy.

The team of science teachers, tutors and the researcher, analysed the Primary Science question items in KCPE from 1985 to 2000 and established the number of

question items set on various topics in Primary Science Course as shown in Table 4.11 below:

Table 4.11: KCPE Science Topical Question Items Distribution from 1985 to 2000

	Primary Science Topics	Number of Question Items
i)	Living Things (Plants and Animals)	143
ii)	Matter and its Properties	83
iii)	Making Work Easier	74
iv)	Energy	56
v)	Weather and Astronomy	44
vi)	Health and Education	31
vii)	Soil	30
viii)	Environment	19

From Table 4.11 above, it can be observed that the topic "Environment" has been the least tested over the sixteen years of coverage. From the review of KCPE past papers it was observed that each year had an average of two question items out of thirty, based on environmental concepts. In 2001 KCPE the number of environmentally based questions have remained to be two despite the increase of science question items from thirty to fifty. This implies that the curriculum evaluators have not assessed the content on environment in the school curriculum adequately. The environmental content question items constituted only 4% of the entire science course in KCPE examinations during that period. These question items are listed in Appendix VIII.

The practice in most schools, during the 8.4.4 education system, has been that, teachers stress topics that they expect the Kenya National Examination Council to set questions from. They would address such topics with precision and care for the good performance of their pupils. From the foregoing discussion, it has been noted that the

environmental concepts infused in Primary Science course had only two question items in the yearly KCPE examinations, hence the absence of stress by science teachers in the classroom on the holistic nature of the environment. This is because the quality of the teachers has been based on how many pupils pass in their respective subjects in KCPE, thus making the teachers lay emphasis mainly on content areas that are commonly examined in the KCPE.

From the pupils' responses, after the formal teaching of the unit "Our Environment," two basic common observations were made: that there was an improved confidence among the pupils since most of them expressed their opinions in response to the questions; there was also marked improvement on the knowledge about the content principles on focus. On the other hand, it was observed that most pupils still perceived the concept of environment as a specified component such as soil. This was demonstrated in their attempts to define pollution of environment where the percentage of pupils holding the view was almost constant as it was before the teaching at 37% and 38%, respectively; and in defining environmental conservation where the same was observed. This observation is similar to the experience of Driver and Oldham (1986: 105 – 118) who argue that the ideas that are used by the pupils to explain the natural world are firmly held and often persist despite formal teaching. This indicates that the prior knowledge that the pupils had before the formal teaching of the unit, "Our Environment," as a designated component of the wider environment, had an effect on the pupils understanding of the concept when it was formally taught. The majority of the pupils did not change their understanding of the concept of environment after the formal teaching of the unit.

4.6 Differential Understanding of the concept of Environment among Standard Seven Pupils from different Backgrounds

Data analysis was further done on the pupils' understanding on the three concept principles: meaning of environment (ME 1), definition of pollution of environment (PE 3) and definition of environmental conservation (EC 3), based on their backgrounds. Such backgrounds included: sex of the pupil; residential status of the pupil; community of origin; agro-ecological zonation of the schools; and the educational and economic status of the pupils' parents.

The sex of the pupil referred to the girl or boy involved in the study. Communities of origin were the Gusii and the Luo, from which the pupils were sampled. Agro-ecological zones were the regions in the rural study area from which the rural schools were sampled and included Lower Midland – Semi Arid, Lower Midland – Semi Humid, Upper Midland and Lower Highland. The Educational status of the pupils' parents involved the division of the parents into those that had tertiary, secondary and primary education, while economically they were grouped into employed and unemployed. In both statuses, it was observed that some pupils did not have their parents who were alive. With respect to statistical analysis, the data pertaining to the dead parents were reflected on educational status but not referred to in the discussion while in economic status they were excluded.

The statistical analysis was based on Analysis of Variance (ANOVA) which compares the mean scores of pupils' understanding of based on different backgrounds as explained above. Since the variables did not have linear relationship, for example, pupils' understanding of the definition of environment and their sex, the analysis was

therefore non- parametric. Because of this, in the expression of values, Eta^2 was used instead of r^2 . The test of significance was done at 95% level and Kruskal-Wallis test, which arranges the means in an increasing order, was further done to counter check the ANOVA's findings. The pupils' understanding was compared on three environmental content principles; meaning of environment (ME 1); definition of pollution of the environment (PE 3); and definition of environmental conservation (EC 3) as outlined in Standard Seven science course. The findings are expressed in Tables 4.12 through 4.17 below.

It was observed that there was no significant difference in the pupils mean scores because of sex difference (Table 4.12), all p-values (measure of significance level) were above 0.05 which is the acceptable limit when the significance level is put at 95%. Eta^2 values further revealed that the variation on pupils' understanding based on sex, only accounted for less than 3% of all variations in the pupils' understanding of all the focused content principles. The Kruskal-Wallis test, further showed that there was no much difference in the mean performance of boys and girls in the three content principles. These values are given in Table 4.12 below:

Table 4.12: Pupils' Mean-Performance with respect to their Sex (Boys and Girls)

	ME 1	PE 3	EC 3
Significance level (p-Values)	0.067	0.755	0.367
Eta	0.153	0.026	0.076
Eta^2	0.023	0.001	0.001
\bar{X} Boys	2.1	2.2	1.4
Girls	1.8	2.2	1.3

On the pupils' mean performance with respect to their residential status, it was observed that there was significant difference in the pupils' understanding of environmental content principles referred to based on their residence (urban or rural). This is because the p-values were well below 0.05 as shown in Table 4.13 below. The Eta² values also indicated that the variations on the pupils' understanding based on their residence accounted for over 12% of all variations in the understanding of the content principles. The Kruskal-Wallis test, further confirmed that the mean scores of pupils from urban schools were relatively higher compared to that of their counter-parts from rural schools.

Since the mean scores of pupils from urban schools were relatively higher than those from rural schools, it gave the impression that the pupils from urban schools performed relatively better than those from rural schools. This is similar to what Hounshell and Ligette (1976, cited in Iozzi, 1989) observed that urban learners are more knowledgeable than rural ones in environmental concepts. It is therefore possible to conclude that the area of residence significantly influenced the pupils' understanding of on the environmental content principles under study.

Table 4.13: Pupils' Mean-Performance with respect to their Residential Status (Urban or Rural)

	ME 1	PE 3	EC 3
Significance level (p-Values)	0.000	0.000	0.000
Eta	0.376	0.348	0.444
Eta ²	0.141	0.121	0.197
\bar{X} Urban	2.6	2.1	2.0
Rural	1.7	1.8	1.1

From the pupils' mean performance regarding their community of origin (Gusii and Luo), it was observed that there was no significant difference in the pupils' understanding of the environmental content principles based on their communities of origin. This was because the p-values were more than 0.05 (Table 4.14). Although the mean score on the definition of pollution of environment (PE 3) for the pupils from Luo community was relatively higher than that of Gusii pupils, the difference was not statistically significant. Eta² value also indicated that the variation on pupils' understanding based on the community of origin, accounted for upto 3.6% of all variations in the understanding of these content principles by the pupils. Further, Kruskal-Wallis test showed that the mean scores of the pupils from Gusii community did not have much difference from the mean scores of pupils from Luo community. Table 4.14 below shows the referred details above.

Table 4.14: Pupils' Mean-Performance with respect to the Community of their Origin

	ME1	PE 3	EC 3
Significance level (p-Values)	0.973	0.065	0.337
Eta	0.004	0.189	0.099
Eta ²	0.000	0.036	0.010
\bar{X} Gusii	1.7	1.6	1.1
Luo	1.7	2.1	1.0

On the pupils' understanding regarding agro-ecological zonation of their schools, it was observed that there was no significant difference in the pupils' mean performance. This was because all the p-values were well above 0.05 (Table 4.15). Eta² values further confirmed that variations on the pupils' mean performance based on agro-ecological zonation of their schools, accounted for less than 4% of all variations in the understanding of the content principles on focus by the pupils. Kruskal-Wallis test, further revealed that there was no much difference on the pupils' mean performance in difference agro-ecological zones, from which schools were sampled. Table 4.15 below, provides the details of the values referred to above.

Table 4.15: Pupils' Mean Performance with respect to their Schools' Agro-**Ecological zones**

	ME 1	PE 2	EC 3
Significance level (p-values)	0.353	0.316	0.460
Eta	0.186	0.194	0.166
Eta ²	0.035	0.037	0.28
\bar{x} Lower Midland Semi Arid	1.8	2.1	1.0
Lower Midland Semi Humid	1.5	1.9	1.0
Upper Midland	1.9	1.6	1.1
Lower Highland	1.5	1.7	1.2

On the pupils' understanding regarding the education level of their parents, it was observed that there was significant difference in the pupils' mean scores in both the definition of environment (ME 1) and of pollution of environment (PE 3), based on their father's education level. The Eta² values indicated that variations of pupils mean performance based on father's education level accounted for over 7% of all variations in the pupils' understanding of the two referred content principles (Table 4.16). Kruskal-Wallis test further revealed that the pupils whose father's had higher Education obtained a relatively higher mean. On the other hand, there was no significant difference in the understanding of the definition of environmental conservation based on the pupils' father's education level. Although Kruskal-Wallis test indicated a progressive increase in

the pupils' understanding with increase in father's educational level, the difference was not statistically significant since the p-value was more than 0.05 (Table 4.16) for the same content principle.

There was significant difference in the understanding of pupils in all content principles based on their mothers' education level. Eta² values indicated that variation due to mothers' education level accounted for over 10% of all variations in the understanding of the content principles referred to, by the pupils. Kruskal-Wallis test further showed that there was much difference in mean performance of pupils of mothers with different education levels and especially it indicated that the higher the education level of the mother, the better the understanding of the pupil.

Both parents' education level had an influence in the understanding of their pupils, but unlike the fathers' case, the mothers' education level had significant influence on the pupils' understanding of all the environmental content principles under study. Table 4.16 below shows the values on pupils' understanding based on the education levels of their parents.

Table 4.16: Pupils' Mean-Performance with respect to the Education Levels of Their parents

	Father			Mother		
	ME 1	PE 3	EC 3	ME 1	PE 3	EC 3
Significance level (p-values)	0.011	0.009	0.067	0.001	0.000	0.000
Eta	0.275	0.280	0.223	0.324	0.373	0.499
Eta ²	0.076	0.078	0.050	0.105	0.139	0.227
\bar{x} Tertiary	2.4	2.9	1.7	2.6	2.9	2.5
Secondary	2.0	2.2	1.4	2.4	3.0	1.8
Primary	1.5	1.7	1.1	1.8	1.8	1.0
Deceased	2.0	2.2	1.33	2.0	2.03	1.3

From the pupils' understanding with regards to their parents' economic status, it was observed that there was no significant difference in the understanding of the pupils based on the economic status of their fathers. The Eta² values indicated that variation on pupils' understanding due to their fathers' economic status accounted for less than 2% of all variations in the understanding of the content principles by the pupils as shown in Table 4.17 below. There was a marked significant difference in the understanding of the pupils based on their mothers' economic status. The Kruskal-Wallis test further confirmed that the understanding of pupils whose mothers were employed was relatively higher than those whose mothers were unemployed. Although this trend was also observable in the fathers' case but the noted difference was not statistically significant.

The fathers' economic status was a relatively poor indicator of the pupils understanding in the environmental content principles under study. On the other hand the mothers' economic status significantly influenced the understanding of their pupils on the content principles. Table 4.17 below outlines the values on the pupils understanding with respect to economic status of their parents.

Table 4.17: Pupils' Mean-Performance with respect to the Parents' Economic Status

	Father			Mother		
	ME 1	PE 3	EC 3	ME 1	PE 3	EC 3
	Significance level (p-values)	0.279	0.141	0.143	0.034	0.024
Eta	0.091	0.123	0.123	0.176	0.188	0.266
Eta ²	0.008	0.015	0.015	0.031	0.035	0.071
\bar{x} Employed Parents	2.0	2.3	1.4	2.2	2.5	1.6
Unemployed Parents	1.8	1.9	1.2	1.8	1.9	1.1

4.7 Summary of the Discussed Results

This study was aimed at establishing the prior knowledge Standard Seven pupils had on the concept of environment before the concept was formally taught in Standard Seven science course and the effects of the prior knowledge on the pupils' understanding on the same when it was formally taught. Below is a summary of the findings and discussions on the same.

The two communities, the Gusii and the Luo, among which the study was conducted, had a lot in common in their traditional perception of the concept of environment. They perceive the environment as a distant source and provider of human needs. In both communities land was seen as the provider of human food and animals' pasture and water bases (e.g. lakes and rivers) as providers of water for various users. Providers (such as land and rivers) of natural resources for human needs were understood to be "independent" environments. In the communities' traditional interactions with their surrounding, humanity was regarded as the owner of the environmental structures within their localities, for example trees, rivers and land. They considered the concept of environment to denote the physical environment that surrounds them. From the sampled Standard Seven pupils that were involved in the study, many of them understood the concept of environment as an individual component such as water, air, soil, animals or plants. Some of them defined environment as "soil where crops are grown"; environmental pollution was considered as the pollution of aspects of the environment such as water or soil; and environmental conservation was perceived by many pupils as a process of conserving a specified unit of the environment, for example, trees or water. The sampled target population expressed their prior knowledge on the concept of environment as that which is made up of one of the following: water, air, soil, animals, plants or buildings. The pupils did not express the environment as a relationship between the individual being and other configurations within its surrounding and the structures such as water, land, animals or plants are its components.

The sources of Standard Seven pupils' prior knowledge appeared to be both the home and school influences. From the home situation, the communities' perception of

the concept of environment was that the providers of natural resources such as land and rivers were taken as independent environments. This perception by the communities of origin of the pupils involved in the study appeared to be similar to the pupils' prior knowledge. On the same note, the school system introduced environmental issues through topics such as soil erosion, pollution of water and conservation of forests in lower classes and in subjects like Agriculture and GHC. The teaching of such topics was done in isolation from one another such that the pupils failed to differentiate between the pollution of water and pollution of environment. Many of such pupils were tempted to equate water and environment with reference to the concept of pollution. Since the pupils' prior knowledge was similar to their communities' perception of environment and equally the curriculum presentation in lower classes on such environmental concepts, tended to support the observed pupils' prior knowledge, it is therefore evident that the sources of pupils' prior-knowledge were the influences from the home and school situations.

Despite the formal teaching of the unit "Our Environment" in Standard Seven science course, which was thought to be the source of information about the concept of environment to the pupils, 45% of the pupils still indicated that environment meant a specified component of environment such as water, animals or plants (Figure 4.5). The percentage of pupils who defined pollution of environment as making a specified component of the environment such as water or soil, dirty or impure moved from 38% to 37%, while most of the pupils still defined environmental conservation as a process of conserving a designated component such as forests. The pupils' prior-knowledge of the concept of environment as a designated component of a wider environment had a strong

effect on their understanding of environmental principles when they were formally taught in science course. This is because a high percentage of the pupils did not change their perception of the concept of environment after the formal teaching of the same.

In comparing the pupils' understanding of the concept of environment, based on different pupils' backgrounds, it was observed that there was no significant difference in the pupils' understanding based on sex; community of origin; rural agro-ecological zonation of the schools; and the economic status of the father. In short, the above background traits of the pupils did not influence their differential understanding of the concept of environment. On the other hand, there was marked significant difference in the pupils' understanding of the concept of environment based on their residential status, parents' education levels (primary, secondary or tertiary) and the mothers' economic status (employed or unemployed). It was observed that urban pupils had better understanding of the content principles under study than rural pupils; the pupils with highly educated parents did better; and that the influence of mother's education was higher than the father's. Further, the pupils of employed mothers did better. It was therefore apparent that pupils' understanding of the concept of environment was distinctly influenced by their residence, education and economic status of the mothers.

On the whole, the Standard Seven pupils' prior knowledge of the concept of environment was a narrow perspective of the wider environment that was restricted to individual components of environment such as water, air, land, plants or animals. This notion of the environment was developed by such pupils through the influences of their communities' indigenous knowledge on the same and the school curriculum presentation of environmental topics in lower classes. The prior knowledge on the concept of

environment by such pupils was observed to have affected their understanding when environmental principles were formally taught under the topic "Our Environment" in Standard Seven science course. This was because many pupils did not change their perception of the concept after its formal teaching.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction:

This study was aimed at establishing the Standard Seven pupils' understanding of the concept of environment as it is outlined in science course. In this regard the five objectives of study were expressed in section 104 on pages 4 and 5.

Based on the objectives of study referred to, this chapter summarizes the findings of the study. It discusses the recommendations based on the findings and especially how the concept of environment may be taught in Primary Education as a complement to the government strategies in the creation of awareness about the conservation of environment. Further research is suggested in relevant aspects of the study area with the aim of improving the strategies for conservation of environment through the school curriculum.

The outline of the chapter includes:

- Summary of the findings based on original objectives.
- Conclusion on the findings.
- Recommendations based on the findings.

5.2 Summary of Findings:

The summary of the findings was organized in a way that each study objective is stated and the summary of its findings is then outlined. The study had five basic objectives, the first objective was to establish the meaning of the term

environment in the indigenous knowledge of the communities (Gusii and Luo), from which the target population is drawn.

The findings of the study on this objective, indicated that indigenous knowledge of the communities, the Gusii and the Luo, had a common perception of the concept of environment. Each community understood environment as a distant source of basic needs. Further Environment was perceived as being distant from humanity because humanity was understood to be the owner of environmental structures within its locality and not as part of the environment. Humanity was further understood as an outsider in the environmental interactions that pose negative effects on its existence. For example, among the Luo, when tsetse flies attacked their cattle, they fled from such localities because they believed that they had no power to counteract such misfortunes. On the other hand, the holistic perception of environment takes the providers of basic needs such as land, forests and water bases as components of an environment and not as independent environments on their own. Equally, humanity is understood as part of or component of an environment and not as the owner of the same.

The second objective of the study was to determine the Standard Seven pupils' prior knowledge of the concept of environment before their exposition to the concept in the formally taught Standard Seven science course. It can be concluded that the Standard Seven pupils had prior knowledge on the concept of environment before they were formally taught the unit "Our Environment" in science course. They understood environment to be denoted by soil, water, air,

animals or plants and therefore, did not perceive the holistic nature of the environment with structures like plants, water and animals as components.

The third objective of the study was to identify the sources of Standard Seven pupils' prior knowledge on the concept of environment. It was shown from the study, that the sources of the pupils' prior knowledge were their respective communities' indigenous knowledge and the school curriculum presentation of the infused environmental issues, in their lower classes. The community's indigenous knowledge of the environment was similar to the pupil's prior knowledge and the curriculum presentation of infused environment concepts in the school curriculum stressed individual components such as water, air and soil, as already been explained in Chapter Four. From such backgrounds the pupils equated the concept of environment with those of water, soil, air and animals. Instead, water, soil, air and animals should be treated as environmental units and the curriculum presentation could have included a holistic introduction of the concept of environment before singling out the treatment of individual components, such as pollution of water.

The fourth objective of the study was to investigate whether the Standard Seven pupils' prior knowledge of the concept of environment had effects, in the pupils understanding of environmental principles when they were formally taught. From the study, it was observed that 53% of the pupils held the observed pupils' prior knowledge on the concept of environment before the formal teaching of the same. After the formal teaching of the concept, six months later, 45% of the pupils still held the same prior knowledge on the concept of environment, where

the individual components of the environment such as land and air were understood to be independent environments. The pupils' understanding of the concept of environment had remained almost the same, despite the formal teaching of the unit "Our Environment", which was expected to assist them in understanding the concept. This therefore implied that the pupils' prior knowledge of the concept influenced their understanding of the same concept even after it had been taught.

The fifth objective of the study was to investigate if there is any significant difference in the understanding of the concept of environment by Standard Seven pupils on the basis of sex, residence status (rural and urban), agro-ecological zonation of the schools, community of origin (Gusii and Luo) and economic and educational backgrounds of their parents. It was observed that there was marked significant difference in the pupils' understanding of the concept of environment based on their residence (rural or urban), parents educational levels and mothers' economic status. The pupils from urban schools understood the concept of environment better than those from rural schools. It was equally shown that pupils whose parents were highly educated and those whose mothers were economically better placed were better informed on environmental issues. On the other hand, there was no statistically significant difference in the pupils' understanding of the concept of environment based on sex, communities of origin (Gusii and Luo), agro-ecological zonation of the schools, and the economic status of the fathers. Pupils' understanding of the concept, based on the above backgrounds appeared similar with no significant difference.

5.3 Conclusion:

The study was set to investigate the pupils' understanding of the concept of environment. In order to do this, several questions were posed. From the results obtained, the study concluded that the Standard Seven pupils understood the concept of environment as a constitute of one of wider environment's components such as air, water, soil or forest. Further more, the sources of pupils' prior knowledge were their communities' perception of the concept of environment and school curriculum.

5.4 Recommendations:

From the foregoing findings of the study, five basic recommendations are proposed to the environmental education stakeholders such as curriculum developers, implementers and evaluators, relevant government ministries and the non-governmental organizations (NGOs) whose activities relate to the environment.

The first recommendation is for the curriculum developers and implementers to have a deliberate move to re-organize the presentation of the concepts of environment in the Primary Education curriculum, with special emphasis to the syllabus, textbooks and classroom teaching. The findings have indicated that curriculum presentation in syllabus and textbooks on the infused environmental concepts such as pollution and conservation of water has made the pupils to equate environment with its individual components, like water, air and soil. The re-organization of the concept presentation may assist the learners to unlearn the already established prior-knowledge on the same concept.

In a recent curriculum review course panel meeting, March 2002, at Kenya Institute of Education, some members proposed that the environmental issues in the Standard Seven science course be excluded because of the crowded curriculum. Despite this move, one of the reasons for the review of the present school curriculum was to integrate the emerging issues such as environment, HIV/AIDS and drug abuse. A few of the members had to come up very strongly for the restoration of the unit "Our Environment" in Standard Seven science course, for it is the only topic in the Primary School curriculum that has attempted to address the holistic nature of the concept of environment.

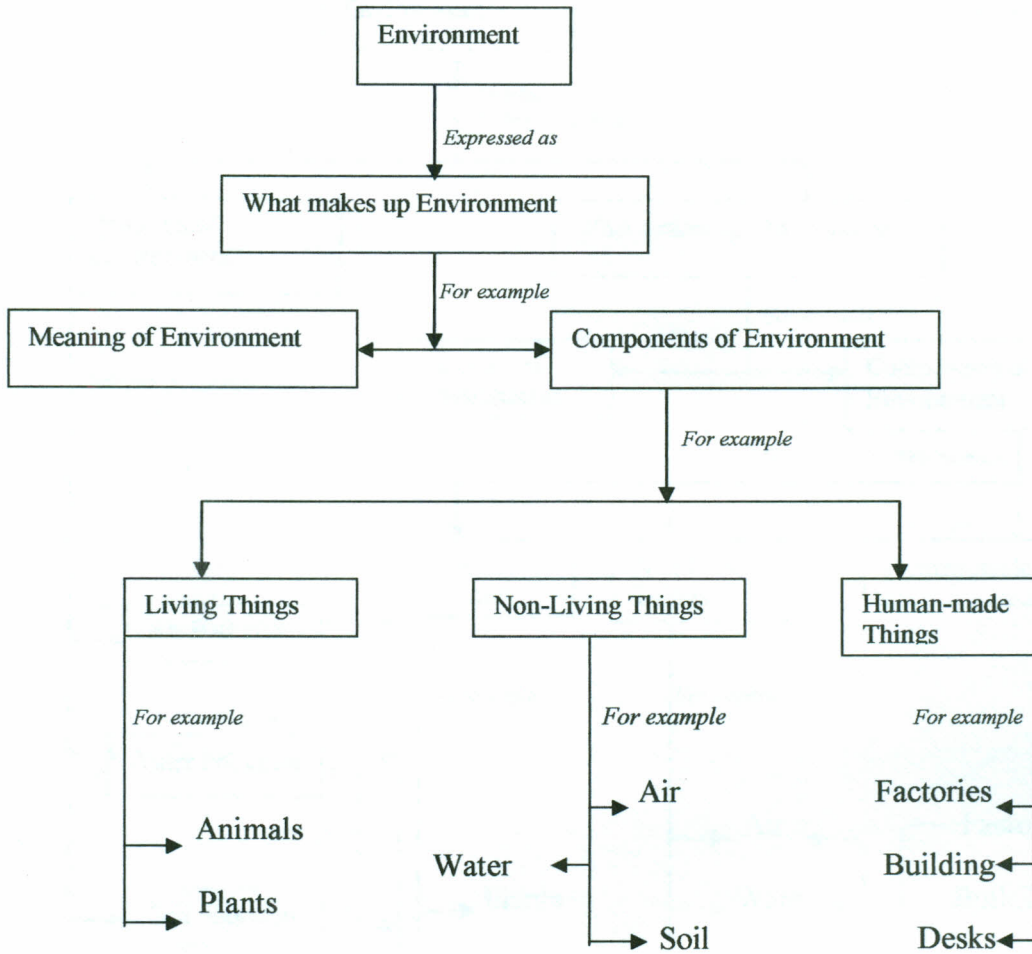
This experience pointed out that most curriculum developers, even at the level of course panel, in Kenya, do not appreciate the importance of the infusion of environmental concepts in the school curriculum. This possibly is the cause of arbitrary allotment of environmental topics such as Soil Conservation and Water Pollution in the current school curriculum, in various carrier subjects such as Science, Agriculture and GHC, with no focal approach to the concept of environment. This in turn, has led to the teaching of such topics in isolation from one another and hence making it equally difficult for curriculum evaluators, the Kenya National Examination Council, to set appropriate question items on the concept.

The concept of environment like any other curriculum concept can be taught at any level (Bruner, 1963: 18-20), depending on its organization by the curriculum developers. With reference to the concept map of environment (Fig. 3.1), curriculum developers can introduce the concept of environment at Standard

Four in Primary science course. At this level, the pupils have completed lower primary and are able to grasp the ingredients of the concept of environment.

At Standard Four the stress could be on the definition of the concept of environment, which should be perceived as an association between an individual being and other components within the surrounding. Further, the focus could be on "What makes up the Environment", that is, components as shown on Figure 5.1 below. The same concept map of environment (Figure. 5.1) can be extended to Standard Five where the components of the environment can further be classified and the importance of each component to its fellow members outlined. The thrust of Standard Four and Five on the knowledge about environment is to explain that structures such as water, plants, air, soil and animals (e.g. Humanity) are components that make up the environment and each one of them depends on one another.

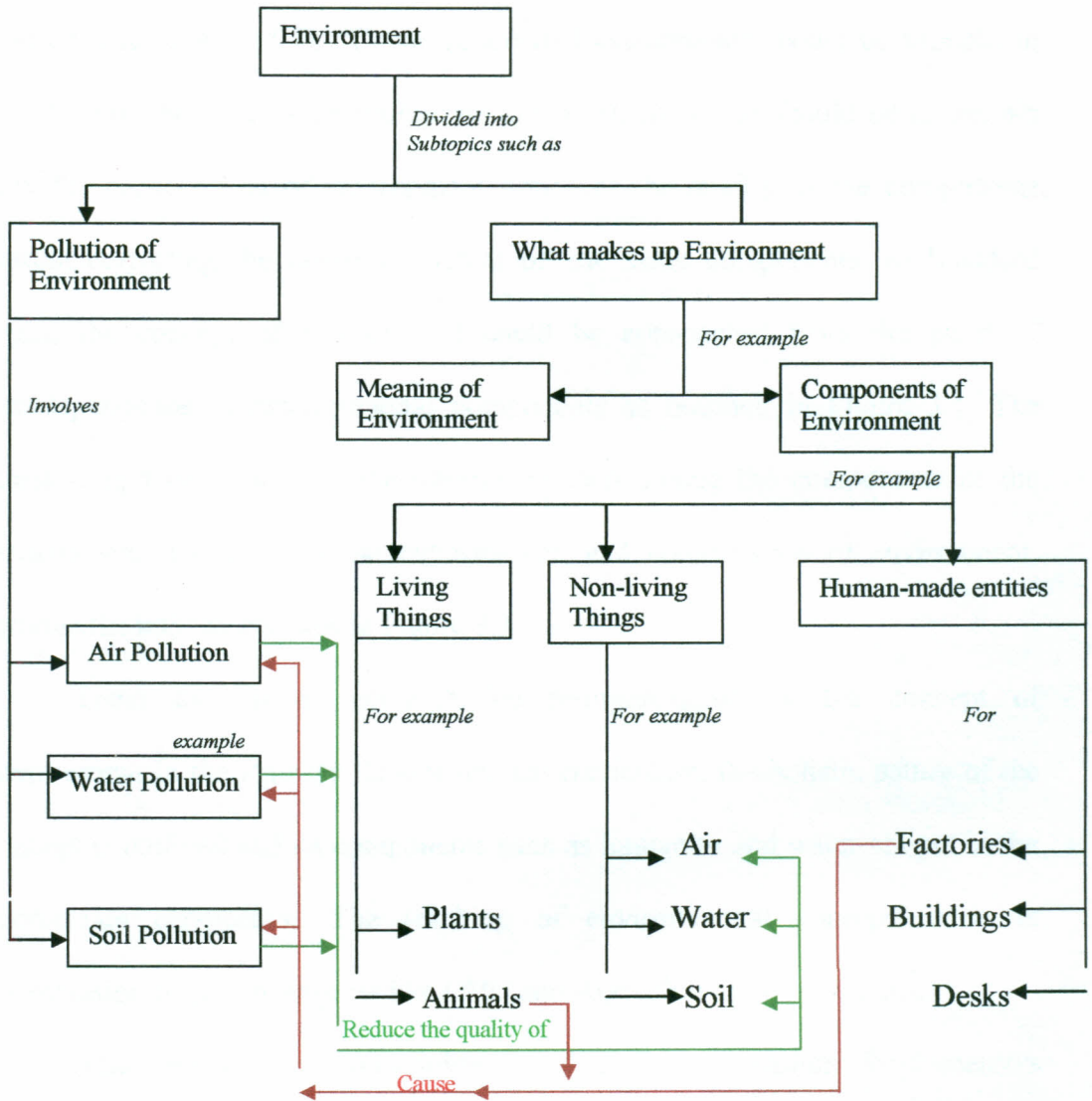
Figure 5.1: The concept Map of Environment for Standards Four and Five Science Course



Source: Author

In Standard Six, further details of Figure 3.1 could be brought in with the focus on pollution, and how it relates to different components of environment, for example water, air or soil. At this level, the stress should emphasize that causes of pollution in the environment come from the activities of some of its components especially the human related activities and the act of pollution takes place on other environmental components, as well. The concept map of environment for Standard Six is shown in Figure 5.2 below.

Figure 5.2: The concept Map of Environment for Standard Six Science Course:



Key:

→ Association between pollution of the environment and the components of the environment for example Factories → Cause → water pollution.

→ Association between pollution of the environment and the components of the environment, for example Water

Pollution $\xrightarrow[\text{of}]{\text{reduces the quality}}$ Water

Source: Author

Progressively, the third and last portion of the concept map of environment (Figure 3.1), "Conservation of Environment", could be brought in for Standard Seven science course. At this level, the focus should be to explain how the conservation of environment improves the quality of the components therein correcting the pollution effects on the same components. In Standard Eight, the concept of environment could be approached from the point of interdependence of environmental components as outlined in Figure 3.1. The stress should be to explain the interrelationship among the components of the environment, pollution of the environment, and conservation of environment, through the linkage outlines in Figure 3.1.

From the above recommended re-organization of the concept of environment in the Primary School science curriculum, the holistic nature of the concept is outlined and its components such as humanity and water are put in the appropriate perspective. The teaching of environmental concepts such as conservation of soil in subjects like GHC and Agriculture will be eased.

The second recommendation is that the curriculum implementers (teachers) be trained and in-serviced on the presentation of environmental concepts infused in various subjects in Primary School curriculum. The classroom teaching follows closely the presentation of various curriculum concepts as outlined in the syllabus and the textbooks and it is therefore possible that the observed problems of concept presentation in the syllabus and textbooks could have influenced it. This study therefore recommends that the Primary Teacher Education curriculum be designed, in such a way as to familiarize the teacher-

trainees with the content they are expected to teach because they (teachers) give the highest priority in the curriculum to those topics about which they are most knowledgeable (Beiswenger, Sturges and Jones, 1991: 24-29). Teachers therefore should be assisted, through both pre-service and in-service programmes, to be able to select and organize the intended learning outcomes in the above recommended Primary Science curriculum on the concept of environment that would challenge the pupils' prior knowledge in their understanding of the same concept. For example, the pupils' prior knowledge that an environment can either be water, land or vegetation and that humanity is the owner of the environment can be approached through the holistic presentation of the concept of environment to the pupils, using the proposed curriculum layout, explained above. Here, environment should be approached as an association of various components such as water and vegetation. The components cannot exist on their own, they have to relate to one another for various services for survival. On the same note, humanity is an example of an animal, which is one of the components of the environment and not the owner. Although humanity has been given the responsibility to manage the quality of other components of the environment such as soil and plants for the good of all members of the worldwide environment, this does not change its status from being part to being the owner of the environment. God is the owner of the environment and has placed humanity to manage the environmental interactions as a steward.

The third recommendation is for the Kenya National Examination Council (KNEC) to take a purposeful shift to popularize the environmental concepts

infused in science course by increasing the number of question items to be set on the concepts in Kenya Certificate of Primary Education (KCPE). The curriculum evaluation in the Kenyan education system is co-ordinated by the KNEC. It has been observed that the practice in most schools has been that the teachers stress topics which they expect the KNEC to set questions from. Unfortunately, to some of such teachers, the past examination papers have become their references from which they choose topics on which they prepare the pupils for National examinations. They then cover such topics with precision and care for the better performance of their pupils in the National examinations. Since the environmental concepts infused in science course are less focused on by curriculum evaluators, the care and precision by the science teachers have missed them, and hence the pupil's knowledge about the same. It is therefore the recommendation of this study that KNEC takes a deliberate move to popularize the environmental concepts in science course. This will motivate both the teachers and pupils to be more concerned in handling such concepts in the science course by improving the teachers' precision in classroom presentation and the chances of improving the pupils' knowledge on the same.

The fourth recommendation is that the Kenya government, through Adult Education programmes or District Environment departments to organize programs for imparting to the Kenyan citizens the relevant concept of environment, including the understanding that humanity is part and parcel of the environment and that any interference with the quality of environment will directly affect its well being.

The fifth recommendation is that the non-governmental organizations (NGOs) whose interests are based on human activities in the environment should establish the environmental perception of the involved communities before the management strategies of the environment are implemented. This is important because the involved communities could have a totally different understanding of what the concerned NGO refers to as environment. For example, the Gusii and the Luo communities' perception of the environment as a distant source of peoples' needs and that humanity is the owner of the environment should caution such organizations' strategies in environmental management. An attempt, therefore, should be made to help the communities involved understand that humanity is part of the environment and the fulfillment of all its needs is derived from the environment, and that any problem that disadvantages any other component of the environment such as vegetation, water or soil will have direct effect on humanity in terms of its primary requirements such as food and air. Humanity should be assisted to be in the forefront in the management of resources for the good of all components of the environment.

The above proposed recommendations will enrich the observed perception of the environment by the target study population. Perception, as a process of acquiring and organizing information through the use of human senses can be improved on when the target population is enriched through structural planning of the curriculum. Such planning will lead them to cognition of the subject of study and cognition being the act of processing information by use of mental structures, the individuals involved will develop relevant environmental ideas in their minds,

which may then be reflected in their attitudes and behaviour for the maintenance of the quality of the environment (Wikipedia, 2005).

5.5 Recommendations for Further Research:

Research is one of the central areas of knowledge acquisition that helps in the development and sustainability of knowledge in any subject area. This study has been restricted to Standard Seven pupils in Primary Education and basically among the Gusii and Luo communities in Kenya. The subject of study has been the understanding of the concept of environment and since environment is a wide subject area, the focus was equally restricted. Because of all these limitations in the study, the findings require further research and therefore the following areas are recommended:

- Do the primary pupils carry the established prior knowledge about the concept of environment upto the end of Secondary Education? If not what do Secondary Education products understand by the concept of environment?
- How does the prior knowledge relate to the attitudes of the pupils towards the environment?
- What is the environmental perception of the nomadic communities of Kenya, among whom many NGO activities are centered, whose activities are closely related to the physical environment and whose negative attitudes towards central government activities in their regions have been observed as outlined below?

This study has attempted to establish the baseline information with respect to the primary pupils' perception of the concept of environment. It has equally

been observed that the primary pupils understanding of the concept of environment is similar to their prior knowledge, that is, their understanding of the concept before formally learning it. This study therefore recommends that a research be done to establish whether the primary school pupils carry their prior knowledge of the concept of environment to Secondary Education, say at the end of Form Three. If not, then further research be done to investigate what the products of Secondary Education, at the end of Form Three or mid of Form Four, understand by the concept of environment. The fact being that more than sixty percent (60%) of the Secondary Education products do not go for further education, thus engaging themselves in activities such as farming and other business practices, that lead them to make decisions on the management of environment.

There have been marked climatic changes in Kenya that many more parts of the country are being claimed as arid and semi arid regions. This has economic implications and for one reason or other such areas are the centres of the activities for non-governmental organizations. It has been observed that communities in such areas treat government administration as another "ecological factor such as unreliable rainfall" and often take precautions to cope with it (Hjort, 1976:79). On the other hand, the attitudes of some government officers, the implementers of government projects, are that development only takes place "by making nomadic people more agricultural" (Renard, 1979:57). This would lead to sedentarisation of such communities by creating permanent villages to them and hence increasing desertification pressures on the adjacent rangelands. Equally, many actors in the

non-governmental organization projects are often ignorant about the rural intricacies but do not want to know what they do not know (Chambers, 1987: 1-5). This is because they undervalue the knowledge of the local communities in their strategies to improve the economic status of such localities. While the impact and effect of economic progress cannot be dealt with without first understanding the relationship between the inhabitants and their surrounding, more so their perception of its potential value, it is important to determine how people perceive and relate to the environment in order to identify relevant behaviour patterns contributing to environmental degradation that can be addressed through strategies of change (Fiedeldey, 1998: 1). This study therefore recommends that a research be done to establish the environmental perception of the nomadic communities in Kenya, for this would lead to the establishment of relevant strategies in the management of their environmental resources and their effective participation on the same.

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APPENDICES

APPENDIX I

HEADTEACHERS' QUESTIONNAIRE

PERSONAL INFORMATION

1	Name				
2	Sex		3	Age	
4	Name of School				
5	School's Address				
6	Agro-ecological Zone				

_____ Date

Instructions

Please answer all the questions in the spaces provided. The responses will be kept confidential and for any other additional information you may use the back of each page.

1. The total enrolment of the school currently.

	<40	40-60	61-100	>100
a) Boys	_____	_____	_____	_____
b) Girls	_____	_____	_____	_____

2. The pupils enrolment in the following classes

	<10	10-30	31-40	>40
a) Std 6	_____	_____	_____	_____
b) Std 7	_____	_____	_____	_____
c) Std 8	_____	_____	_____	_____

3. What are the professional qualifications (e.g. P1) of your staff that teach the following subjects in the indicated classes?

Subjects	Classes		
	6	7	8
a) Agriculture	_____	_____	_____
b) Geography/History and Civics (GHC)	_____	_____	_____
c) Science	_____	_____	_____

4. How long has/have the Standard Seven Science teacher(s) taught the subject to the Standard Seven pupils?

	0-1 Years	2-3 Years	>3 Years
a) In the school	_____	_____	_____
b) Elsewhere	_____	_____	_____

5. In what ways is your school involved in the community activities such as the national tree planting day?

6. For each of the ways you listed in Q.5 above, indicate by ticking, who carries out the activity by using the following guide:-

- | | |
|--|-------|
| a) a club in the school (e.g. 4K Club) | _____ |
| b) pupils during work programme | _____ |
| c) a particular class | _____ |
| d) any other, specify | _____ |

7. Does school have any project in the following areas?

Yes

No

a) Soil conservation

b) Water conservation

c) Afforestation

8. If the answer to Q7 above is yes, then answer the following questions:-

a) How is the project operated?

i) by an outside NGO

ii) by a club in the school

iii) by an interested teacher

iv) by school administration

v) any other, specify

b) How does the school relate the learning activities to the project activities?

9. Rank the following as barriers to effective teaching of environmental concepts in the school curriculum, from the most effective to the least effective with special reference to your school. The most effective barrier to be ranked 1 and the least ranked 7:

- a) Large class size _____
- b) Inadequate support by administration _____
- c) Inadequate time during school days _____
- d) Limited environmental knowledge by teachers _____
- e) Inadequate preparation time for teachers _____
- f) Unavailability of natural environment _____
- g) Inadequate instructional materials for
environmental concepts _____
- h) Others (Specify) _____

10. What do you feel when you see houses being built in places where wild animals used to live?

11. Give reasons why the school should be involved in environmental management activities in the local community.

12. Does your school experience any problem as it gets involved in environmental activities in the local community?

a) Yes _____

b) No _____

13. If the answer in Q 12 is yes, please list the problems your school often experiences.

14. What plans does the school have in sorting out the mentioned problems?

15. From your experience as the head teacher, what other sources of environmental information apart from school curriculum, are available to the teachers and the pupils especially in your community?

1. Name of the book			
2. Author			
3. Title of the book			
4. Date of purchase			
5. Price			
6. Name of the library			
7. Name of the librarian			
8. Name of the borrower			
9. Date of issue			
10. Date of return			

APPENDIX II

STANDARD SEVEN SCIENCE TEACHERS' QUESTIONNAIRE

PERSONAL INFORMATION

PERSONAL INFORMATION					
1	Name of Teacher				
2	Sex		3	Age	
4	Name of School				
5	School's Address				
6	Pupil's enrolment in Standard 7		Boys	Girls	Total
7	How long have you been teaching Science		0 – 1 yr	2 – 3yrs	> 3 yrs
a.	In other Classes (specify)				
b.	In Standard Seven?				
8	Agro-ecological zone				

Date _____

Instructions

Your class has been selected for this study and please answer all the questions by ticking below the most relevant response to each question.

	YES	NO	NOT AWARE
<p>1. The topic “Our Environment” in Std 7 Science course mainly covers environmental concepts such as meaning of environment, components of the environment, pollution of the environment and conservation of the environment</p>			
<p>2. The topic “Our Environment” covers more of the concept of environmental pollution than both conservation of the environment and components of the environment in Std 7 Science course</p>			
<p>3. The topic “Our Environment” covers all that the Std 7 science pupils need to understand about the meaning of environment</p>			

<p>4. The topic “Our Environment” outlines clearly the ideas the Std 7 pupils need to understand about the effects of pollution in each component of the Environment (air, soil and water).</p>			
<p>5. The topic “our Environment” covers well the concept of interaction of the components of environment with one another as outlined by Std. 7 Science course.</p>			
<p>6. The concept of “ components of environment” is adequately covered in Std 7 science textbooks and in the KCPE past papers as outlined by the syllabus.</p>			
<p>7. The four environmental concepts placed under the topic“ Our Environment” in Std 7 science course are equally examined in national examination (KCPE)</p>			
<p>8. The concept of environment can be taught in all subjects in the primary school curriculum</p>			

<p>9. Understanding of environmental concepts such as pollution of the environment requires the pupil to be involved in the related practical exercises in addition to class discussion</p>			
<p>10. The teaching of environmental concepts in Std 7 Science course requires different approach as compared to other topics such as mater and its properties.</p>			
<p>11. The condition of the natural environment is very delicate and can easily be upset.</p>			
<p>12. Environmental studies assume that humanity is a special part of the environment.</p>			
<p>13. Unavailability of natural environment around a school makes some teachers to develop low commitment in teaching environmental concepts in the school curriculum</p>			

21. Deforestation leads to soil erosion, which in turn leads to desertification.			
22. Cultural background of a pupil contributes to his/her understanding of environmental concepts in the school curriculum that differ from what the syllabus provides.			
23. Pupils often have some ideas about the topics in the school curriculum even before such topics are formally taught			
24. The following are barriers to effective teaching of environmental concepts, please rank them in order of priority from most to least important: -			
▪ Large class size			
▪ Inadequate support by school administration			
▪ Inadequate time during school days			
▪ Limited Environmental Knowledge by teachers			
▪ Inadequate preparation time for teachers			

▪ Unavailability of natural environment			
▪ Inadequate instructional materials for Environmental Concept			
▪ Others (Specify			

APPENDIX III

CULTURAL OPINION LEADERS' INTERVIEW SCHEDULE

PERSONAL INFORMATION				
1.	Name	2.	Age	
3	Sex			
4	Profession			
5	Community			
6	Agro-ecological zone			

Date _____

Instructions:

You have been chosen to be a cultural opinion leader in your community. Please could you answer the following questions as precisely as you can and the responses will be kept confidential.

1. State the synonymous words or phrases to the concept of environment in your mother tongue?

2. For one to establish a homestead in your community, what environmental conditions were being looked for?

3. In your traditional community lifestyle, what environmental conditions could make people to migrate from one area to the other?

4. How was the environmental components such as, forests (e.g. on hills), water sources (e.g rivers) and land (e.g. pasture) being conserved in your community traditionally?

5. Are you still doing the same to date?

a) Yes _____

b) No _____

6. If the answer for question five is No, what has gone wrong that the environment cannot be conserved in the same way as you used to?

7. If you compare the quality of your home environment during your youth and now, what difference can you note?

8. Describe how human beings relate to the environment, with respect to your traditional community.

9. What are the sources of environmental information do the children, at least in your community, have access to?

APPENDIX IV

MULTIPLE CHOICE SCIENCE TEST

PERSONAL INFORMATION

PERSONAL INFORMATION					
1	Name of Pupil				
2	Sex		3	Age	
4	Class				
5	Name of school				
6	Agro-ecological zone				

Date _____

Instructions

Your school has been selected for this study. This is not a school TEST and your responses will be kept confidential. Please answer the following questions by ticking the letter corresponding to the right answer among the four choices.

1. Which one of the following practices does NOT pollute the environment?
 - A. Spilling used oil in a forest away from home
 - B. Spraying some oil in a lake to kill mosquito larvae
 - C. Dumping vegetable remains in a farm near home
 - D. Dumping factory wastes into a river that flows into a sea

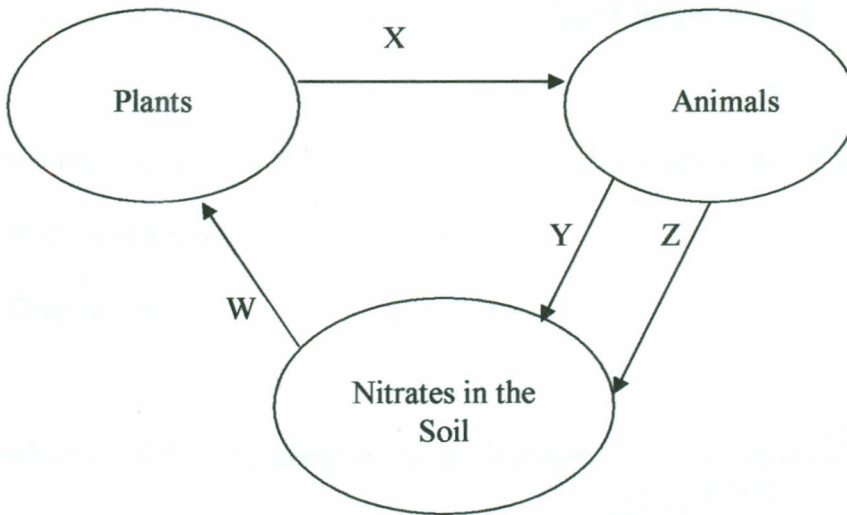
2. The parts that make up our environment are called.....
 - A. Locations
 - B. Sections
 - C. Components
 - D. Districts

3. Which one of the following is away of conserving the environment?
 - A. Diversified use of water
 - B. Deforestation
 - C. Opening upland for cultivation
 - D. Poaching wild animals

4. The following form the non-living part of our environment. Which one is NOT?

- A. Soil B. Light
C. Water D. Bacteria

5. The chart below shows part of Nitrogen cycle. Study it and answer the question that follows :-



Which one of the following gives the correct processes represented by arrows W,X,Y and Z?

- | | W | X | Y | Z |
|----|------------|------------|-----------|-----------|
| A. | Absorption | Feeding | Excretion | Decaying |
| B. | Feeding | Absorption | Decaying | Excretion |
| C. | Absorption | Decaying | Feeding | Excretion |
| D. | Feeding | Absorption | Excretion | Decaying |

6. One of the following is NOT a human part of our environment. Which one is it?
- A. Building B. School
C. Factories D. Water
7. Which one of these will NOT bring about soil pollution?
- A. Over using fertilizer C. Mulching the soil
B. Crop sprays D. Dumping of used factory chemicals
8. One of the following is NOT important in the balance of nature. Which one is it?
- A. Micro-organisms C. Hospitals
B. Crop sprays D. Plants and Animals
9. Which of the following make up our environment?
- A. Man-made things, Air and living things
B. Living things, Man-made things and non-living things
C. Non-living things, animals and Man-made things
D. Plant, Animals and non-living things
10. Which one of the following describes the term "environment" BEST?
- A. Organism's association with its surrounding
B. Home
C. Surrounding
D. School

11. Which one of the following is NOT used by Kenyans in conserving wildlife (wild animals)?
- A. National Parks and Game Reserves
 - B. Controlled hunting
 - C. Taming the wild animals in the orphanage
 - D. Protecting the rare animals
12. One of the following is not important for the conservation of vegetation to humanity. Which One is it?
- A. Provide land for agriculture
 - B. Provide habitat for wild animals
 - C. Provide air we breathe
 - D. Provide rainfall for our crops
13. Which ONE of the following does describe the term “environmental conservation”?
- A. Saving what we have for future use
 - B. Preventing the loss of air, water, plants and animals
 - C. Maintaining the environment for the future generation
 - D. Protection of the environment for the sake of tourism
14. What is meant by the term pollution?
- A. Smelly, unwashed bodies
 - B. Breathing out smelly and offensive odour
 - C. Making the environment dirty by releasing offensive substances
 - D. A boy in class passing out bad air

15. In which of the following would there be less pollution in the area?

- A. People smoking in a room
- B. A charcoal jiko burning outside
- C. Motorcar lights flashing in the dark
- D. Dusting a pair of shoes in the room

16. Environmental studies assume that humanity is what part of nature?

- A. Special
- B. Related to all other parts
- C. Not important
- D. The best part

17. Which of the following is the most dangerous to the earth's environment?

- A. Damming rivers
- B. Pollution
- C. Civil wars
- D. Desertification

APPENDIX V

ENVIRONMENT APPERCEPTION TEST
(EAT)

PERSONAL INFORMATION					
1.	Name of Pupil				
2.	Sex		3.	Age	
4.	Name of School				
5.	Agro-ecological zone				
6.	Education level of Parents		Primary	Secondary	Tertiary
	a) Father				
	b) Mother				
7.	Economic Status of Parents		Employed		Un-employed
	a) Father				
	b) Mother				

Date: _____

Introductions:

You have been selected for this study. This is not a school test and your response will be kept confidential. Please answer the following questions as precisely as possible:

1. The photograph below shows a school environment



- What does environment mean to you?
- Mention the structure that makes up the school environment as shown in the photograph above.
- Which one of the following words describes the structure that makes up an environment?

Surrounding Components Parts

- Is humanity part or the owner of the environment?

2. The photograph below shows the sewage wastes being poured into the flowing river water:



- a) What happens when the sewage wastes mix with flowing river water as shown in the above photograph?
- b) What section of the environment is being polluted as shown in the above photograph?
- c) What does environmental pollution mean to you?

3. The photograph below shows the pupils planting and watering Paw-paw seedlings on the bare ground in a school compound:



- a) What has made this school to loose the grass covering the ground as shown in the above photograph?
- b) Do you think that planting trees will change the bareness in the school ground? Explain?.....
- c) What does environmental conservation mean?

APPENDIX VI

PHOTOGRAPHS USED IN THE ENVIRONMENT APPERCEPTION TEST

INSTRUMENT

The following photographs were used during the administration of Environment Apperception Test instrument to the pupils:-

1. Showing a school environment with components such as buildings, pupils weeding flowers, trees, flag post and teachers.



2. Showing sewage wastes being poured into a flowing river water:



3. Showing pupils planting and watering Paw-paw seedlings on a bare ground in a school compound, being supervised by teachers:



APPENDIX VII

**THE SCORING SCHEME OF PUPILS' RESPONSES TO THE BASIC IDEAS
INVESTIGATED IN THE EAT INSTRUMENT**

1. Meaning of Environment (M.E.)

a) Definition of the Environment (ME1)

i) The Association with organism's

Surrounding that affects its life *5 points*

ii) The surrounding of an organism *4 Points*iii) The surrounding/area *3 Points*

iv) One of the structures in the

environment such as air, water or soil *2 Points*

v) No grasp of the relevant idea *1 Point*

b) The structures that make the school environment

as observed in photograph 1 of appendix "Vi"

(ME2)

i) Living things such as animals (e.g. pupils)

and plants (e.g. flowers);

non-living things namely soil, water and air;

and

human made entities such as desks and

buildings *5 Points*

- ii) At least one example from living things, non-living things and human-made entities (without listing the groups such as living things). *4 Points*
- iii) At least one example from any two groups e.g. animals (living things) and water (non-living things). *3 Points*
- iv) At least one example from only one of the groups such as water, animals or buildings *2 Points*
- v) No grasp of the relevant idea *1 Point*
- c) The term that specifically describes the structures that make up the environment according to Standard Seven Science course (ME 3).
- i) Mentioning and explaining the term “component” before the choices are shown *5 Points*
- ii) Choosing the word “component” from the provided choices and explaining its meaning *4 Points*

- iii) Choosing the word "Component" from the provided choices and failing to explain its meaning *3 Points*
 - iv) Choosing any other option in the list, for example 'surrounding' or 'parts' *2 Points*
 - v) Failing to choose from the given points *1 Point*
- d) Asserting whether humanity is part or the owner of the environment (ME 4)
- i) Humanity is part of the environment because:-
Humanity is an animal that forms one of the components of the environment, and God is the owner of the environment. *5 Points*
 - ii) Humanity is part of the environment because of any one of the reasons given in i above.
4 Points

- iii) Humanity is part of the environment
without giving any reason *3 Points*
- iv) Humanity is the owner of environment
with or without any supporting reason *2 Points*
- v) No grasp of the relevant idea *1 Point*

2. Pollution of the environment (PE)

a) What happens when sewage wastes mix with the flowing water (PE 1)?

- i) The river water becomes polluted, dirty
or smelly *5 Points*
- ii) Living things in the water will die or
the users of the river water will suffer from
water-borne diseases *4 Points*
- iii) Diseases will be spread *3 Points*
- iv) Mentioning any other negative state of water *2 Points*
- v) No grasp of the relevant idea *1 Point*

b) The section of the environment that is being
polluted as shown in photograph '2' of
Appendix VI (PE 2)

- i) River water *5 Points*
- ii) Water *4 Points*
- iii) River *3 Points*

iv) Mentioning any other structure in the photograph *2 Points*

v) No grasp of relevant idea *1 Point*

c) Definition of pollution of the environment (PE 3)

i) Making an environment dirty or impure *5 Points*

ii) Making an environment to change color *4 Points*

iii) Causing diseases in the environment *3 Points*

iv) Making a specified component of the environment such as water, air or soil bad *2 Points*

v) No grasp of relevant idea *1 Point*

3. Conservation of the environment (EC)

a) The causes of bareness in the school compound

As observed in the photograph '3' of Appendix

VI (EC I)

i) Lack of enough rainfall *5 Points*

ii) Poor management of ground cover (grass) *4 Points*

iii) Lack of ground cover (grass) *3 Points*

iv) Lack of tall trees *2 Points*

v) No grasp of the relevant idea *1 Point*

- b) Whether tree planting could change the state of bareness/drought in the school compound as reflected in the photograph '3' in appendix VI (EC 2):

Yes, because trees will attract rain and this will

revive the ground cover vegetation *5 Points*

Yes, because trees will attract rain *4 Points*

Yes (without any supporting reason) *3 Points*

No (without any supporting reason) *2 Points*

No grasp of any relevant idea *1 Point*

- c) Definition of environmental conservation (EC3):

i) Sparing of what we have for future use or preventing the loss of environmental components such as air, water and soil for future use *5 Points*

ii) Conserving the environment for future use *4 Points*

iii) Conserving the environment *3 Points*

iv) Conserving one specified component of the environment such as trees *2 Points*

v) No grasp of the relevant idea *1 Point*

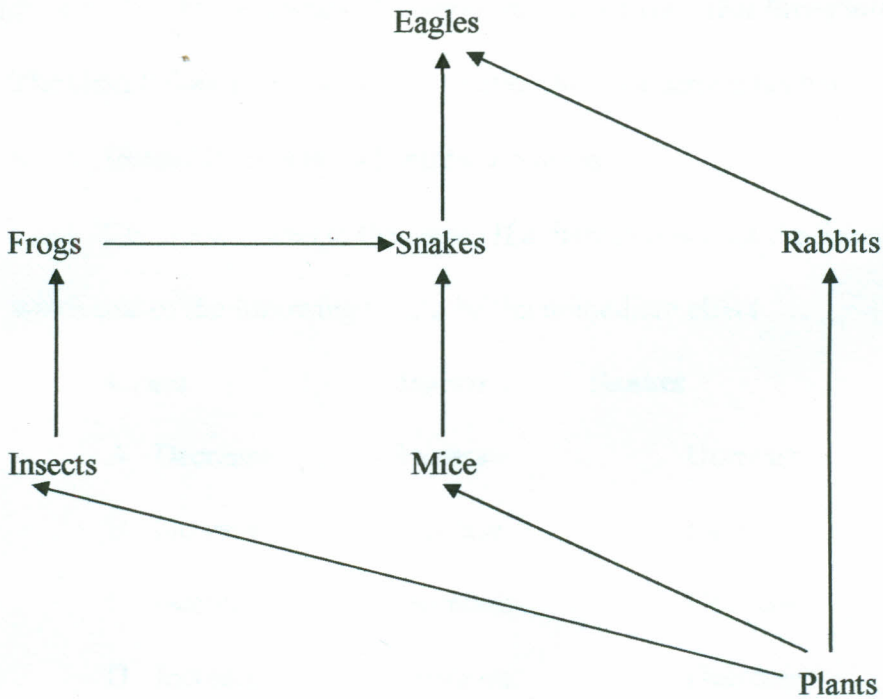
APPENDIX VIII

QUESTION ITEMS SET ON ENVIRONMENT IN KCPE FROM 1985 TO 2000

1. The slowest way of recycling carbon in sawdust is by:

- A. Putting the sawdust in the cowshed
- B. Putting the sawdust in the Shamba
- C. Using the sawdust in a jiko for cooking
- D. Using the sawdust for making hardboards

2. Study the diagram of the food web below and answer the question that follows: -



Which of the following animals should be most abundant in the food web?

- A. Insects
- B. Snakes
- C. Frogs
- D. Rabbits

3. Which one of the following LEAST pollutes the environment when used for cooking?

- A. Cow dung B. Kerosene
C. Biogas D. Charcoal

4. Which one of the following practices does NOT pollute the environment?

- A. Spilling used oil in a forest away from homes
B. Spraying some oil in a lake to kill mosquito larvae
C. Dumping vegetable remains in a farm near home
D. Dumping factory wastes into a river that flows into the sea.

5. The chart below shows a feeding relationship in a certain habitat.

Grass → Insects → Lizards → Snakes

Note: The arrow points to the eater. If a disease killed all the lizards, which one of the following would be the immediate effect

Grass	Insects	Snakes
A. Decrease	Increase	Decrease
B. Increase	Increase	Decrease
C. Decrease	Decrease	Decrease
D. Increase	Decrease	Decrease

6. Use the information below to answer the question that follows.

Frogs eat grasshoppers

Grasshoppers eat grass

Snakes eat frogs

From this information, which one of the following is correct food chain?

- A. Frogs → grasshoppers → grass → snakes
- B. Snakes → frogs → grasshoppers → grass
- C. Grass → grasshoppers → frogs → snakes
- D. Grass → grasshoppers → snakes → frogs

7. Which one of the following materials DOES NOT pollute the environment?

- i. Sawdust
- ii. Broken pieces of glass
- iii. Plastic paper bags
- iv. Metal cans

8. Which one of the following materials could be used as a pesticide?

- i. Coffee husks
- ii. Wood husks
- iii. Chalk dust
- iv. Saw dust

9. The main reason why “jua kali” artisans use scrap metal is that

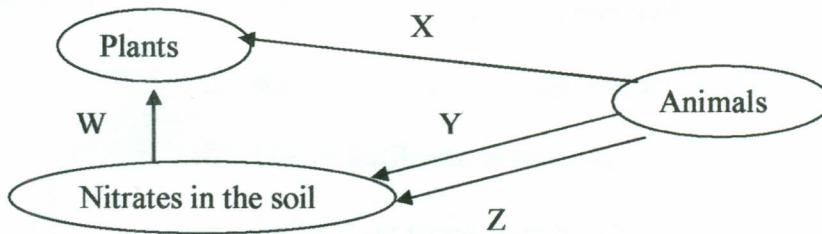
- i. They want to clean the environment
- ii. Raw materials are not readily available
- iii. Kenya has a lot of scrap metal
- iv. Products made from scrap metal are cheap

10. Susan studied feeding relationships among butterflies, owls and chameleons in the bush near her school.

Which one of the following food chains CORRECTLY shows the feeding relationship?

- A. Owl → Chameleon → Nectar → Butterfly
 B. Owl → Chameleon → Butterfly → Nectar
 C. Nectar → Butterfly → Chameleon → Owl
 D. Nectar → Butterfly → Owl → Chameleon

11. The chart below shows part of the nitrogen cycle. Study it and answer the question below



Which ONE of the following gives the correct processes presented by the arrows W,X,Y and Z?

- | W | X | Y | Z |
|---------------|------------|-----------|-----------|
| A. Feeding | Absorption | Excretion | Decaying |
| B. Absorption | Decaying | Feeding | Excretion |
| C. Absorption | Decaying | Excretion | Feeding |
| D. Feeding | Absorption | Decaying | Excretion |
12. Which one of the following is NOT an air pollutant

- i. Noise
- ii. Vehicle exhaust gases
- iii. Industrial fumes

iv. Decomposing vegetable matter

13. Which one of the following DOES NOT lead to destruction of the environment?

i. Poaching in game reserves

ii. Keeping a large number of livestock on a small piece of land

iii. Dumping vegetable wastes in the garden

iv. Planting eucalyptus trees in swamps

14. Which one of the following DOES NOT pollute river water

i. Spraying of crops with pesticides

ii. Releasing treated sewage water into the river

iii. Use of fertilizers in farming

iv. Cultivating along river banks

15. The correct way to get rid of used plastic containers from the environment is to

i. Bury in the soil

ii. Throw into the river

iii. Burn

iv. Recycle

16. Which one of the following is the most effective method of controlling mosquitoes?

i. Killing them

ii. Destroying their breeding places

iii. Using mosquito nets

iv. Removing mosquito eggs from water

17. Which one of the following is the LEAST important reason for building dams in

Kenya

- i. Production of electricity
- ii. Irrigation of land
- iii. Conservation of water for domestic use
- iv. Providing places for fishing

18. During a science lesson pupils listed the following substances as pollutants.

Fertilizers, gases from factories, herbicides, wash off from factories and aerosols.

Which of the following pairs are the main air pollutants?

- A. Fertilizers and gases from factories
- B. Herbicides and gases from factories
- C. Aerosols and gases from factories
- D. Wash off from factories and gases from factories

19. I, II and III in the diagram below represent processes involved in a simple water

cycle. Choose the correct order of processes represented by I, II and III

- | I | II | III |
|-----------------|---------------|---------------|
| A. Condensation | Evaporation | Precipitation |
| B. Evaporation | Condensation | Precipitation |
| C. Evaporation | Precipitation | Condensation |
| D. Condensation | Precipitation | Evaporation |

APPENDIX IX

LETTERS OF CORRESPONDENCES

1. Research authorization by the Ministry of Education, Science and Technology. 4th
February, 2000
2. Research Permit Certificate, 4th February 2000
3. Research authorization by Provincial Director of Education, Nyanza Province, 9th
February, 2000
4. Research authorization by Municipal Education Officer, Kisumu Municipality, 11th
February, 2000

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

Telegrams: "EDUCATION", Nairobi
 Telephone: Nairobi 334411
 When replying please quote



JOGOO HOUSE "B"
 HARAMBEE AVENUE
 P.O. Box 30040
 NAIROBI

Ref. No. ... NOES&T-13/001/30C 27/2
 and date

Date ... 4th February, 2000 ...

John Odhiambo Otewa
 Kenyatta University
 P.O. BOX 43844
NAIROBI

Dear Sir

RESEARCH AUTHORISATION

I acknowledge receipt of your application for authority to conduct research on 'The Pupils Understanding of the concept of Environment: A case study of Standard seven Pupils in Nyanza Province' with thanks.

This Office has no objection to your intended research being conducted in Primary Schools in Nyanza Province for a period ending 31st December the year 2001.

You are advised to pay courtesy call to the Provincial Commissioner and the Provincial Director of Education Nyanza Province before commencing your research project.

This Office expects to receive two bound copies of your final research report upon completion of your research project.

Yours faithfully

A. G. Kaaria

A. G. KAARIA

FOR: PERMANENT SECRETARY/EDUCATION, SCIENCE AND TECHNOLOGY

CC.

The Provincial Commissioner
 Nyanza

The Provincial Director of Education
 Nyanza

The Municipality Education Officer
 Kisumu Municipal Council
 P.O. BOX
 KISUMU

RESEARCH PERMIT CERTIFICATE

Research Permit No. IGES/RES/001/2001
 Date of Issue 04-12-2000
 Issued at 9/5/2000

Name of Applicant JOHN ODIA AMBO OTHENA
 of (Address) P.O. Box 595
KISUMU

has been permitted to conduct research in
 Location
 District
NYANZA Province

on the topic THE RURAL'S UNDERSTANDING OF THE
CONCEPTS OF SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL
PROTECTION IN RURAL AREAS OF THE NYANZA PROVINCE

for a period ending 31st December 2001



Signature [Signature]
 Permanent Secretary
 Ministry of Education,
 and Religion,
 P. O. Box 30040, Nairobi

MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY

PROVINCIAL DIRECTOR OF EDUCATION
 NYANZA PROVINCE
 P.O. BOX 575
KISUMU.

Ref. No. NP/GA/23/8/49.

9th February, 2000.

John Odhiambo Otewa
 Kenyatta University
 P.O. Box 43844
NAIROBI.


Dear Sir,

RE: AUTHORITY TO CONDUCT RESEARCH ON ENVIRONMENTAL
 EDUCATION - PRIMARY SCHOOLS.

I acknowledge receipt of a copy of the Permanent Secretary's letter Ref. MOES & T.13/001/30C/27/2, dated 4th February, 2000 authorising you to conduct research on 'The Pupils Understanding of the Concept of Environment - A case Study of Standard Seven pupils in Nyanza'.

This office has no objection to your intended visits to our primary schools for the research.

Kindly pay courtesy calls to the District/Municipal Education Officers before proceeding to the respective schools for the same.


 (MWALO M.O.)
 for PROVINCIAL DIRECTOR OF EDUCATION
NYANZA PROVINCE.

c c The Permanent Secretary, Ministry of Education.
 The Director of Education.

KISUMU MUNICIPAL COUNCIL

EDUCATION DEPARTMENT

Tel. No.40394



P.O. Box 105,
Kisumu, Kenya.

Our Ref: MEO/43/Wo1 VII/81

Date: _____

Your Ref: _____

11th February 2000

Headteachers

M W Shah Primary School

H H Aga Khan " "

Arya " "

Kibuye Mixed " "

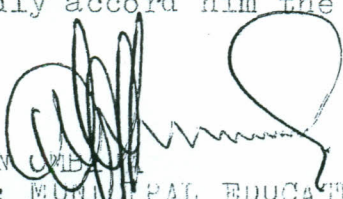
Singh Saba " "

Kisumu Union " "

RE: RESEARCH AUTHORIZATION

Mr John Odhiambo Otewa has the authority of this office to carry out research in your schools for his Phd thesis. He is a student from Kenyatta University.

Kindly accord him the necessary support.


JOHN ODHIAMBO OTEWA
for: MUNICIPAL EDUCATION OFFICER

APPENDIX X

THE TRANSCRIPTION SHEET OF PUPILS'

1. Meaning of the Environment (M.E)

a) Definition of the Environment (ME 1)

.....
.....
.....

b) The structures that make up the school environment as shown in photograph 1 in Appendix V (ME 2)

.....
.....
.....

c) The term that specifically describes the structures that make up the environment according to Standard Seven Science Course (ME 3)

.....
.....
.....

d) Assertion on whether humanity is part or the owner of the environment (ME 4)

.....
.....
.....

2. Pollution of Environment (PE)

a) What happens when the sewage wastes mix with flowing river water? (PE 1)

.....
.....
.....

b) Section of the environment that is being polluted as shown in photograph 2 of Appendix V (PE 2)

.....
.....
.....

c) Definition of environmental pollution (PE 3)

.....
.....
.....

3. Environmental Conservation (EC)

a) The causes of bareness in the school compound as shown in photograph 3 of Appendix V (EC 1).

.....
.....
.....

b) Whether tree planting could change the state of bareness in the school compound as shown in photograph 3 in Appendix V (EC 2)

.....
.....
.....

c) Definition of environmental conservation (EC 3)

.....
.....
.....

NB: The researchers deduction on the pupils' understanding of the concept of environment

.....
.....
.....