

**ENVIRONMENTAL EDUCATION TO ADDRESS NEGATIVE IMPACTS OF
COPPER MINING IN KANKOYO TOWNSHIP OF ZAMBIA'S COPPERBELT
REGION**

by

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**A Dissertation Submitted to the University of Zambia in partial fulfillment of the
Requirements for the Degree of Master of Education in Environmental Education**

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DECLARATION

I, Chipatu Lillian, declare that the dissertation hereby submitted is my own work and it has not previously been submitted for a degree, diploma or other qualification at the University of Zambia or any other University.

Signed

Date

CERTIFICATE OF APPROVAL

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ABSTRACT

With a rapid pace of economic activities that had also brought along with them a series of fallouts and negative impacts, many mining communities in Zambia did not generally receive Environmental Education on the negative impacts of mining. Using Environmental Education to address negative impacts of mining in Zambia's Kankoyo township of Mufulira constituted the aim of this study.

To achieve this aim, the study established the provision of Environmental Education among Kankoyo residents. Having done this, the nature of Environmental Education provided was assessed. Lastly, an improved version of Environmental Education suitable for Kankoyo residents was proposed.

The study predominantly used qualitative methodology. However, for further clarity, it was supplemented by quantitative methodology. Questionnaires with both closed and open ended questions were administered to Kankoyo residents while interviews were conducted for Environmental Education providers and Coordinators. Furthermore, onsite observations were conducted by the researcher.

The Study's findings confirmed reviewed literature assertions that there was Environmental Education offered to Kankoyo residents which did not incorporate in its content environmental issues related to negative impacts of copper mining.

The major recommendations of the study are the need for the inclusion of environmental issues related to copper mining in the Environmental Education programme. Another recommendation is the need for the Zambian government and its cooperation partners to work together in making Environment Education responsive to a combination of economic, social and environmental crises that make everyday life difficult in Kankoyo Township.

DEDICATION

To my late grandmother Jennipher Mambwe Mutengo, Bishop Shem Kapangula, my mother Beatrice Mambwe and sisters namely Barbra and Suwilanji, my cousin Lombe and my niece Lukwesa for their encouragement and moral support.

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List of Acronyms

AMD	Acid Mine Development
CBRM	Community Based Resource Management
CEP	Copperbelt Environmental Project
CIDA	Canadian International Development Agency
CBU	Copperbelt University
DDA	Delegated Authorising Agencies
ECZ	Environmental Council of Zambia
EE	Environmental Education
EFA	Environmental Foundation for Africa
EIAR	Environmental Impact Assessment Regulation
EMMS	Environmental Management in Mining Sector
EMP	Environmental Management Plan
EPPCA	Environmental Protection Pollution and Control Act
EPA	Environmental Protection Agency
ESP	Environmental Support Program
GFID	German Foundation for International Development
GMA	Game Management Areas
IUCN	International Union for Conservation of Nature
MCM	Mopani Copper Mine
MMC	Mufulira Municipal Council

MMSD	Mining, Mineral, and Sustainable Development
MSD	Mine Safety Department
MTENR	Ministry of Tourism, Environment and Natural Resources
NEAP	National Environmental Action Plan
NGO	Non Governmental Organization
NISIR	National Institute for Scientific and Industrial Research
PAID	Pan African Institute for Development
PCB	Poly-Chlorinated Biphenyl
UGWA	Upper Guyandotte Watershed Association
UNDP	United Nations Development Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNZA	University of Zambia
USA	United States of America
USEPA	United States Environmental Protection Agency
RDC	Resident Development Committee
SADC	Southern African Development Community
WECSZ	Wildlife and Environmental Conservation Society of Zambia
WPA	Wildlife Producers Association
WWF-ZEP	Worldwide Fund for Nature-Zambia Education Program
ZAWA	Zambia Wildlife Authority

CHAPTER ONE

BACKGROUND TO THE STUDY

Overview

This chapter presents the background that generated the need to conduct this research. The statement of the problem, purpose, objectives, research questions and the significance of the study are also brought out. Operational definitions of terms used in the study and delimitations of the research are also presented.

1.1 Introduction

The changing trends in the field of industry and commercial activities have reflected themselves quite clearly in the way new and supportive industries have come up. Such a rapid pace of economic activities has also brought along with it a series of fallouts and negative impacts, leading to the need for newer initiatives such as creating awareness about environmental safety and the practices required to observe the same. It has become exceptionally vital to pursue concrete Environmental Education programmes in all types of industries such as mining and production houses of all categories.

In Zambia, there are abundant mineral resources and the mining industry plays a crucial role in the economic and social- political development of the country. The mining industry offers a source of foreign exchange earnings. It contributes \$822 million (US dollars) in total exports (Monde, 2010). Not only does the industry offer a source of foreign exchange earnings, it is also an important source of income for people through direct and indirect employment. Indirect employment created by the mines includes mine contractors and suppliers who supply the mining industries. Thus, the total effect of the operations on local and regional employment is significant. Suffice to say that the mining industry is still the economic blood of the country.

Despite the potential of the mining industry to generate wealth and employment for the people, there are mammoth challenges in harmonizing economic gains with environmental integrity and social concerns. This is the case of Mopani Copper Mine which was established in 1933. Copper mining at this mine involves processes which are designed to remove impurities in order to obtain 99.99 per cent copper from the ore. The mining

operations result in various negative impacts such as the displacements of people and other organisms in the ecosystem, human health risks and an increase in environmental degradation.

Suffice to say that with all the negative impacts of copper mining activities on the environment, the enormous contribution of the industry to the economy of the country makes it difficult to discard it. This consequently calls for environmental stability and sustainability advocacy.

Negative impacts of copper mining are aggravated by lack of environmental awareness among the local community, especially among adults with low literacy levels. People with low literacy levels, low family income and large families focus their efforts on fulfilling the basic needs like food and shelter. In earning a living, although scavenging in the mine dumpsite can be a health hazard, health becomes a luxury if they have to take care of bringing food on their tables. Environmental Education could help them to become aware of the impacts of mining, avoid negative impacts of mining activities and to take better care of their environment. Environmental Education on both the mining companies and the local community is vital in environmental management and in safeguarding the health of the local community and the environment at large.

1.2 Statement of the Problem

Despite many studies on the impact of mining and regulations to mitigate the negative impacts on the environment, many local people of the mining towns do not generally receive Environmental Education. Lack of Environmental Education among mining communities can be deduced from various indicators such as the establishment of settlements near the mines, scavenging in the mine dumpsites and the polluted streams and rivers that are known to be the main recipients of mine effluent as well as the continued utilization of the expansive but polluted wetlands by subsistence anglers. This scenario has resulted in poor health conditions on both the physical environment and the Mufulira residents of Kankoyo Township (Christophe, 2009). Such a situation calls for ameliorative measures to address the problem, and Environmental Education could be such a measure and hence, the present study.

1.3 Purpose of the Study

The purpose of the study was to use Environmental Education in order to address the identified negative impacts of mining on Kankoyo residents of Mufulira in Zambia.

1.4 Specific Objectives

In order to address the above aim, the study specifically set out:

1. To establish whether or not any organization or Company provided Environmental Education among Kankoyo residents.
2. To assess the nature of Environmental Education provided among the residents, if any.
3. To propose an improved version of Environmental Education among the study community if at all there is already one.

1.5 General Research Question

The study tackled the following general research question:

How can Environmental Education be used in order to address negative impacts of mining to be identified among residents of Zambia's Kankoyo mining town?

1.6 Specific Research Questions

Specific research questions addressed by the study included the following:

1. Does any organisation or company provide Environmental Education among residents of Kankoyo Township?
2. What type of Environmental Education is provided to residents of Kankoyo Township?
3. In what ways could Environmental Education provided be improved upon for the future?

1.7 Rationale

The study is expected to help the following institutions; Environmental council of Zambia, Ministry of Education and Ministry of Mines to put in place Environmental Education appropriate to residents of Zambia's mining towns. It is envisioned that the study will also help Mufulira town planners to plan conducive settlements to safeguard the health of the people. In addition, the study will fill the gap on how Environmental Education could be

used to address negative impacts of mining that has been left by educational researchers dealing with impacts of mining on the environment.

1.8 Limitations of the Study

Conducting the research was not easy due to limited time, as observation (one of the methods used to collect data) required a lot more time to observe and understand behavior of people. Furthermore, the data supplied by some government departments was limited due to bureaucratic nature of government departments and also due to concealment of facts on perceived government failures. The situation was also similar to company X who could not release any information on the research topic.

1.9 Operational Definitions of Terms

This section presents a brief description of the main concepts dealt with in the study. Different scholars have defined them in different ways. However, in this study they will mean as defined below;

Environment: An interaction between the physical surroundings and the social, political and economic forces that organise people in the context of these surroundings.

Environmental Activity: Actions or lessons learnt on how to deal with impacts of mining and also how to care for the environment.

Environmental Issue: It is a debatable outcome or result from an environmental concern which requires a serious debate to agree or disagree on the course of action to take.

Environmental Education (EE) : A multi-disciplinary approach to learning that develops the knowledge, awareness, attitudes, values and skills that will enable individuals and the community to contribute towards maintaining and improving the quality of the environment.

Learners: Locals who are recipients of EE activities.

Mining Community: People in a local area where mining activities are located.

Participation: A process that enables the provider of EE and the recipient to take part more fully in the planning, implementation and evaluation of an education activity aimed at solving an environmental issue.

Providers: Institutions that are involved in providing EE activities.

Residents Development Association: People who facilitate the EE activities and programmes from the providers to the local community.

1.10 Structure of the Dissertation

The study consists of five chapters. The first chapter introduces the study and presents the background to the problem under investigation, the statement of the problem, the rationale and the purpose of the study. The chapter also outlines the objectives, the research questions, operational definitions as well as the scope of the study. The second chapter presents a review of literature related to the topic. The methodology of the study is described and outlined in Chapter three. Chapter four presents the findings while Chapter five discusses the findings. Finally chapter six draws the conclusion and makes some recommendations.

Summary

This chapter focused on the background, statement of the problem, purpose of the study, the objective of the study, research questions, rationale, and limitations of the study and the operational definitions of terms.

The next chapter evaluates the significance of this study in relation to the related literature from studies that were done responding to similar challenges arising from the need to reduce negative impacts of mining on the mining communities.

CHAPTER TWO

LITERATURE REVIEW

Overview

Chapter two focuses on the literature reviewed about the background of Environmental Education, negative impacts of mining on the environment and the use of Environmental Education in addressing the negative impacts of mining on mining communities from a global and local perspective.

2.1 Introduction

Knowledge about the interdependence between human life and the rest of the world has always been there since time immemorial. However, it was not until the 1960s that interdisciplinary and multi-disciplinary models of Environmental Education came into existence although its programmes could not be implemented immediately in most countries (Reddy and Rao, 1997).

By 1970, professional organizations and individual countries advocated for Environmental Education as a way of dealing with environmental problems (Aggarwal *et al.*, 1996). In Brazil, the negative effects of mining on the environment made organisations and individuals to realise that Environmental Education could be used to address the problem of land pollution. This made individuals and organisations to begin advocating for Environmental Education (<http://econ.worldbank.org/external/default/main>).

At present, Environmental Education has attained a status of acceptance in many countries if not in all countries (Jensen 2000). In support of the above statement, World Bank Group (2010) highlighted that Brazil was using appropriate technology and Environmental Education to address the negative impacts of gold mining in the Amazonia region.

Environmental Education activities in Africa are being carried out by some government departments and stakeholders such as Non Governmental Organizations (NGO's). For example, the Environmental Foundation for Africa (EFA) is a Sierra Leone based non-governmental organization established in 1992. This organisation aimed at protecting and restoring the environment in West Africa.

James (2008) noted that for more than 15 years, EFA in Sierra Leone had spearheaded Environmental Education and awareness raising campaigns, restored degraded lands and conserved preserved forests, minimized the impacts of civil war on the environment and its inhabitants, and equipped thousands of people with sustainable livelihood skills. EFA specialises in Environmental Education, environmental awareness raising and capacity building at the national, regional and international levels using high impact communication tools and training programmes to build an environmentally conscious society motivated to maintain the integrity of nature in Africa. Apart from Sierra Leone, EFA operates in Liberia and in some European countries.

In Zambia, it is Environmental Council of Zambia (ECZ) and other stakeholders and not EFA that handles issues of Environmental Education (EE) and awareness. ECZ is the lead agency in the development of EE activities and enforcing laws and legislation on environmental Protection. It is an implementing arm of government for all projects and programmes that aim at protecting the environment. The Ministry of Tourism, Environment and Natural Resources is responsible for policy guidance, coordination and monitoring of environmental and natural resources management issues in the country.

According to ECZ (2000), the level of environmental awareness has improved although it is still low in certain specific areas. It is in this regard that ECZ should prioritise the need to begin co-coordinating and enhancing networking among stakeholders and partners, which will contribute towards strengthening of EE processes in Zambia.

In the same vein, the United Nations Educational Scientific and Cultural Organisation (UNESCO) (2000) are of the view that EE should clearly constitute a comprehensive lifelong education; one responsive to changes in a rapidly changing world. It should equip society to play a productive role towards improving life and protecting the environment with regard given to ethical values.

2.2 Environmental Education Activities in Zambia

Zambia's long tradition of EE activities has its roots in wildlife and forest conservation. For many decades, informal and indigenous education was wrapped up with practical and

applied knowledge of the environment. However, Aongola *et al.*, (2009) claim that wildlife clubs were possibly the first shoot to formalize a national conservation education programme for Zambia and the Southern Africa Development Community (SADC) region. The main purpose of the national conservation education programme was to raise awareness about Zambia's wildlife resources through lectures and education tours.

By 1972, EE movement had become consolidated with Wildlife Conservation Society of Zambia (WCSZ) partnering with World Wide Fund for Nature (WWF), mining companies and the Ministry of Education for the purposes of sponsoring and creating an opportunity to influence the formal education system.

Influencing the formal education system was achieved when WWF initiated the Zambia EE Programme to be incorporated into the school curriculum. To infuse EE in the informal and non formal education, the 1994 National Environmental Action Plan (NEAP) provided money for public information and environmental awareness under the Environmental Support Programme (ESP) (Aongola *et al.*, 2009).

Currently, EE has expanded to other environmental issues such forest conservation, waste management and climate change. However, not so much has been done on EE to address the negative impacts of mining on the environment. To give a picture of EE activities in Zambia, wildlife, waste management and Climate change will be discussed in the subsequent section.

2.2.1 Wildlife

Zambia is endowed with a profusion of natural resources and a rich biological diversity. The country has an elaborate network of natural reserves which include 19 National Parks, 32 Game Management Areas (GMAs) and rivers, lakes and several protected forests (Manning , 2007). Despite the large wildlife estate base, there is a threat of encroachment and wildlife depletion. Manning (2007) reports that human settlements in Zambia have encroached on game reserves. As a result poaching by the settlers has led to depletion of wildlife.

The Ministry of Tourism, Environment and Natural Resources (MTENR) is the national focal point on matters pertaining to the management of biological diversity in Zambia (<http://www.un.org/esa>). The duties of the ministry include coordination, conservation and restitution of the full range of biological diversity of the country. In striving to achieve this, the MTENR collaborates with all relevant ministries and agencies responsible for wildlife conservation such as enforcement of laws and legislation.

The following are the relevant ministries and agencies that work with MTENR;

1. Environmental Council of Zambia (ECZ). ECZ is mandated by law to control pollution and protect the environment from any damage and offering EE programmes.
2. Zambia Wildlife Authority (ZAWA) which is mandated by law to protect and ensure sustainable use of wildlife resources.
3. Zambia Alliance for Women which is a Women NGO representative.
4. Wildlife and Environmental Conservation Society of Zambia (WECSZ) which is a Non Governmental Organisation (NGO) that has a long history of involvement in offering EE and advocating for sustainable management of Zambia's wildlife resources.
5. The fisheries sub-programme in the Ministry of Agriculture, Food and Fisheries which is mandated to promote sustainable use of fish resources.
6. Wildlife Producers Association (WPA). WPA is a forum for promoting good ethics in management of wild animals reared in captivity.
7. National Institute for Scientific and Industrial Research (NISIR) which is a government agency established to initiate and coordinate scientific and industrial research.

The institutions offering biodiversity training include the Copperbelt University (CBU) and UNZA (Environmental Education Section) in the school of Education, Department of Geography, Department of Biology and the School of Agriculture).

In addition, various institutions have developed specific programmes for EE. For example, ESP and ECZ have been sponsoring Television series to educate the public on the value and importance of conserving the country's biological resources (<http://www.un.org/esa>).

On one hand, Zambia embarked on the development of priority sectoral databases for five pilot areas. These included the wildlife information system in Kafue National Park and land degradation information system in Mpika and Siavonga districts. Information systems already developed include computerised databases at ECZ, ZAWA and UNZA. The Departments of Wild life have libraries, which contain books, and local reports on specific biodiversity components.

On the other hand, radio broadcasts have been used by some NGO to promote EE. The institution involved is the Wildlife and Environmental Conservation Society of Zambia (WECSZ). Workshops and Seminars have also been used by the German Foundation for International Development (GFDS), Pan African Institute for Development (PAID), WWF and International Union Conservation of Nature (IUCN) to promote high level involvement in biological resource conservation (<http://www.un.org/esa>). Some of the radio programmes and clubs initiated by WECSZ include the following;

2.2.1.1 Chipembele News Club

A key element of EE Programme in Chipembele News is the production of EE materials such as the Chipembele Newsletters and Magazines that are distributed free to schools and community-based Chongololo and Conservation clubs in Zambia. The printed materials are also supported by a weekly environmental commentary column, 'Environmental Notes by Warthog' in the Sunday times of Zambia News paper.

Similarly, several of the local tour operators such as Norman Carr Safaris and Mfuwe Lodge Camp Company have been actively supporting the WECSZ programmes and had partnered with the Zambian Carnivore Programme, South Luangwa Conservation Society, and the local drama group (Sensitisation and Education through Kunda Arts) and the local Forestry Department in a range of conservation programmes and activities (<http://www.networklearning.org/index>).

2.2.1.2 Chongololo Club of the Air

Chongololo Club of the Air, a weekly Sunday lunchtime radio programme on Radio 2 also disseminates conservation messages. This programme has a good number of declared memberships with countless passive listeners countrywide, making it probably the largest environmental radio club in Zambia. To further EE activities on wildlife conservation, the Munda Wanga garden was turned into an Environmental Park (<http://www.mundawanga.com>).

2.2.1.3 Munda Wanga Environmental Park

Munda Wanga Environmental Park was rebuilt from a dilapidated zoo to a modern facility that provides EE to the young and old. The facilities on offer include; an EE Centre, a Wildlife Park and a Botanical Garden.

Teachers and pupils go to Munda Wanga to learn about the threats, the ways to conserve nature and the ways to benefit from the natural resources that are available in our environment. They also learn how to use these resources without depleting them. This means using them in a sustainable way so that even the people who will come after them can enjoy the same resources that Mother Nature has offered us (<http://www.mundawanga.com>).

2.2.1.4 Local Involvement in Management

Local Community residents in Game Management Areas (GMA) participate in decision making through local Community Based Natural Resources Management Committees. The Community Based Resource Management (CBRM) activities in wildlife are well intentioned programmes attempting to achieve conservation through the involvement of local people. Phiri (2008) reports that WWF had been training communities of Kalasamukoso and Chiundaponde on resource management in areas of wildlife, fisheries and forestry. He further confirms that these programmes received maximum support and participation from the local communities. From the above discussion, it can be concluded that Zambia has elaborate EE programmes on wildlife sustenance.

2.2.2 Waste Management

Due to industrialization and population growth during the last few decades, Zambia is producing more waste than ever. Waste is categorised into domestic and industrial. The municipal councils through out the country handle issues of domestic waste management while industrial waste is handled by various generating companies. In both cases, ECZ monitors the disposal of waste. However, due to financial constraints and lack of manpower to collect and dispose the waste at designated places, waste remains uncollected in most places (ECZ, 2000). Even with the involvement of private companies in the collection of waste, waste management still poses a major challenge. The uncollected waste results in several outbreaks of diseases such as cholera and the general deterioration of the environment. The above statement was confirmed by ECZ (2000) which reported that uncollected waste was one of the factors that led to cholera outbreaks reported in Lusaka's high density areas such as Kanyama and Msisi in the year 1999.

Various organisations such as ECZ and the Municipal Councils offer EE activities in connection with waste management and general cleanliness of the environment. In support of EE related to waste management, the late president Dr Levy Patrick Mwanawasa launched the 'Make Zambia Clean and Healthy Campaign' in 1996 which was meant to raise awareness on the benefits of a clean environment on human health. In this campaign, all residents of Zambia were expected to participate in cleaning the environment.

However, the 'Make Zambia Clean and Healthy Campaign' has not been effective especially after the death of Mr Mwanawasa. There has been little or no effort on educating the people on how to change their attitude towards activities affecting them and the environment negatively.

2.2.3 Climate Change

Zambia's main objective in implementing Chapter 9 of Agenda 21 over the past years has been to improve the nation's understanding of the processes that influence and are influenced by the Earth's atmosphere. The objective has also been in the quest to reduce the adverse effects of the energy sector on the atmosphere, develop and promote cost effective policies and programmes aimed at controlling harmful emissions into the

atmosphere (<http://www.un.org/esa>). The nation is encouraging industrial development in ways that minimise adverse impacts on the atmosphere, promoting appropriate land use practices that contribute to reduction of atmospheric pollution and enhance conservation and sustainable management of all sinks for green house gases, controlling the use of ozone depleting substances and developing strategies aimed at reducing emissions responsible for stationary and trans-boundary air pollution and their effects.

In an effort to combat ozone layer depletion, measures have been taken under the industrial pollution prevention programme and the ozone layer project ([http:// www. un.org/esa](http://www.un.org/esa)). Equipment to measure industrial stack emissions and various equipment for recycling, retrofitting and proper handling of ozone depleting substances have been acquired.

Training workshops on air pollution and monitoring systems for the industries, the public, NGOs and various bodies involved in environmental programmes have been conducted by the UNZA (<http://www.un.org/esa>). CBU has also introduced courses in environmental pollution control. Zambia has also conducted training in refrigeration handling and servicing techniques for refrigeration technicians at the UNZA and Northern Technical College in Ndola under the ozone layer project

2.2.4 Challenges

Even though EE has become firmly established in both formal and non-formal education systems, it does not seem to address all environmental issues in Zambia. Zambia is constrained by socio-economic problems which make EE unable to respond in a timely and effective manner to challenges of protecting the environment. As a result, environmental degradation has continued to be a major problem.

2.3 Environmental Education and Mining

EE is one of the effective measures to achieve sustainable development. There is no doubt that EE targets all organizations and individuals and therefore, it is an indispensable component of society's effort to realise a better future. EE makes a vital contribution to the task of managing the environment. It fosters various concepts and approaches for

understanding the environment, and highlights the interest and values at stake in all situations.

UNESCO (1976) highlights a number of things about EE among which is that of it being holistic; relevant to all subjects and all subjects are relevant to it. EE does not only cover academic areas, it also covers other areas that are beyond academic circles. In line with the above statement, Musonda (1989) echoes that EE is an area of concern that cuts across disciplines and therefore, tries to synthesise knowledge from several disciplines.

EE also entails practices in decision-making and self-formation of a code of behavior about issues concerning the quality of the environment (IUCN, 1996). As applied to mining, EE should emphasise on clarifying the concepts that entail practices in decision-making and self-formation of the code of behavior about issues concerning the environment, including the health of the people.

2.4 Negative Impact of Mining from a Global Perspective

Mining activities by nature have environmental, social, and economic impacts, a fact acknowledged by MMSD in 2002 report which stated that mining industries have enormous impacts on the environment. These impacts on air, land, water and people are highlighted in the following section.

2.4.1 Impacts of Mining on Air Quality

Air pollution is essentially due to the emission of particulate material and gases which include carbon monoxide, methane, oxides of nitrogen, sulphur dioxide and dust (Boocock, 2002). Exposure to these gases endangers the lives of the people either through occupation or living around the mining sites. Human health problems and environmental degradation may occur as a result of direct inhalation from the air, soil deposition, or accumulation within a water body. In Zambia, most of the air quality deterioration is concentrated on the Copperbelt province. WWF-ZEP (2005) notes that effects of the emission of such gases had been observed in Kankoyo Township in Mufulira where the growth of vegetation had been inhibited and corrosion of housing units observed. Further, high levels of dust in the air aggravate respiratory diseases such as chronic bronchitis and asthma in the exposed

population. Evans (1993) points out that dust from the mines also pollute nearby surface waters and cause asphyxia of plants and trees.

2.4.2 Impacts of Mining on Land

Mining always results in large scale land disturbances. For example, removal of top soil, large pits are created through excavation, dumping of solid wastes and large tracts of derelict land are created. As observed by MMSD (2002), the waste generated as a result of mining has the long-term effect of reducing the land productivity. Thus, productive land which ideally could have been used for other economic enhancement sectors like agriculture is rendered unproductive.

2.4.3 Impacts of Mining on Water System

Mining is a source of degradation of natural resources systems such as water courses (USEPA, 1995). The enormous consumption of water required by some mining activities negatively affect the water aquifer around the site, drying up wells and springs. Further, mining deteriorates the quality of the water and this is done through the wastewater that is discharged into the surface drainage system. The waste water which is released from mining operations can have major impacts on the quantity and quality of both surface and groundwater. In addition, Brown (2003) explains that erosion due to mining activities may cause momentous loadings of sediments to nearby rivers and streams especially during severe rainstorm events. This means that in countries like Zambia where only 58 percent of the population have access to improved water source while the rest consume water direct from water bodies such as rivers and streams which may be polluted, they are constantly increasing their health risk due to consuming polluted water (Kangwa, 2008).

Pollutants from mines which end up in rivers and streams impact negatively on aquatic biodiversity. ECZ (2000) observes that in Zambia, young *Tilapia* fish species do not survive in the water of the Kafue River around the mining area because the water is polluted. Additionally, World Bank (2003) confirms that dust particles containing copper, nitrous oxides and organic acids may also be in the emissions which may enter streams and affect aquatic fauna.

2.4.4 Biodiversity and Habitat Loss

Mining operations especially during exploitation phase impacts negatively on the biological diversity of the area as the operations involve clearing of vegetation and topsoil. World Bank (2003) states that vegetation removal disturbs the habitat of hundreds of endemic species and alters the availability of food and shelter for wildlife. As a result, mining operations bring about habitat loss and fragmentation for animals. Thus, mining has the capacity to alter species composition and structure.

2.4.5 Mining and Health

Stephens and Ahern (2001) note that mineral mining causes more fatalities than any other occupation because of its dual impact on the health of both the workers and the local communities living around the mining areas. Local communities get exposed through pollution such as air, water, soil and noise and these directly or indirectly impacts on their health. The deafening sounds of the blasting and machinery used in mining cannot be considered as negligible impacts because they create conditions that may become unbearable for the local population and wildlife. Nyambe (2000) (quoted in Yona 2005) states that mining leads to noise pollution resulting into health ailments to do with hearing. In some studies conducted by Blot and Fraumeni (1975), results show that the average death-rates from lung cancer for both males and females in the United States of America (USA) were significantly increased in the region with copper, lead, or zinc smelting and refining industries. Furthermore, exposure to copper has been associated with nonmalignant respiratory disease mortality rates in men. Similarly, lung and thoracic mortality in people living in copper mining regions has been noted (World Bank, 2003).

2.4.6 Mining and Local People

Although it is a well known fact that mineral development results in national economic growth, the benefits are not always equitably shared, and local communities closest to the source of mineral developments suffer the most negative impacts. In some cases, mining has provided jobs and other community services in otherwise economically marginal areas. However, these jobs and other services are limited in number and duration.

In Zambia, Kangwa (2008) indicates that most of the mining companies on the Copperbelt have programmes that are aimed at improving the lives of the people in this mining region. Mufulira Copper Mine Company for example is actively involved in malaria and HIV/AIDS prevention and treatment programmes in Mufulira and Kitwe. On the contrary, these programmes are mostly targeted at their employees as the majority can not afford to pay for these services.

Mining development tends to raise wage levels for their employees, leading to displacement of some community residents and existing businesses which fail to meet up with the mines. Additionally, mining may also trigger indirect negative social impacts, such as alcoholism, prostitution, and sexually transmitted diseases. Mining brings about in-migration which is the major cause of disruption to social relationships and cultural identity around mining regions.

Despite the negative impacts of mining on the environment, the immense contribution of the mining industry to the economy world wide has been appreciated. Various countries have come up with laws and regulations to enhance environmental management in the mining sector. Moreover, many countries have realised that laws and regulations have little tangible results without education to avoid those negative impacts. As a result, implementation of laws and regulations in these countries are accompanied by EE programmes. EE programmes target small scale miners and the local mining communities.

2.5 Environmental Education and Mining in Developed Countries

Most of the developed countries have elaborate EE programmes to address the impacts of mining. Amongst these are the United State of America and Portugal which are discussed below.

2.5.1 The Case of United States of America

In the United States of America (U.S.A), the principal minerals mined are coal, petroleum and copper. Mining operations and the resulting rock waste harm the environment. Environmental problems associated with mining for example, occur when freshly excavated coal beds are exposed to the air. According to Sklar (2008), sulphur-bearing

compounds in the coal oxidize in the presence of water vapour to form sulphuric acid. When this sulphuric acid solution enters surface water and groundwater, it is detrimental to water quality and aquatic life.

Coal burning produces harmful emissions such as carbon dioxide. Carbon dioxide is a greenhouse gas because it traps the Earth's heat and may contribute to global warming. Other emissions from coal combustion can lead to air pollution.

In response to the challenges caused by mining activities on the environment, Speight (2008) indicates that the U.S.A government has imposed stringent laws and regulation on mining enterprises. Some of the regulations demand that the mining companies submit plans detailing proposed methods for blasting, road construction, land reclamation, and waste disposal before exploration. Land reclamation policies in the U.S.A, require mining companies to restore strip-mined landscapes to nearly premine conditions.

Besides land reclamation policies, the government implemented U.S Clean Air Act - a federal law regulating air pollution in the United States. This legislation has significantly reduced emission of sulphur oxides, known as acid gases (Speight, 2008).

Another step, EE activities have been put in place to cater for both the young and older members in the mining communities. EE programmes are discussed in the section below.

2.5.1.1 Environmental Education Activities

The Environmental Protection Agency (EPA) of the U.S.A has put in place the EE Grant Programme. The EE Grant Programme provides seed funds to support EE projects that increase public awareness about environmental issues and provide them with skills to take responsible actions to protect the environment (EPA, 1999). As observed by Smith (1970) EE grant contributed to learning and teaching by extending the school curriculum to cover the outdoor learning in the mining communities of the U.S.A.

Some of the programmes under EE grant include;

2.5.1.1.1 Acid Mine Drainage Awareness Education Programme

Mc-Cormick (2009) states that a total of \$3,232 is given to friends of the Cheat Inc to coordinate EE activities. The programme enhances guided tours of the Acid Mine Development (AMD) an interpretative trail in Preston to educate the communities about the impacts of coal mining on the Cheat River watershed and measures taken to bring back the Cheat River to its original state.

Likewise, an Acid Mine Drainage (AMD) Awareness Education Programme for students at Preston High School, Bruceton School and Boy Scouts had been developed. The acid mine drainage awareness programme provides the participants with a comprehensive understanding of water quality issues, water sampling, and the importance of restoring the Cheat River to health as a waterway.

2.5.1.1.2 Identification of PCB Hot Spots Programme

The Southern Appalachian Labour School Staff gets a funding of \$5,000 for workshops, research and site identification (EPA, 1999). The Southern Appalachian Labor School staff works with community groups to identify sources of poly-chlorinated biphenyl (PCB) contamination from coal mining operations and report “hot spots” to EPA. Through this programme, the general public learn about the health risks of PCBs and how to prevent the risks.

2.5.1.1.3 Outdoor Environmental Learning Center Project

The Outdoor Environmental Learning Center project creates an outdoor learning space where the public, children, and their guardians are educated about human health threats associated with environmental pollution. EPA (2010) suggests that the project gives special attention to providing information on how pollution affects children and how human exposure to pollutants can be minimized in order to preserve good health.

2.5.1.1.4 Community Stewardship Initiative

The Community Stewardship Initiative grant allows the Upper Guyandotte Watershed Association (UGWA) to reach further into the watershed issues through small community forums, public meetings, the media, stream cleanups, and fostering meaningful

partnerships. Apart from encouraging watershed stewardship, UGWA educates the community about the health risks surrounding untreated water and how to avoid hazardous contact.

2.5.1.1.5 Keep Well Water Programme

Under this programme, students in middle and high schools are trained in testing for the presence or absence of foreign elements in water samples in their own homes. Results of their findings are reported to the local media and also posted on Cacapon Institute's Web site. According to EPA (2010), the public learn about the quality of community drinking water and about health concerns associated with contaminated drinking water through the reported results.

2.5.1.1.6 Grow with Us Programme

Preschool children are said to enjoy an outdoor environmental learning site. Mc-Cormick, (2009) notes that they (children) are taken to the water site that is furnished with flowers and trees that attract birds and butterflies. The water site also houses fish, aquatic vegetation, frogs, tadpoles, and some insects. The children learn about nature by observing plants and animals in their natural environment.

As seen from above, the U.S.A has elaborate EE programmes associated with the impacts of mining on the environment. The programmes are diverse and cater for all members of the community.

2.5.2 The Case of Portugal

Despite economic benefits of mining gold and silver, abandoned mining sites in Portugal pose several problems to the environment and to human health. The most important sites are Jales, Cunha Baixa and Pejão (Costa and Leite, 2000).

The negative impacts of abandoned mines are solid wastes accumulated in the landfill resulting into contamination of the surface and groundwater. The assimilation of contaminated water seriously affects the liver, kidneys and intestines (Pereira *et al.*, 1999).

In addition, Chaves (2000) notes that waste form a deposit of 5 million tonnes of dust. This dust can spread on windy days causing serious respiratory problems and also contaminates soil and plants.

2.5.2.1 Environmental Education Activities

Considering the risks posed by abandoned mining sites, the Portuguese government and the European Union funded the rehabilitation of the landfill. The purpose of this project was to seal the landfill containing the waste.

The first step was to reduce the area requiring impermeability to water and also guarantee its slope to stability and better landscape integration. Pinto *et al.*, (2004) observe that a draining system was installed at the base of the landfill to combat possible wastewater infiltration.

Since the project is on going, the Portuguese government has also been working with the local communities on land reclamation as part of EE activities. The government and the local communities have been working towards covering landfills with clean soil to be planted with adequate vegetal species contributing to valuing the local landscape (Pinto *et al.*, 2004).

Furthermore, the governmental of Portugal has put in place mechanisms to raise public awareness of the risks posed by mining sites, and environmental risks in general.

2.6 Environmental Education and Mining in Developing Countries

This section highlights how EE has been used as a response to negative impacts of mining in Mongolia and Guyana.

2.6.1 The Case of Guyana

Gold mining in Guyana is linked with the Greenstone Belt, an ancient metamorphic rock formation that cuts through the Country. According to WWF (2010) mining attracted both local and foreign interests most of which are small to medium scale operations about 3000 to 4000 units.

Negative impacts of mining are due to the fact that the Greenstone Belt is poorly managed. To give weight to the argument, WWF (2010) further explains that poor management of the Greenstone Belt had resulted in extensive damage to the natural environment with considerable ecological, biological, physical and health impacts. It further asserts that unsound gold mining leads to 500 tonnes of mercury being released annually into the environment.

In the aquatic ecosystem, mercury collects and concentrates within the food chain, especially in carnivorous fish (Stabroek, 2010). Consumption of such fish may be harmful to the health of people.

Similarly, the burning of gold in open flame without the use of protective gears contributes to harmful exposure from mercury vapour if inhaled. High intake of mercury vapours cause life threatening lung damage and fatal effects to the kidneys, nervous, digestive, and respiratory system.

2.6.1.1 Environmental Education Activities

Through the WWF funding to the Guyana Geology and Mines Commission, a comprehensive education and awareness programme was developed and is executed throughout the mining districts in Guyana.

WWF (2010) states that the programme concentrates on educating the local community and miners on the dangers of inhaling toxic mercury vapour, eating mercury contaminated fish, the use of proper mining techniques, and evaluation of possible mining sites before investing in equipment.

Apart from this, the WWF funded a project of building awareness amongst medical practitioners on the implications of mercury use on human health, and how to detect signs and symptoms, and appropriate treatment procedures for mercury poisoning (Stabroek, 2010).

The WWF Guyana education and awareness activities have resulted in more of the people being aware of the dangers of mercury and how to protect their environment from unsound mining practices.

2.6.2 The Case of Mongolia

Mongolia used to be one of the most environmentally pristine countries in Asia. For a long period of time, nomadic Mongolians had lived in harmony with nature. However, the pristine natural environment is being severely threatened due to unprecedented economic development associated with mining.

Mongolia is rich in copper, uranium, and gold. The launch of the ‘Gold’ programme by the Mongolian Government in 1993 saw large scale mining operations being undertaken by various mining entities. This not only had positive but negative impacts on the environment and health of the people as well. The unspoiled environment faces threats while water pollution from mine effluence is a challenge.

2.6.2.1 Environmental Education Activities

The Mongolian government has taken significant steps to ensure that the environment is protected from mining operations. One of the steps taken is the enactment of the ‘*Law on the Prohibition of Mining Operations at Headwaters of Rivers, Protected Zones of Water Reservoirs and Forest Areas*’ (World Commission on Protected Areas, 2009). This law prohibits mining operations within areas critical for water and biodiversity protection. To strengthen the step taken above, the government of Mongolia came up with a project that was to run from 2010 for a period of three years. This implies that, funding requirement of \$435,000 US would be used in the project with the sole purpose of engaging the local community to help reduce the impacts of mining. The following are some of the EE programmes under the project

2.6.2.2.1 Education Programme

An education programme has been launched in the eastern areas of Mongolia to raise awareness amongst school children on the ecological values of the region. Collaboration

between local people, teachers and scientists, is expected to ensure that young children learn about their local environment from early childhood.

2.6.2.2.2 Plantation Programme

Five hectares of damaged river banks has been set aside for rehabilitation. The local communities have an ongoing activity of planting Sea buckthorn tree species along river banks. World Commission on Protected Areas (2010) states that this activity would have ecological benefits such as prevention of soil erosion and protecting river ecology.

2.6.2.2.3 Local Community Capacity Building

A capacity building programme for local communities is underway and is expected to focus attention on advocating for reduced mining effects. Awareness raising and training is provided to the locals regarding mining prohibition law and environmental issues. According to EPA (1999), series of meetings are conducted between local people, local representatives and government officials to assist in local communities' participation in the process of mining law implementation. In addition, a monitoring programme is under way within mining prohibition zones.

2.7 Environmental Education and Mining in Zambia

This section gives a review of the negative impacts of mining, laws and regulations in the mining sector. A review of EE activities to address those impacts is also highlighted.

2.7.1 Negative Impacts

Mining is crucial to the economic and social development of Zambia even though the end result has been environmental degradation. The negative impact of mining are reviewed below.

2.7.1.1 Air Pollution.

The copper smelters emit 300,000 to 700,000 tons of sulphur dioxide per year and considerable amounts of dust into the air (World Bank, 2003). Sulphur dioxide causes enormous problems for local communities who rely on land resources for their livelihood. It severely affects the health of the people by causing respiratory problems, polluting water and causing loss of vegetation. ECZ (2003) confirms the above findings by acknowledging

that sulphur dioxide has been responsible for lack of vegetation growth, eroding of roofs for houses and other infrastructure closer to the mine in Kankoyo Township.

2.7.1.2 Soil Contamination

Sulphur dioxide emission from the smelter convert to H_2SO_4 (sulphuric acid) and then affects soil and causes loss of vegetation downwind of the smelter. Soil contamination, chemical and oil spills have also been occurring. Soil from sites contaminated by oil laced with PCBs, by redundant chemicals or other hazardous waste (including radioactive waste and asbestos) are not properly removed and disposed of. Aongola *et al.*, (2009) is of the view that despite clean up activities such as the Copperbelt Environmental Project and better technology, mining remains an environmental burden with negative impacts on people.

2.7.1.3 Water Pollution.

Large amounts of effluents are discharged into the environment from various mining operations. The effluents are usually deposited into local streams and rivers. Similarly, runoff and leakages from existing waste rock dumps and tailings dams pollute streams flowing out of the mine areas, causing widespread negative impacts downstream from the mines that extend as far as the Kafue River and affect wetlands and tributaries (World Bank, 2003).

This form of pollution has an impact on human health and ecology in general. The Copperbelt Environmental Project (2009) indicates that significant environmental and health dangers associated with water pollution on the Copperbelt include the following: contamination of aquatic life-this can endanger humans who eat fish, pollution of domestic water supply and contamination of vegetables and fruits through polluted ground water. Moreover, lower water quality due to mining pollution leads to increased water treatment costs.

Like other countries in the world, Zambia has a number of laws and regulations to protect the natural environment and its people from the negative impacts of mining. The laws and regulations that pertain to mining are described in the proceeding section.

2.7.2 Laws and Regulations in the Mining Sector

The Environmental Council of Zambia (ECZ) enforces environmental regulations and coordinates sectoral government agencies involved in environmental management in the mining sector. Under ECZ, environmental liabilities are determined by Environmental Protection Assessment and Pollution Control Act (EPPCA) of 1990, Environmental Impact Assessment Regulation (EIAR) of 1997 and the Mines and Mineral Act of 1955 and Mineral Environmental Regulations of 1997 (ECZ, 2006).

The EPPCA also sets environmental quality standards and makes the polluter responsible for meeting them. As a result, all effluents and emissions from mining operations are regulated through a system of permits, licenses and fines under the EPPCA. Dumps, including overburden dumps and tailings dams are similarly regulated.

In the same vein, EIAR demand for the preparation of an Environmental Impact Assessment (EIA) for all investments that have a major impact on the environment (CEP, 2009). The identification and implementation of adequate environmental mitigation measures is also regulated by the EIAR.

The Mines and Minerals Act and the Mines and Minerals Environmental Regulations of 2008 address the environmental, health and safety aspects of the mining licenses delivered by the Mines and Minerals Development Department. They regulate environmental protection and pollution control in the areas where prospecting, exploration and mining operations are being carried out. Furthermore, they demand that any licensed mining operator closing down a mining facility must first decommission the site to a level where it does not pose any danger to public safety and health.

Regulation of the environmental impacts of the mining sector also involves other sectors, each with its own regulatory instruments. These sectors are: transport, tourism, health, radiation protection, energy, national heritage conservation, water, local government and land. These bodies are responsible for sectoral regulations and comprise Delegated Authorizing Agencies (DAAs) under the EPPCA (ECZ, 2006). ECZ defers to these agencies on specific technical issues, but retains the role of overall coordination of their

respective contributions. For example, Mine Safety Department (MSD) is the DAA for issues arising from mining licences. Close coordination between ECZ and all the DAAs regarding mining activities is critical, given the complex cross-sectoral nature of their environmental impacts.

The Environmental Support Programme (ESP) funded by International Development Agency helped ECZ increase its capacity to fulfil its regulatory role. The ESP was launched in 1998 to support the Ministry of Environment and Natural Resources (Now Tourism, Environment and Natural Resources) in implementing the environmental priorities defined by the NEAP. In 2001, ESP was restructured to provide direct support to ECZ for improving enforcement and compliance with national environmental safe guards. The ESP closed, but the Copperbelt Environment Project is still in operational to support the ECZ capacity building effort started under ESP.

In addition, the Canadian International Development Agency (CIDA) also funded the Environmental Management in the Mining Sector Project (EMMS). The initial project was to strengthen the technical and managerial capacity of MSD and other key mining sector institutions to execute statutory mandates to regulate, monitor, enforce and/or implement appropriate environmental management practices in the mining sector (ECZ, 2006).

However, during the course of its implementation, EMMS focused solely on technical capacity building within MSD as well as on its financial sustainability. It did not include the resources necessary to monitor the compliance performance of the mining industry, nor to enforce existing regulations. Furthermore, it did not include significant support to ECZ, nor to any of the other DAAs concerned with mining activities.

Although in some cases effective capacity has been built, ECZ and the efforts of DAAs in the implementation of environmental regulations is still weak. In some study conducted, Kangwa (2008) noted that identification and monitoring of environmental risks resulting from mining activities is often inadequate. Moreover, the appropriate permits and licenses are not issued. Additionally, existing regulations are rarely enforced, revenue from licenses and permits and fines for mining pollution are only partially collected.

As a result, the regulatory dispositions for the mining sector portray poor handling of environmental and social safeguards. Kangwa (2008) therefore, claimed that the poor handling of environmental and social safeguards in the mining sector led to the lead poisoning crisis in Kabwe. In a similar incident, acid waste from Chingola's mines entered groundwater at Mufulira around 40km away causing diarrhoea, abdominal pains and vomiting to Mufulira residents (Mukanga, 2009). Such a scenario shows that legislation should go alongside awareness campaigns for the environment.

2.7.3 Challenges in Monitoring Mining Activities

ECZ has limited capacity in different fields including Environmental Assessments (EAs), Water Pollution Assessment (both surface and ground water), and sound management of toxic substances including PCBs, Environmental Emergency Response System and Air Pollution Assessment such as point source measurements (ECZ, 2006). However, ECZ has embarked on building environmental auditing skills which are essential for effective compliance and monitoring of Environmental Management Plans (EMPs).

2.7.4 Environmental Education Activities

EE and participation in the regulatory enforcement mechanism is vital to successful management of the environment in mining areas. People have the power to compel the mines to consider environmental protection in their operations. However, ECZ (2006) notes that residents on the Copperbelt Province are not environmentally conscious on the negative impacts of mining, to the extent of influencing enforcement of environmental legislation. The reason for such a scenario is given by Manning (2007) who observes that there is less provision for EE to address most environmental issues in Zambia. This therefore, calls for EE activities to address the negative impacts of mining.

Conclusion

Most of the studies that have been conducted on mining in Zambia have focused on the impacts of mining on the environment. These include Mopani Copper Mine (2004) and Monde (2010). Further research conducted by Kangwa (2008), Yona (2005), World Bank (2003) and Mukanga (2009) concentrated on negative impacts of mining. Unlike other

countries such as the U.S.A., Guyana and Mongolia, little attention has been paid to studies on using EE to address the negative impacts of mining. Therefore, there seem to be a gap on whether the mining communities in Zambia undergo EE to fully understand these impacts and how they could reclaim the degraded environments.

Summary

The chapter provided a review of literature related to the study. It traces the development of EE in Zambia, EE activities in Zambia and impacts of mining on the environment. Relevant research works on EE as well as environmental mainstreaming in mining were reviewed and acknowledged. Some of the relevant research works include those of U.S.A, Portugal, Guyana and Mongolia.

The following chapter explains the methodology that was used to carry out this study and gives the reasons for the choice of a particular approach or technique.

CHAPTER THREE

METHODOLOGY

Overview

Chapter 3 explains the research methodology that was used to collect the desired data. In particular, it concentrates on the research design, target population, sample size and sampling procedure, research instruments, data collection procedure and analysis thereafter. It also gives a description of the study area.

3.1 Introduction

The study predominantly used a qualitative research methodology, but supplemented by quantitative (data). Interview guides were used to get views from EE providers and Coordinators, while information from EE Learners came from questionnaires. The collected data was analysed using both qualitative and quantitative methods.

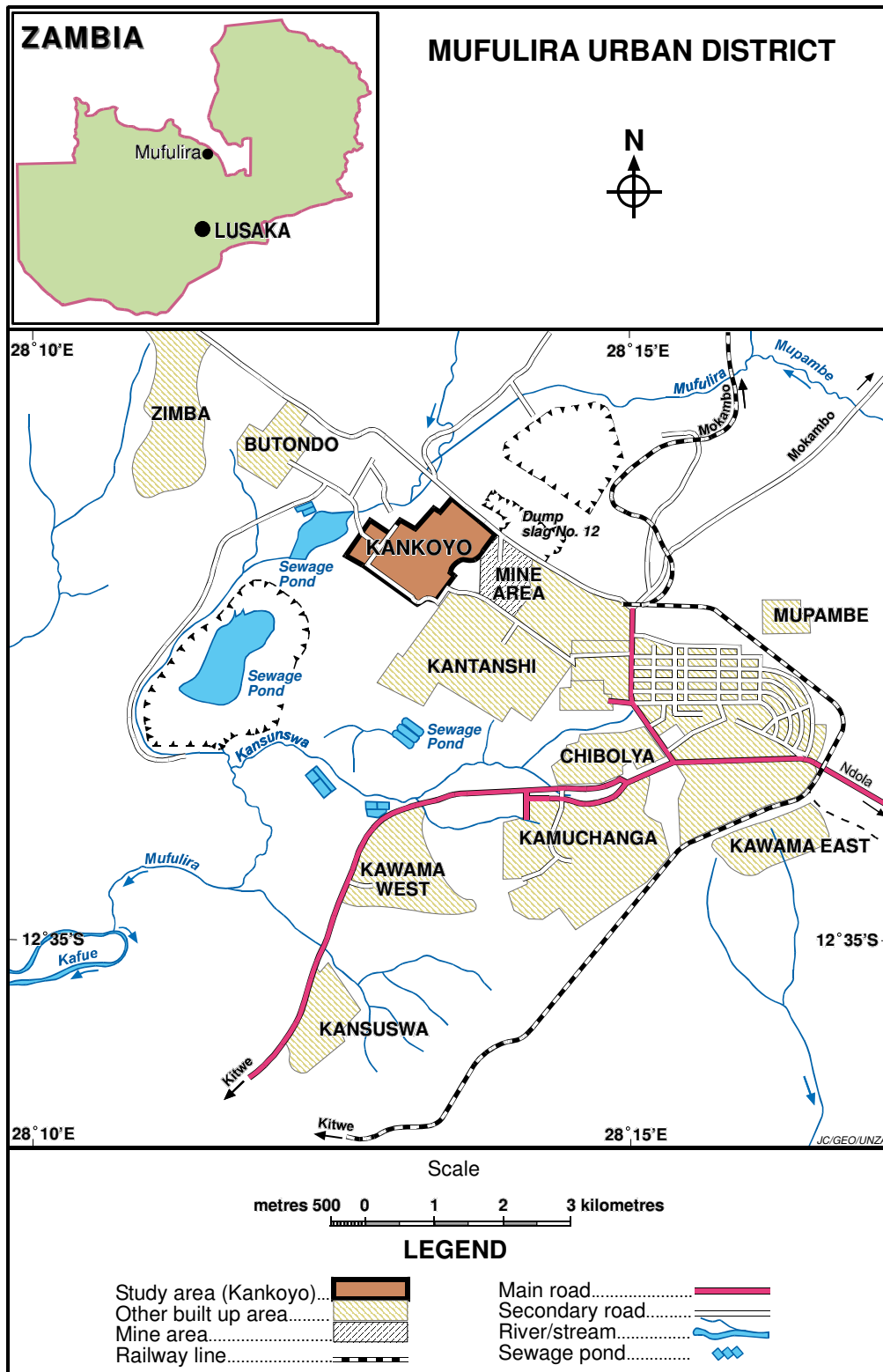
3.2 Description of the Study Area

This part of the report gives a description of the study area in terms of geographical location, physical and social economic characteristics.

3.2.1 Geographical Location

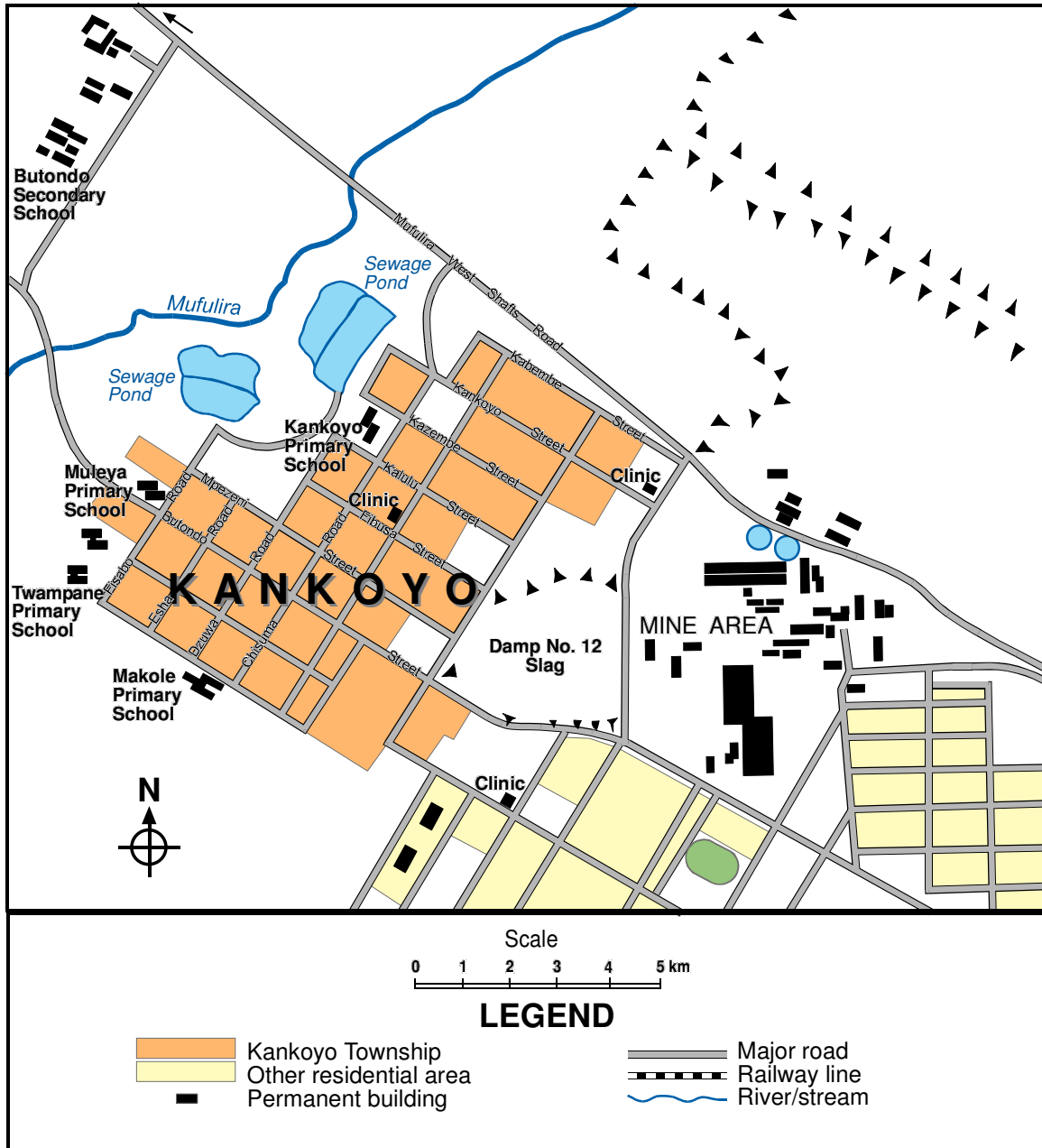
Kankoyo Township is located on the downwind of the smoke spewing out of Mufulira Copper Mine's blast furnace. The Township lies between 28°13' 49°57'' E and 12°31' 55'' S of Mufulira town on the Copperbelt province of Zambia (SRK Consulting, 2003). Generally, its altitude is 1288 meters and topography between elevations of 1,250 and 1,400 meters (Mopani Copper Mine, 2004). Kankoyo area is drained by a number of streams such as Luansobe, Butondo, Mupambe and Kansuswa which eventually discharge into the Kafue River located about 15 km to the west of the Township (Mopani Copper Mine, 2004). The geographical location of Kankoyo Township is shown in figures 1 and 2 on the next pages.

Figure 1: Map Showing Location of Kankoyo Township in Mufulira District



Source: Surveyor General, Lusaka, 1985

Figure 2: Map showing Kankoyo Township and Surrounding Areas



Source: Surveyor General, Lusaka, 1985.

Having established the geographical location of Kankoyo Township, the next section looks at the physical characteristics of the area.

3.2.2 Physical Characteristics of Kankoyo as a Study Area

Under the physical characteristics of the study area, climate, soils and vegetation will be discussed.

3.2.2.1 Climate

There are three distinct seasons, namely Cold and dry season; May to July Hot and dry season; August to October and Wet season; November to April. The climate is tropical with maximum rainfall between 1200mm and 1400mm and mean temperature of 24°C. This relatively high precipitation occurs mainly in the summer months, between November and March and falls principally as intense thunderstorms. The 30-year maximum 24-hour precipitation has been calculated as 126 mm and the 100 year maximum 24-hour event as 149 mm (Mopani Copper Mine, 2004).

The meteorological station in Mufulira is Kafilonda station located 10km from Kankoyo Township. Data from this station indicate that the predominant wind direction is from North west and south west. According to Mopani Copper Mine Report (2004), wind speed ranges from 2.4m/s and 2.9m/s. However, wind gusts can reach 30m/s.

3.2.2.2 Soils and Vegetation

The Copperbelt province, Kankoyo Township inclusive, has red lateritic soils with sandy top soils overlaying more loamy clayed subsoil. The soil profile is thickest over the high ground and gradually thins towards the dambos and stream valleys. These soils are susceptible to erosion by rainwater if soil conservation practices are not used. The soils are acidic but acidity is aggravated by the mining activities. Christophe (2009) observes that on some days, the township is smothered in a choking fog making soils acidic and also affecting plant growth. He further argues that the release of nearly 700,000 tonnes of sulphur dioxide into the air has left the Kankoyo Township a canker on an otherwise fertile verdant landscape. Consequently, only two things grow and these are avocado trees and cactus.

3.2.3 Social Economic Characteristics

The mining industry is the principal employer for people on the Copperbelt province. However, MCM (2004) states that labour shocks brought about by the privatisation of the

mining industry in 1991 triggered high unemployment levels in Kankoyo Township. High unemployment levels have further translated into high poverty levels among the people.

Consequently, most residents do not have access to social services such as good sanitation and electricity supply. Open sewers and dilapidated shacks with tin roofs corroded by acid rain exist. Christophe (2009) suggests that due to the open sewers, cholera is common in the area.

3.3 Research Design

In conducting this research, the researcher used a case study design based on the research questions posed which mostly answered the “what” questions. The use of a case study offered in-depth information about the type of EE offered to Kankoyo residents. It also offered the researcher an opportunity to use multiple sources of evidence which increased the validity and reliability of the findings. The complex nature of copper mining and EE at one case scenario called for the use of case study inquiry which Yin (2003) confirms has the advantage over other research methodologies of explaining and describing complex issues. Further, Yin (2003) explains that the case study not only facilitates in finding an in-depth analysis and logical explanations of contemporary events, but also helps in yielding qualitative data from one locality.

3.4 Target Population

The target population for this study consisted of all individual adults above the age of 19 years. Its composition included coordinators, EE providers and learners who learnt EE. These included Environmental Council of Zambia (ECZ), Mopani Copper Mine (MCM), Mufulira Municipal Council (MMC), Resident Development Committee (RDC) members of Kankoyo Township and Kankoyo residents.

3.5 Sampling Procedure

The sample was identified using the following guidelines;

3.5.1 Sample Size

Three (3) respondents involved in EE activities from different institutions were interviewed. The respondents included 1 Public Awareness coordinator from MMC, ECZ and RDC Member. Further, 120 Kankoyo residents from sections A, B, C, D, E and F

were selected for this research. Efforts to interview an officer from MCM proved futile as the officer was always unavailable for the interview at the time of the research.

3.5.2 Characteristics of the Sample

Public Awareness coordinators from MMC and ECZ were responsible for the preparation, designing and implementation of the EE activities in Kankoyo Township. Similarly, RDC members of Kankoyo Township coordinate EE programmes in the community. EE learners were Kankoyo residents.

3.5.3 Sampling Technique

Purposive sampling was used to decide on the Township. Kankoyo Township was chosen because it is officially defined as a mining area. EE coordinators from ECZ, MMC and RDC were also purposively sampled based on the fact that the officers catered specific areas of environmental concerns.

Simple random sampling technique was used in the selection of Kankoyo residents in Mufulira district. According to Christensen Johnson (2004), Simple random sampling is a basic sampling technique by which a sample is selected for study from a larger group where each individual is chosen entirely by chance and each member of the population has an equal chance of being included in the sample. To add on, Borg and Gall (1989) noted that the use of simple random sampling technique facilitates the application of inferential statistics.

3.6 Research Instruments

The research employed three types of instruments namely: a questionnaire, unstructured observation guide and semi structured interview guides. Interview guides were used to get in depth information from the EE providers and it was possible to observe non verbal behaviour, hence easier to assess the validity of the respondent's answers (White, 2003). A questionnaire was used for the learners. The use of a questionnaire which had both closed and open-ended questions in this study hinges on Christensen and Johnson (2004) views, that it is a versatile tool and provides qualitative and quantitative data.

3.7 Data Collection Procedure

In order to obtain the needed data, an introductory letter from the University of Zambia (UNZA) was presented to the institution where research was to be carried out. The researcher reported to the information desk where she was directed to the person in charge of the institution. After presenting an introductory letter from UNZA and briefing on the purpose of the visit, the researcher was given permission to carry out the research.

The study used multiple sources of inquiry and the underlying principle behind this was that this offered the opportunity to address the issue efficiently. The most significant advantage presented through the use of multiple sources of inquiry was the “development of converging lines of inquiry “and this increased the validity, quality and reliability of the findings.

3.7.1 Primary Data

Primary data was collected through interviews, questionnaires and observations.

3.7.1.1 Interview

The researcher conducted interviews with the ECZ, MMC and RDC member to get detailed information. No interview was conducted with an officer from MCM as mentioned earlier, because he was always unavailable for the interview. As a research instrument, the researcher prepared questions in advance (see interview guide in appendices) to guide and keep the interview in focus. The researcher recorded all the responses in script for future analysis. Where the explanations were not clear, the researcher asked additional questions for clarification.

3.7.1.2 Questionnaires

The researcher collected information from the Kankoyo residents using a questionnaire. The questionnaire comprised open-ended and closed questions with clear instructions on how to complete them. For respondents who had difficulties in answering the questionnaire, the researcher and the research assistant were at hand to assist them. The presence of the researcher and the assistant was to make further clarification where necessary and, to ensure 100 per cent of questionnaire’s collection. Respondent’ anonymity and confidentiality were exercised by not asking them to write the names on the

questionnaire which removed fear of victimization thereby promoting honest responses. Questionnaires were administered for a period of one month.

3.7.1.3 Observation

The researcher physically went into the field to observe people's activities and impacts of mining on Kankoyo Township. Unstructured observation guide was used to help understand behaviour patterns of the Kankoyo residents. Observations made it possible for the researcher to observe non verbal behavior which is important in validating the respondent's answer. Further, this method of data collection is flexible; meaning that the researcher's focus was easily shifted, as new data became known.

3.7.2 Secondary Data

The bulk of secondary data was obtained from the University of Zambia. The study further made use of publications and information available on the Internet in different formal organizations in Zambia which included ECZ, Ministry of Natural Resources and Environment, Ministry of Mines, United Nations Development Programme (UNDP). The idea was to collect information from as many different sources as possible and then be able to counter check the information so as to further validate the findings.

The internet was also useful on how EE is used to reduce the impact of mining on the environment and consequently, on communities near the mines in different parts of the world.

3.8 Data Analysis

Qualitative data were analysed by bringing out emerging themes that were categorized and interpreted. Responses were grouped in themes according to the research questions of the study. These themes were used as the variables whose frequency distribution showed which ones were more recurring than others thereby providing answers to the research questions of the study

Furthermore, quantitative data were analysed using the Statistical Package for Social Science (SPSS) software. Descriptive statistics were applied to the processed data by

showing variable frequency distributions from learner's responses. Data were presented using graphs, tables and percentages.

Summary

The methodology chapter described the design of the research and how data was collected and analysed. The next chapter displays the findings.

CHAPTER FOUR

PRESENTATION OF FINDINGS

Overview

In this chapter, subheadings derived from the study objectives and research questions were used to present the findings of the study.

4.1 Introduction

The chapter presents findings on EE that can address the negative impacts of copper mining in Kankoyo Township. Findings were obtained using questionnaires, interviews and observations. The results of the study are presented under subheadings derived from the study objectives and research questions. These include background information of the respondents, nature of EE offered and dimensions to be considered in a proposed improved version of EE.

Quantitative data was obtained using questionnaires from which tables, percentages and graphs were generated. Qualitative data obtained from interviews, observations and open ended questions from the questionnaires were analysed by coding and categorizing the emerging themes and subtitles accordingly. The views of the majority of the respondents represented the most significant categories. The findings are presented under the headings below.

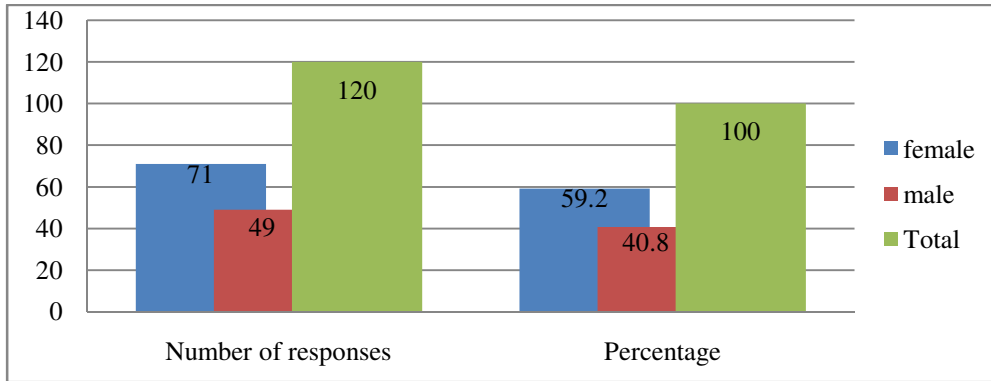
4.2 Characteristics of Respondents

This part of the study findings gives characteristics of the respondents. They are addressed in items 4.2.1 to 4.2.5.

4.2.1 Gender of Respondents

The gender of respondents was important in coming up with appropriate methods to use in the delivery of an improved version of EE. It was also vital in getting diverse views on EE that were offered in Kankoyo Township. The information collected from the respondents, showed that there were seventy one females representing 59.2 per cent and forty nine males representing 40.8 per cent of the respondents. The information on gender distribution is shown in Figure 3 on the next page.

Figure 3: Gender of Respondents



Source: Field Data, 2010

Having dealt with the gender of respondents, the next point looked at their age.

4.2.2 Age of Respondents

As indicated in the Table below, thirty five respondents came from the 20-25years age group standing for 29.2 per cent of the respondents. Twenty-three of the respondents came from 26-30 age group indicating 19.2 per cent and twelve respondents from fifty plus corresponding to 10 per cent. To add on, eighteen respondents came from 31-35 and another eighteen from 36-40 age groups indicating 15 per cent in each case. Furthermore, 41-45 and 45-50 age groups had seven respondents each representing 5.8 per cent. The information on age was crucial in coming up with EE programmes that would cater for all age groups within Kankoyo community. Responses on age are presented in Table 1 on the next page.

Table 1: Age of Respondents

Age of Respondents	Frequency	Percentage (%)
20-25	35	29.2
26-30	23	19.2
31-35	18	15.0
36-40	18	15.0
41-45	7	5.8
46-50	7	5.8
51+	12	10.0
Total	120	100.0

Source: Field Data, 2010

Furthermore, having dealt with the age of respondents, the next item looked at their educational level.

4.2.3 Educational Level of Respondents

Table 2 below shows the educational level of the respondents. Fifty-four respondents representing 45 per cent, attended secondary school while forty-nine representing 40.8 per cent went up to primary education. Only seventeen respondents representing 14.2 per cent had tertiary education. Educational levels were important because they influenced the views of the respondents concerning the provision of EE activities.

Table 2: Educational Level of Respondents

Level of Education	Frequency	Percentage (%)
Secondary	54	45.0
Primary	49	40.8
Tertiary	17	14.2
Total	120	100.0

Source: Field Data, 2010

Having established the educational level of respondents, the next item tackled their period of stay in Kankoyo area.

4.2.4 Period of Stay in Kankoyo Township

The respondents' views in Kankoyo Township were cardinal in establishing the provision of EE and in assessing the nature of EE provided to the residents. Responses in relation to the period of stay specified that each respondent had lived in Kankoyo at a different period of time. The period ranged from a minimum of two years to above sixteen years. No respondent was recorded to have lived there for less than two years. The information on the period of stay is summarised in Table 3 below:

Table 3: Period of Stay of Respondents

Period of Stay	Frequency	Percentage (%)
2-5	82	68.3
6-10	31	25.8
11-15	2	1.7
16+	5	4.2
Total	120	100.0

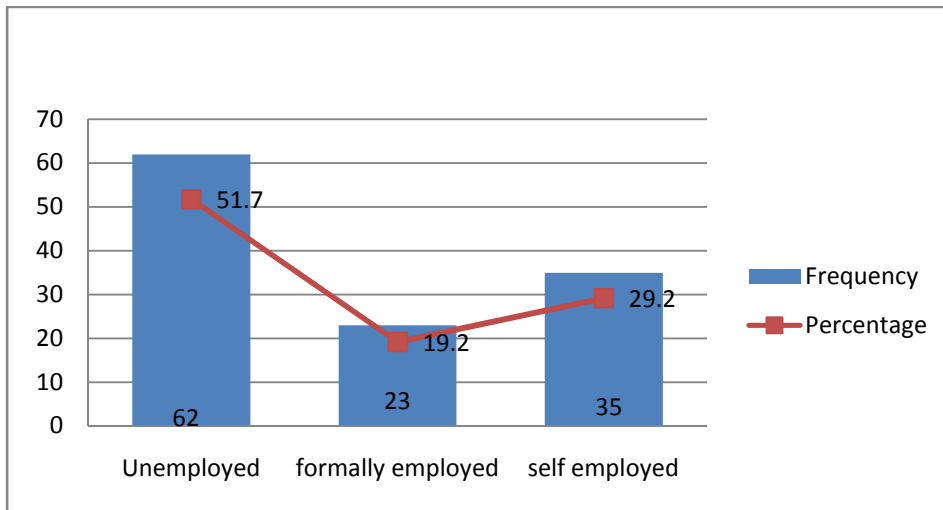
Source: Field Data, 2010

A summary of respondent's period of stay in Kankoyo area led to a presentation on occupations of respondents.

4.2.5 Occupations of Respondents

The findings on the occupations of respondents showed that sixty two (51.7 per cent) of the respondents were unemployed. The self employed amounted to thirty five (29.2 per cent) primarily small scale business people selling mainly vegetable and sweets. The formally employed accounted for twenty three (19.2 per cent) comprising teachers and miners. The occupations of respondents were crucial in establishing economic status of the residents. Economic status of the respondents was vital as it would have an influence on the content of the improved version of an education programme for Kankoyo residents. Occupation of Kankoyo residents is shown in Figure 4 on the next page.

Figure 4: Occupations of Respondents



Source: Field Data, 2010

Having presented some characteristics of respondents, the next section examined the provision of EE to Kankoyo residents.

4.3 Provision Of Environment Education To Kankoyo Residents

The first objective of the study was to establish the provision of EE among Kankoyo residents. This objective is very important and serves as a backbone for the other two objectives. It is addressed in items 4.3.1 to 4.3.10.

4.3.1 General Environmental Problems Experienced In Kankoyo Area

On environmental problems experienced in Kankoyo Township, Kankoyo residents indicated lack of vegetation growth, chest infections, dust, noise and pollution of water and air. In the same vein, MMC, ECZ and RDC members also stated pollution of air, water and land and chest infections. The least common response was cholera outbreak.

Site observations by the researcher confirmed the presence of pollution of air and lack of vegetation growth. Other observations were the presence of dust and noise pollution, corrosion of roof houses and cracks on most buildings that were close to the mine. This information was helpful in identifying all environmental problems experienced in Kankoyo area.

4.3.2 Environmental Problems Related To Negative Impacts of Copper Mining

In relation to environmental problems that emanated from copper mining, Kankoyo residents specified pollution of land, water and air. Others were chest infections, corrosion of roof for houses and cracked buildings that were close to the mine. Additionally, some Kankoyo residents indicated lack of electricity supply, poor sanitation and joblessness. To support the claim, MMC, ECZ and RDC members pointed out pollution of air, water and land as environmental problems that had come about due to mining activities in Kankoyo area.

In connection with air pollution, sulphur dioxide as one of the main air pollutants from mining activities had negative effects on the physical surrounding of Kankoyo Township. The release of sulphur dioxide from Mufulira Mine Smelter is depicted in Figure 5 below:

Figure 5: Sulphur Dioxide Being Released In the Air



Source: Copperbelt Environmental Project, 2009

Moreover, Kankoyo area had undergone some form of desertification as a result only two plant species were able to survive the effects of sulphur dioxide. The two plants species are avocado trees and cactus. This is portrayed in Figure 6 on the next page.

Figure 6: Physical Surrounding of Kankoyo Township



Source: Field Data, 2010

The discussion on the physical surrounding of Kankoyo area proceeded an argument on EE provision to Kankoyo residents.

4.3.3 Provision of Environmental Education

Under the provision of EE, the researcher wanted to find out from the respondents if EE was offered to the residents of Kankoyo Township. Kankoyo residents stated that EE was offered to them. To support this claim, MMC, an RDC member and ECZ confirmed that EE was provided to the residents of Kankoyo Township.

Residents and MMC stated that it was only MMC that was offering EE to them (residents of Kankoyo Township) while ECZ claimed that it was also providing EE to Kankoyo residents through RDCs. On the contrary, one RDC members highlighted that only Caritas Zambia and Green Environment were the ones that provided EE to Kankoyo residents. The information on the provision of EE to Kankoyo residents was vital in this study in order to assist in designing an improved version of EE programme.

4.3.4 Topics and Issues Covered

The researcher wanted to ascertain the topics and issues that were covered in the educational programmes that were provided to Kankoyo residents. The residents claimed

that only education on hygiene and how to avoid cholera was made available to them. Similarly MMC, ECZ and an RDC member also supported the claim and further added that cleaning the surrounding was cardinal. The above responses were helpful to this researcher in deciding the topics to include in the improved version of an EE programme which is presented in item 5.5 of this document.

4.3.5 Methods Used In Teaching and Learning of Environmental Education

The researcher wanted to find out the methods that were used in the noted educational activities. Kankoyo residents indicated that group discussion method was used. Similarly MMC, ECZ and RDC member acknowledged that group discussion was the only method used and further added that no evaluation of the learning and teaching activity were conducted. Such information on methods of teaching and learning helped this researcher in coming up with appropriate methods that would be effective in the improved version of EE.

4.3.6 Language Used In Teaching and Learning of Environmental Education

One hundred per cent of the respondents affirmed that *Bemba* was the prominent language used. This information was crucial in designing a localised EE programme that would be effective, responsive and stand a test of time.

4.3.7 Participation of Kankoyo Residents in Environmental Education Activities

The findings on participation confirmed that all the respondents (100 per cent) did not participate totally in all educational activities such as planning, implementation and evaluation. The information on community participation helped this study in coming up with an appropriate EE programme as presented in item 5.5 of this document that would enhance community participation in all EE activities.

4.3.8 Characteristics of ‘Environmental Education’ Offered

All the respondents (100 per cent) were unable to point out the characteristics of EE offered to them. The information on the characteristics of EE offered to Kankoyo residents was central to the process of assessing the nature of EE offered.

4.3.9 Understanding of the Term ‘Environment’

On understanding of the term ‘Environment’, it was found out that all of the respondents (100 per cent) understood the term. It must be noted that the researcher and the assistant

explained the term in *Bemba* to respondents who had some difficulties with the English language.

Respondents who understood the word ‘Environment’ were also able to mention environmental problems connected to copper mining in the area. The information on understanding the word ‘environment’ was important in assessing the nature of EE offered to Kankoyo residents.

4.3.10 Understanding the Phrase ‘Environmental Education’

Responses on the understanding of the phrase EE are shown in Table 4 below. The data revealed that 80.8 per cent of the respondents had no idea about the phrase EE while only 15.8 per cent understood the phrase under discussion. Respondents who felt EE referred to the health of the people accounted for 3.3 per cent. The information on understanding EE was critical in assessing how much still needed to be done in terms of filling in gaps related to conceptions of EE in Kankoyo area.

Table 4: Understanding the phrase ‘Environmental Education’

Responses	Frequency	Percentage (%)
Learning about the environment	19	15.8
No idea	97	80.8
Health of the people	4	3.3
Total	120	100

Source: Field Data, 2010

Having looked at respondents’ understanding of the phrase ‘EE’, the next section looked at the background features of the proposed EE to address negative impacts of copper mining.

4.4 Background Features of the Proposed Environmental Education to Address Negative Impacts of Copper Mining

This part of the dissertation gives background features of the proposed improved version of the EE programme that would address the identified negative impacts of copper mining in Kankoyo area. Features of the proposed programme are addressed in items 4.5.1 to 4.5.5.

4.4.1 Community Interest in Environmental Education to Address the Negative Impacts of Copper Mining

On community interest, the researcher asked the respondents if they would be interested in EE that would address the negative impacts of copper mining in Kankoyo area. One hundred per cent of the respondents wanted the kind of EE that was related to negative impacts of copper mining to be introduced in the area. The information was key in designing an EE programme appearing in item 5.5 of this document that would be responsive to the needs of Kankoyo residents.

4.4.2 Suggested Topics to Be Included In the Environmental Education Programme

The researcher enquired from the respondents the topics that would be covered in EE. The data confirmed that 69.2 per cent wanted topics such as pollution (air, water and land) and mine dumpsites while 25.8 per cent wanted ‘Policy on pollution’ as a topic. Only 5 per cent of the respondents wanted information related to growing plants. This information was essential in deciding the relevant topics to be included in the improved version of an EE programme. The data on issues to be included in an improved version of EE are summarised in Table 5 below;

Table 5: Issues to be covered in EE

Responses	Frequency	Percentage (%)
Pollution (water, air and land) and mine dumpsites.	83	69.2
Growing of plants in the area	06	5.0
Policy on pollution	31	25.8
Total	120	100

Source: Field Data, 2010

Having examined suggested topics to be included in an improved version of EE, the next subsection looked at the suggested mode of teaching EE.

4.4.3 Suggested Mode of Teaching Environmental Education on the Impacts of Copper Mining Activities in Kankoyo Area.

The respondents suggested the following as the best ways of delivering EE to Kankoyo residents.

- (a) Holding discussions and seminars with locals by the people in authority.
- (b) Public broadcasting of environmental issues through the media like radio programmes.
- (c) Distribution of brochures and pictures portraying negative impacts of mining and how to avoid them.
- (d) Drama and cultural performance based on environmental issues.

The information on the suggested mode of teaching was important in designing the improved version of EE which is presented in item 5.5 of this document. Responses to the suggested mode of teaching are illustrated in Table 6 below;

Table 6: Mode of Teaching EE

Mode of Teaching	Frequency	Percentage (%)
Discussion and Seminars	60	50.0
Public Broadcasting	10	8.3
Brochures and Pictures	30	25.0
Drama and Cultural Performance	20	16.7
Total	120	100.0

Source: Field Data, 2010

Having examined suggested mode of teaching EE, the next subsection looked at the suggested EE learning and teaching resources.

4.4.4 Suggested Environmental Education Learning and Teaching Resources

The respondents were also asked to propose the teaching and learning resources to be used in an improved version of the EE programme on negative impacts of copper mining in Kankoyo area. Their responses are presented in Table 7 on the next page.

Table 7: EE Learning and Teaching Resources Suggested By Respondents.

Item	Frequency	Percentage (%)
Books	54	45.0
Posters	30	25.0
Pamphlets	20	16.7
Chalkboard	16	13.3
Total	120	100.0

Source: Field Data, 2010

According to Table 7 above, 45 per cent of the respondents supported the use of books. Those who preferred posters and pamphlets to books were represented by 25 per cent and 16.7 per cent respectively. A percentage of 13.3 of the respondents chose the use of chalkboards. The information on the teaching and learning resources was vital in designing an improved version of EE.

4.4.5 Preferred Methods of Evaluating the Teaching and Learning Activity

The respondents were also asked to suggest evaluation tools to be used for such type of education. Their responses are portrayed in Table 8 below:

Table 8: Preferred Methods of Evaluating Teaching and Learning Activity

Item	Frequency	Percentage (%)
Teacher, Test	40	33.3
Interviews	70	58.3
Monitoring	10	8.3
Total	120	100

Source: Field Data, 2010

As shown above, 58.3 per cent of the respondents wanted interviews as mode of evaluating EE activities. Others favoured tests and this is represented by 33.3 per cent. Those who chose monitoring constituted 8.3 per cent. The information was helpful in coming up with appropriate methods of evaluating the learning process.

Summary

Findings from all the informants of the research were presented in the manner that they

were obtained from either the questionnaires or the interview. This was in an attempt to provide a foundation for appropriate interpretation of the results and to determine whether they gave answers to the research questions.

Therefore, in the following chapter, the discussion of these findings will relate the results to the objectives of the study and try to answer the questions that were posed in the research.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

Overview

This chapter presents the discussion of the research findings that were presented in the previous chapter.

5.1 Introduction

In this chapter, discussion of these findings will contribute to the understanding of the situation concerning EE on the impacts of mining in Kankoyo Township. This discussion is based on the research objectives as an attempt to answer the key research questions. It will also seek to establish commonalities between views of different informant groups which in turn will serve as a means of validating the findings of the study. Ultimately, the discussion will culminate in a proposed EE programme considered to be an improved version of the one previously offered to Kankoyo residents.

5.2 Characteristics of Respondents

This part of the chapter gives a discussion on the characteristics of the respondents. Characteristics of the respondents are addressed in items 5.2.1 to 5.2.4.

5.2.1 Age of Respondents

The age of the respondents in this study had an influence on the learning programme that will be designed. As stated in item 4.2.2 of chapter 4, most respondents (seventy four in number) were youth that came from the age group of 20-35, while the adult members were forty four from the age group of thirty six and above. The information collected on age distribution among Kankoyo residents showed the need to formulate an EE programme tailored to the needs of the youths and another EE programme tailored to the needs of the adult members of Kankoyo resident as youths and adults have different needs in their learning experiences. The idea is supported by Crawford (2010), who advocated for the need to consider diversity among learners when applying principles of good teaching.

The same is true for gender as a variable. In this study, there were more females (59.2 per cent) than males (40.8 per cent). An analysis of this distribution entailed the development of educational programmes and activities that incorporate the roles, needs and participation

of both men and women. In this case, the sole use of group discussion as a way of delivering EE activities for example, may not be viable due to cultural limitation that exist between men and women in Zambia. This means that for EE to be effective, a variety of learning and teaching methods have to be used.

To add detail to the importance of using a variety of learning and teaching styles, Crawford (2010) argued that the educator prone to using a cookie cutter approach to teaching may find student dissatisfaction with the instructional efforts that result in few rewards and less professional satisfaction for the instructor and student. Therefore, it is necessary to have a variety of teaching methods and strategies in order to cater for the needs of both males and females in EE programmes.

5.2.2 Educational Level of Respondents

As observed from item 4.2.3 of chapter 4, most respondents finished secondary education representing 45 per cent, followed by primary education representing 40.8 per cent. Only 14.2 per cent of the respondents attained tertiary education. This entailed that all the respondents had some educational background which made them understand environmental issues affecting them. Nevertheless, understanding environmental issues only may not be sufficient without the skills to identify and anticipate environmental problems and also to be able to work with others in resolving, minimizing and preventing them. This therefore calls for more EE that would help the respondents solve problems, define and achieve desired objectives and be able to deal with their developmental needs in a broad context and in a sustainable manner.

5.2.3 Period of Stay in Kankoyo Township

With regards to the period of stay, 100 per cent of the respondents said they had lived in Kankoyo for more than two years while no respondent was recorded to have lived in the area for less than two years. The results on the period of stay in Kankoyo area showed that migration trends in Kankoyo Township for the past two years had changed because no migrants were recorded at the time of the study. As a well known fact, migration trends in Zambia had been from rural areas to mining towns and other urban areas. This was also reported by United Nations-Habitat (2009) which affirms that mining towns and cities have

attracted people from other places due to better social services and employment opportunities. The reason for the change in Kankoyo could be attributed to the economic, social and environmental impacts of mining activities.

Furthermore, another implication on period of stay was that, the respondents had stayed long enough in the area to have concrete information on the nature of EE offered and may have observed changes on the environment due to mining activities.

5.2.4 Occupation of Respondents

The results presented in Figure 4 shows that the majority (51.7 per cent) of the respondents were unemployed while the self employed (29.2 per cent) were mainly involved in small businesses such as selling vegetables and sweets. Those who were formally employed accounted for 19.2 per cent. The implication of mass unemployment among the Kankoyo residents is that the unemployed could be involved in activities such as quarrying that would further degrade the environment of Kankoyo Township as they seek a living.

To add on, the situation may have ramification on the effectiveness of EE in Kankoyo Township. It may be an inadequate response to a combination of economic, social and environmental crises that make everyday life in Kankoyo Township complex.

5.3 Assessing The Nature of Environmental Education Provided to Kankoyo Residents

The second objective in this study was to assess the nature of EE provided to Kankoyo residents. It is addressed in items 5.3.1 to 5.3.5.

5.3.1 Provision of Environmental Education

On one hand, ECZ stated that it provided EE to Kankoyo residents. On the other hand, RDC member declared that only Caritas Zambia and Green Environment provided EE to Kankoyo residents. This contradicted the findings from MMC and Kankoyo residents who both claimed that only MMC offered EE to Kankoyo residents.

The above situation shows a mismatch between the EE providers and Kankoyo residents. The implication of the mismatch is that there is no interaction among the coordinators, Kankoyo residents and the EE providers (ECZ, Caritas Zambia and Green Environment).

It also throws into doubt the point of whether the EE providers (ECZ, Caritas Zambia and Green Environment) took any EE to the people of Kankoyo Township. However, it might also be true that the EE providers had plans of EE for Kankoyo residents on paper which had not yet been disseminated to the clients.

5.3.2 Characteristics of Environmental Education Offered

The information collected on the characteristics of EE offered to Kankoyo residents indicated that 100 per cent of the respondents could not identify the characteristics of EE offered. The implication of failure by the respondents to identify the characteristics of EE offered to them was that the EE on offer was either superficial in nature or it was not EE at all. The following were the reasons that supported the assertion that the type of EE being offered is superficial:

Firstly, a number of environmental problems affected Kankoyo residents though, all the respondents confirmed that only cleaning the surrounding to avoid cholera outbreak was the topic covered in EE activities. World Bank (2003) acknowledges the above assertion by noting that the majority of residents in the mining communities had information on issues such as maintaining clean surroundings except on mine pollution. The document further states that mining companies did not provide warning system for residents when there were excessive emissions and that there where no legal requirement for mining companies to share environmental data with the public.

One way to respond to environmental problems is through the development of community based learning activities that are responsive to local environment context and issues. In view of the above, all environmental issues affecting Kankoyo residents were supposed to be covered in various topics in order for the programme to be responsive to the needs of the learners.

Secondly, in disseminating the information on cleanliness to avoid cholera outbreak only discussion method was used though, it is a well known fact that learners learn in different ways and have different ways of absorbing information and of demonstrating their knowledge. Consequently, there was need to use a variety of teaching and learning styles to enhance the process of learning. This idea is supported by Knowles (1980), who points out

that educators should employ a variety of teaching methods and strategies to help learners retain information and strengthen understanding. A variety of teaching methods and strategies ensures that all learners have equal opportunities to learn and to take action based on their newly acquired knowledge.

EE offered to Kankoyo residents also unfolded its superficial nature in lack of evaluation methodology for the teaching and learning activity. Evaluation of the teaching and learning activity can serve two purposes. The first is to determine if objectives have been achieved and resources used appropriately. The second is to learn lessons that can be used to improve ongoing and future capacity development efforts. Thus, for any EE programme to be effective, evaluation mechanisms must be put in place.

After that, the nature of EE offered to Kankoyo residents seemed to be limited in the sense that it was biased towards offering awareness only. On the contrary, EE does not only create awareness, but also changes people's attitudes towards adopting a new approach and acquiring new knowledge (<http://www.gdrc.org/uem/ee/2-1.html>). Therefore, there is need to introduce EE that would promote not only awareness but also interest leading to action and instilling sustainable development skills in individuals.

In view of the above, it is necessary to promote inclusive EE programmes that would offer prospect for learning about sustainability throughout one's life. The programmes should provide a unique theme to allow the learners integrate content and all issues affecting them across disciplines and curricula. As a result, skills, attitudes, motivations and commitment to work individually and collectively towards solutions of current problems and preventing new ones would be cultivated in the people of Kankoyo Township.

5.3.3 Community Participation

On the question of community participation in all EE activities, 100 per cent of the respondents highlighted lack of participation. The reason could be that community members were not aware of their role in the execution of EE activities. In addition, lack of community involvement could suggest lack of interaction between EE providers, RDCs and Kankoyo residents. Which ever the case, both the EE provider and the recipient of an education activity should be able to identify an environmental issue and work towards

resolving the issue. EE should be a process of nonstop participation by the EE provider and the beneficiaries in initiatives such as planning, implementation and monitoring (<http://publicwebsite.idrc.ca/EN>). Hence, this calls for new strategies which would foster active participation of Kankoyo residents at all levels of EE process.

5.3.4 Understanding the Word ‘Environment’

When asked if the respondents understood the term ‘environment’, all the respondents (100 per cent) understood the term environment in one context. For them, the term environment meant the surrounding. This may be correct especially that the concept ‘environment’ is socially constructed and synonymous with the word ‘surroundings. However, a critical mind may ask what surroundings?

Di Chiro (1987) gives a comprehensive answer by stating that the environment should be understood as an interaction between the physical surroundings and the social, political and economic forces that organise people in the context of these surroundings. This definition shows the multidimensional nature of the environment. As such, the natural environment cannot be defined without considering the social, political and economic forces that shape it.

As a result, the above situation calls for an education that will help the people of Kankoyo understand what their environments are, if they are to avoid the negative impacts of copper mining.

On one hand, 80.8 per cent of the respondents did not understand the phrase EE, while 3.3 per cent of them understood EE as health of the people. Health of the people as a response could be attributed to the fact that education on how to maintain the surroundings clean is known to most people as health education.

Nevertheless, the above responses may be partly due to the fragmented nature of the EE offered to Kankoyo residents. It can also be attributed to low literacy levels because only 14.2 per cent of the respondents attained tertiary education.

Whatever the case, understanding the phrase EE is important if environmental sustainability has to be achieved. EE should be understood as a multi-disciplinary approach

to learning that develops the knowledge, awareness, attitudes, values and skills that will enable individuals and the community to contribute towards maintaining and improving the quality of the environment.

5.3.5 Environmental Problems Experienced in Kankoyo Area

Kankoyo residents were able to state the general environmental problems of Kankoyo Township and those that were connected to copper mining activities. Amongst those connected to copper mining, the most highlighted environmental problems were pollution of water, air, noise and dust. Others were chest infection and lack of vegetation growth. These research findings were in agreement with MMC who stated that ‘pollution of water, air, noise and dust, lack of vegetation growth and chest infection were some of the environmental problems experienced in Kankoyo Township’. The information also agreed with ECZ (2000) which identifies air pollution, water pollution and lack of vegetation growth as common environmental problems in Kankoyo Township. Furthermore, the site observation made by the researcher confirmed the environmental problems stated by respondents, Mufulira Municipal Council, and Environmental Council of Zambia.

Contrary to the above mentioned, some Kankoyo residents indicated poor sanitation, lack of electricity supply and joblessness as environmental problems related to copper mining in Kankoyo Township. This argument is in agreement with Grange and Reddy (2007) who identifies environmental problems as complex and products of interaction between the biophysical, economy, political and social dimensions.

An explanation to the state of affair is that, before the privatization of the Zambia Consolidated Copper Mine (ZCCM), all social services such as water provision, sanitation and electricity were provided by ZCCM. After it was privatized, the provision of such services was in the hands of private companies. Because some Kankoyo residents were unable to pay for such services and unaware of such changes, they felt that Mopani Copper Mines was obliged to provide the mentioned services to them. It is therefore not surprising that the respondents’ claims on provision of social services to Kankoyo community was also supported by World Bank (2003), which indicates that privatization of ZCCM negatively affected the mining communities in the provision of social services.

5.4 Dimensions of the Proposed Environmental Education Programme

The third objective was to design an improved version of EE programme to address negative impacts of copper mining activities. The programme focused on pollution of water, air and land that are generalized in Kankoyo Township. Designing an EE programme for Kankoyo residents was based on suggestions from the residents themselves and the researcher's analysis. The dimensions are addressed in items 5.4.1 to 5.4.4.

5.4.1 Topics to Be Covered In the Proposed Environmental Education Programme

In this section, the researcher wanted to find out from the respondents the issues to be included in the EE programme. As it was observed from Table 5, the respondents wanted issues such as pollution (representing 69.2 per cent of the responses) and pollution policy, represented by 25.8 per cent of the responses. Five per cent of the respondents suggested growing of plants. The responses confirmed that the suggested topics are related to negative impacts of copper mining and needed to be incorporated in the improved version of the EE programme.

Considering the above suggested topics, development of social nets among Kankoyo residents would have positive effects on the residents and similarly on the implementation of the improved version of EE. As noted in other studies conducted, Aongola *et al.*, (2009) discloses that EE had limited impacts on the livelihood of the poor and the disadvantaged. Therefore, the case of Kankoyo Township where a lot of residents were unemployed calls for the reintroduction of windfall taxes which could be ploughed back into the community through social programmes. With the social nets in place to alleviate poverty, EE programmes in Kankoyo Township would be a very successful story.

5.4.2 Mode of Teaching Environmental Education Activities

The respondents identified use of brochures, drama, cultural dances, discussions, seminars and radio programmes as effective modes of disseminating the information. The responses indeed confirmed that there was need to vary the modes of delivering EE to Kankoyo residents.

5.4.3 Environmental Education Learning and Teaching Resources

The research findings showed that 45 per cent of the respondents who were the majority favoured books as opposed to 25 per cent who preferred posters. A percentage of 13.3 of the respondents however preferred pamphlets to other resources. These research findings confirmed that the suggested teaching and learning resources were needed in the execution of EE activities. Nevertheless, if this type of education is not evaluated, the providers may not know their short comings, hence the need for an evaluation to direct the way forward.

5.4.4 Evaluation of Environmental Education Teaching and Learning Activities

The purpose of evaluation in any learning process is to find out how effective the instructions might have impacted on the learners. Enhancing environmental awareness on the negative impacts of copper mining and developing practical skills such as problem solving are the long-term goals of the environmental programme. Understanding the negative impacts of copper mining was to be assessed by interviews, which most respondents preferred to other methods suggested. Moreover, practical skills could be evaluated by various land reclamations activities in Kankoyo. However, other respondents favoured school based type of test. In any case, the efficiency of an EE programme is not about the learners passing an examination but acquiring the knowledge, values, attitudes and skills necessary in solving environmental issues.

5.5 Proposed Environmental Education Programme to Address the Negative Impacts of Copper Mining For Kankoyo Residents

EE programmes are an integrated sequence of planned educational experiences and materials intended to attain a particular set of objectives. Programmes can be small or large and can range from short-term, one-time events to long-term, community capacity building efforts. The EE programme proposed for Kankoyo residents is a long term capacity building effort in addressing the negative impacts of copper mining in the area.

The main objectives of the proposed programme are:

1. To provide residents of Kankoyo Township with the opportunity to be actively involved in exercising their skills of solving the problem of pollution in their area.

2. To provide Kankoyo residents with clear awareness and concern for environmental problems affecting them.

The above objectives were used in this study to devise a proposed EE programme for the youth (left side of diagram) and adults (right side of diagram). Details of the proposed programme appear in Table 6 below. The main features of the proposed programme are that it contains;

1. Themes

- Vegetation
- Pollution (water pollution, air pollution and land pollution).

2. Methods of Teaching such as;

- Youth Conservation Clubs
- Drama
- Sponsoring Events
- Discussion

3. Teaching and Learning Resources

4. Learning outcomes

5. Stakeholders such as;



- ECZ
- MMC
- Government
- Kankoyo Residents
- Mopani Copper Mine
- WWF
- WECSZ
- Agricultural Extension Officers
- Mwekera Training College

- National Institute of Industrial Research
- Resident Development Committee Members

6. Figures showing pictorial elements of the area such as;

- Figure 7 showing vegetation growth in Kankoyo area
- Figure 8 showing polluted water in Mufulira stream
- Figure 9 showing main air pollutant sulphur dioxide being released in air
- Figure 10 showing ditches created through mining activities

Table 9: Proposed EE Programme for Youths and Adults of Zambia's Kankoyo Mining Area.



Youth programme	Adult programme
<p>Vegetation</p> <p>Air pollution in Kankoyo area had affected vegetation types negatively. Effects of air pollution on vegetation is depicted in Figure 7 below:</p> <p>Figure 7 : Vegetation growth in Kankoyo Township</p>  <p>Source: field Data, 2010</p> <p>Content</p> <p>Lack of Vegetation growth:</p> <p>1. Vegetation types in Kankoyo area.</p>	<p>Vegetation</p> <p>Air pollution in Kankoyo area had affected vegetation types negatively. Effects of air pollution on vegetation is depicted in Figure 7 below:</p> <p>Figure 7 : Vegetation growth in Kankoyo Township</p>  <p>Source: field Data, 2010</p> <p>Content</p> <p>Lack of Vegetation growth:</p> <p>1. Vegetation types in Kankoyo area.</p>

<p>2. Importance of trees.</p> <p>3. Negative impacts of mining on trees (The above three points will offer Kankoyo youths an opportunity to acquire knowledge, values and attitudes to protect and improve their environment.</p> <p>4. Relationship between people and natural resources (value and attitude development towards responsible stewardship).</p> <p>Methods/Teaching and Learning Resources</p> <p>Youth Conservation Club</p> <p>-Competitions i.e. quiz will be run to describe lack of vegetation growth in Kankoyo area and proposing solutions (30minutes time frame).</p> <p>Special Day</p> <p>A sports day will be chosen by the youths. After sport activities, a talk on implications of lack of vegetation in Kankoyo will be given by WWF.</p> <p>This will help youths discover symptoms, real causes and solutions to environmental problems.</p> <p>Discussions</p> <p>-Peer discussions in voicing out personal views over lack of vegetation growth.</p> <p>-Discussion on lack of vegetation growth and solutions.</p> <p>-Exchange of ideas will be spontaneous regarding level of awareness on environmental issues faced in</p>	<p>2. Importance of trees.</p> <p>3. Negative impacts of mining on trees (The above three points will offer Kankoyo residents an opportunity to acquire knowledge, values and attitudes to protect and improve their environment).</p> <p>4. Relationship between people and natural resources (value and attitude development towards responsible stewardship).</p> <p>Methods/Teaching and Learning Resources</p> <p>Discussion</p> <p>-Exchange of ideas between community members will be spontaneous regarding level of awareness on environmental issues faced in Kankoyo Township (30minutes time frame).</p> <p>-EE facilitator will moderate to allow all to participate.</p> <p>Demonstration</p> <p>-Agricultural extension officers, NISIR officers and officers from Mwekera training college will demonstrate plant planting.</p> <p>Sponsoring Events.</p> <p>Local events such as Earth Day Celebration can be sponsored to provide relevant environmental information to the Kankoyo residents.</p> <p>Problem solving activity</p> <p>-Plant growing (selected plants that can withstand</p>
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<p>Kankoyo Township.</p> <p>Demonstration</p> <p>-Agricultural extension officers, NISIR officers and officers from Mwekera training college will demonstrate planting.</p> <p>Problem solving activity</p> <p>-Plant growing (selected plants that can withstand pollution) will be done by Kankoyo Youths.</p> <p>This will help youths in Kankoyo area to acquire the action competence or skills of environmental citizenship and capacity building through learning by doing.</p> <p>Learning outcomes</p> <p>Learners should be able to (LSBAT)</p> <p>-describe the causes of vegetation growth in Kankoyo area.</p> <p>-use a compass rose to relate development and environment.</p> <p>- develop skills of resolving environmental challenges.</p> <p>Key questions</p> <p>-What attitudes and values should be developed towards the environment?</p> <p>-What social/cultural factors make trees/vegetation important?</p> <p>- What are the skills that should be developed in resolving environmental challenges?</p> <p>Stakeholders</p>	<p>pollution) will be done by Kankoyo residents.</p> <p>This will help individuals and groups in Kankoyo area to acquire the action competence or skills of environmental citizenship.</p> <p>Learning outcomes</p> <p>Learners should be able to (LSBAT)</p> <p>-Explain the importance of trees.</p> <p>- relate development to the environment</p> <p>-develop attitudes and values in favour of the environment.</p> <p>-demonstrate plant planting.</p> <p>Key questions</p> <p>-What attitudes and values should be developed towards the environment?</p> <p>-What social/cultural factors make trees/vegetation importance?</p> <p>- What is the role of Kankoyo community in the environmental sustainability?</p> <p>Stakeholders</p>
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<p>Government</p> <ul style="list-style-type: none"> • Financial Support. • Input to education and capacity development needs. <p>Environmental Council of Zambia and Mufulira Municipal Council</p> <ul style="list-style-type: none"> • In put as to education and capacity development needs. • Participate in education and training. <p>Mwekera Training College, NISIR and Agricultural extension officers</p> <ul style="list-style-type: none"> . Will provide expertise on plant species which would withstand pollution. . Organize and conduct training. <p>Mopani Copper Mine</p> <ul style="list-style-type: none"> . Will offer financial support. <p>Youth coordinator</p> <ul style="list-style-type: none"> . Will organise youths to be actively involved at all levels in working towards land reclamation in Kankoyo Township. <p>Kankoyo youths</p> <ul style="list-style-type: none"> . Learners but active participants in all EE activities to promote the value and necessity of local cooperation in preventing and finding solutions to environmental problems in Kankoyo area. 	<p>Government</p> <ul style="list-style-type: none"> . Input as to education and capacity development needs. . Financial support. <p>Environmental Council of Zambia and Mufulira Municipal Council</p> <ul style="list-style-type: none"> • In put as to education and capacity development needs. <p>Mwekera Training College, NISIR and Agricultural extension officers</p> <ul style="list-style-type: none"> . Will provide expertise on plant species which would withstand pollution. . Organize and conduct training. <p>Mopani Copper Mine</p> <ul style="list-style-type: none"> . Will offer financial support. <p>Resident Development Committee members</p> <ul style="list-style-type: none"> . Will organise residents to be actively involved at all levels in working towards land reclamation in Kankoyo Township. <p>Kankoyo residents</p> <ul style="list-style-type: none"> . Participation . Input as to education and capacity development needs.
<p>Pollution</p> <p>Definition of pollution.</p>	<p>Pollution</p> <p>Definition of pollution.</p>

<p>Types of pollution;</p> <ul style="list-style-type: none"> • Water • Air • Land <p>1. Environmental legislation.</p> <p>2. Enforcement and compliance.</p> <p>Methods/Learning and Teaching Resource</p> <p>Discussion</p> <p>-Peer discussions will be used to voice out personal views over pollution.</p> <p>-Discussion on environmental legislation, enforcement and compliance.</p> <p>Pamphlets</p> <p>-Reading materials on environmental legislation, enforcement and compliance will be distributed by ECZ.</p> <p>This will provide opportunity to Kankoyo youths to be actively involved in exercising their skills of environmental citizenship and also gaining understanding on environmental legislation.</p> <p>Learning outcomes</p> <p>LSBAT:</p>	<p>Types of pollution;</p> <ul style="list-style-type: none"> • Water • Air • Land <p>1. Environmental legislation.</p> <p>2. Enforcement and compliance.</p> <p>Methods/Learning and Teaching Resource</p> <p>Discussion</p> <p>-EE facilitator to group discussion on environmental legislation, enforcement and compliance.</p> <p>This will provide opportunity to Kankoyo residents to be actively involved in exercising their skills of environmental citizenship and also gaining understanding on environmental legislation.</p> <p>Community Talk</p> <p>-Talk on environmental legislation and enforcement by ECZ (inspectorate department).</p> <p>Learning outcomes</p> <p>LSBAT:</p> <p>-describe environmental legislation, enforcement</p>
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<p>-describe environmental legislation, enforcement and compliance.</p> <p>-mention types of pollutions.</p> <p>Key questions</p> <p>-What attitudes should be developed towards environmental legislation?</p>	<p>and compliance</p> <p>-mention types of pollutions</p> <p>Key questions</p> <p>-What attitudes should be developed towards environmental legislation?</p>
<p>Water Pollution</p> <p>Mine effluents are a source of water pollution in mining districts. Figure 8 below shows polluted water in Mufulira stream;</p> <p><i>Figure 8 : Polluted Water in Mufulira Stream</i></p>  <p><i>Source: Field Data, 2010</i></p> <ul style="list-style-type: none"> - Sources of water. - Uses of water. -Importance of water. -Negative impacts of mining on water resources. - Identification of polluted water. -Steps to be taken in case of water pollution. -Environmental Protection Pollution Control Act. <p>Methods/Teaching and Learning Resources</p>	<p>Water pollution</p> <p>Mine effluents are a source of water pollution in mining districts. Figure 8 below shows polluted water in Mufulira stream;</p> <p><i>Figure 8 : Polluted Water in Mufulira Stream</i></p>  <p><i>Source: Field Data, 2010</i></p> <ul style="list-style-type: none"> - Sources of water. - Uses of water. -Importance of water. -Negative impacts of mining on water resources - Identification of polluted water. -Steps to be taken in case of water pollution Environmental Protection Pollution Control Act. <p>Methods/Teaching and Learning Resources</p>

<p>Community talk</p> <p>- Talk from ECZ officers on water pollution as an environmental issue (15 minutes time frame).</p> <p>Demonstration</p> <p>-ECZ , NISIR and Mulonga and Sewerage Company officers will demonstrate ways of identifying polluted water.</p> <p>Drama</p> <p>-Youths will perform plays to portray the steps to take in case of water pollution. Play will be directed by EE facilitators.</p> <p>Posters</p> <p>These will depict effects of water pollution on Kankoyo environment. Posters will be pre-tested for a small group of people from the target group before being reproduced and used on Kankoyo residents. Posters will be placed in strategic points e.g. community halls, market places, social clubs, churches and along the road sides.</p> <p>Learning outcome</p> <p>LSBAT:</p> <p>-Explain the importance of Clean water.</p> <p>-Explain why fish and water from Mufulira stream should be avoided.</p> <p>-Identify social impacts of Mufulira stream (Livelihoods and health on Kankoyo youths).</p> <p>Key questions</p> <p>-Why is water sustainability from Mufulira stream an environmental issue?</p>	<p>Drama</p> <p>-Community members will perform plays on steps to take in case of water pollution .Play will be directed by EE facilitators.</p> <p>Demonstration</p> <p>-ECZ officers will demonstrate ways of identifying polluted water.</p> <p>Community talk</p> <p>- Talk from ECZ officers on water pollution as an environmental issue (15 minutes time frame).</p> <p>Posters</p> <p>These will depict effects of water pollution on Kankoyo environment. Posters repeatedly will be pre-tested for a small group of people from the target group before being reproduced and used on Kankoyo residents.</p> <p>Learning outcome</p> <p>LSBAT:</p> <p>-Explain the importance of Clean water.</p> <p>-Explain why resources such as fish and water should be avoided from Mufulira stream.</p> <p>-Identify social impacts of Mufulira stream (Livelihoods and health on Kankoyo community).</p> <p>Key questions</p> <p>-Why is water sustainability an environmental than economic in the Mufulira stream?</p> <p>Role play</p> <p>-Demonstrate steps that can be taken in case of water pollution.</p>
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<p>One of main air pollutants from mining activities is sulphur dioxide. The release of sulphur dioxide is shown in Figure 9 below;</p> <p>Air</p> <p>Figure 9: Main Air Pollutant Sulphur Dioxide (SO₄) Released in Air</p>  <p>Source: field Data, 2010</p> <ul style="list-style-type: none"> -Negative impacts of mining activities on air. -Other sources of air pollution. -Legislation dealing with air pollution. - Enforcement and compliance. <p>Methods/Teaching and Learning Resources</p> <p>Discussion</p> <ul style="list-style-type: none"> -Peer discussions in voicing out personal views over air pollution. -Discussion on air pollution legislation, enforcement and compliance. <p>Pamphlets</p> <ul style="list-style-type: none"> -These materials on air pollution legislation, 	<p>One of main air pollutant from mining activities is sulphur dioxide. The release of sulphur dioxide is shown in Figure 9 below;</p> <p>Air</p> <p>Figure 9: Main Air Pollutant Sulphur Dioxide(SO₄) Released in Air</p>  <p>Source: field Data, 2010</p> <ul style="list-style-type: none"> -Negative impacts of mining activities on air -Other sources of air pollution. -Legislation dealing with air pollution. - Enforcement and compliance. <p>Methods/Teaching and Learning Resources</p> <p>Discussion</p> <ul style="list-style-type: none"> -small group of 5 in each group to voice out personal views over pollution. -EE facilitator to lead discussion on environmental legislation, enforcement and compliance.
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<p>enforcement and compliance will be distributed by ECZ, WECSZ and WWF.</p> <p>Posters</p> <p>These will depict effects of air pollution on Kankoyo environment. Posters will repeatedly be pre-tested for a small group of people from the target group before being reproduced and used on Kankoyo residents.</p> <p>This will provide opportunity to Kankoyo youths to be actively involved in exercising their skills of environmental citizenship and also gaining understanding on air pollution legislation.</p> <p>Learning Out comes</p> <p>LSBAT</p> <ul style="list-style-type: none"> -Identify the negative effects of air pollution. -explain legislation dealing with air pollution. -use the compass rose to show the social, economic, ecological and political dimension of air pollution. <p>Key questions</p> <ul style="list-style-type: none"> -What is the role of Kankoyo youths in policy making? -What is the role of the youths in ensuring that individuals and companies comply with air pollution regulations? 	<p>Pamphlets</p> <p>-These materials on air pollution legislation, enforcement and compliance will be distributed by ECZ.</p> <p>Posters</p> <p>These will depict effects of air pollution on Kankoyo environment. Posters will repeatedly be pre-tested for a small group of people from the target group before being reproduced and used on Kankoyo residents.</p> <p>This will provide opportunity to Kankoyo residents to be actively involved in exercising their skills of environmental citizenship and also gaining understanding on air pollution legislation.</p> <p>Learning Outcome</p> <p>LSBAT</p> <ul style="list-style-type: none"> -Identify the negative effects of air pollution. -explain legislation dealing with air pollution. -explain the social, economic, ecological and political dimension of air pollution. <p>Key questions</p> <ul style="list-style-type: none"> -What is the role of Kankoyo residents in policy making? -What is the role of the community in ensuring that individuals and organizations comply with air pollution regulation?
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<p>Land Pollution</p> <p>Effects of mining on land</p> <p>(a)Land Contamination.</p> <p>-Definition of land contamination</p> <p>-Causes of land contamination (acids, dump sites).</p> <p>-Dangers of scavenging in mine dumpsites.</p> <p>-Ecological, social, political and economical implications of land contamination (will foster awareness of and concern about interdependence of the four dimension of the environment).</p> <p>Methods/Teaching and Learning Resources</p> <p>Games</p> <p>-Social games for youth participation i.e. football and netball will be organised by youth coordinators.</p> <p>-After the games, a talk on land contamination and dangers of scavenging in mine dumpsites will be given by EE educators.</p> <p>Drama</p> <p>-A play depicting dangers of scavenging in mine dump site will be performed by Kankoyo youths. The play will be directed by EE educators.</p>	<p>Land Pollution</p> <p>Effects of mining on land</p> <p>(a)Land contamination.</p> <p>-Definition of land contamination</p> <p>-Causes of land contamination (acids, dump sites).</p> <p>-Dangers of scavenging in mine dumpsites.</p> <p>-Ecological, social, political and economical implications of land contamination (will foster awareness of and concern about interdependence of the four dimension of the environment).</p> <p>Methods/Teaching and Learning Resources</p> <p>Comics Strips</p> <p>These will be used to disseminate information on dangers of scavenging in mine dumpsites, especially to those who are illiterate. Comics will be short and printed in Bemba as a local language.</p> <p>Drama</p> <p>-A play depicting dangers of scavenging in mine dump site will be performed. The play will be directed by EE educators.</p> <p>Community Talk</p> <p>-A talk will be given on effects of land contamination.</p> <p>Learning Outcomes</p>
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<p>Learning Outcomes</p> <p>LSBAT</p> <ul style="list-style-type: none"> -demonstrate an understanding of the dangers of scavenging in mine dumpsites. -explain the social and economic implication of soil contamination. <p>Key questions</p> <ul style="list-style-type: none"> -What social impacts does scavenging in mine dumpsites have on the youths? <p>Mining activities always leave behind bench marks on the earth surface. The footprints left by mining activities in Mufulira district. are depicted in Figure 10 below;</p> <p><i>Figure 10: Ditches near a mine waste dump</i></p>  <p><i>Copperbelt Environment Project, 2009</i></p> <p>(b) Degradation (creation of ditches)</p> <ul style="list-style-type: none"> -Dangers of ditches. -Land reclamation activities. <p>Methods/Teaching and Learning Resources</p> <p>Fact sheets/Flyers</p>	<p>LSBAT</p> <ul style="list-style-type: none"> -demonstrate an understanding of the dangers of scavenging in mine dumpsites. -explain the social and economic implication of soil contamination. <p>Key questions</p> <ul style="list-style-type: none"> -What social impacts does scavenging in mine dumpsites have on the community of Kankoyo Township? <p>Mining activities always leave behind bench marks on the earth surface. The footprints left by mining activities in Mufulira district. are depicted in Figure 10 below;</p> <p><i>Figure 10: Ditches near a mine waste dump</i></p>  <p><i>Copperbelt Environment Project, 2009</i></p> <p>(b) Degradation (creation of ditches)</p> <ul style="list-style-type: none"> -Dangers of ditches. -Land reclamation activities. <p>Methods/Teaching and Learning Resources</p> <p>Fact sheets/Flyers</p>
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<p>Short and simple, fact sheets and flyers will be used to provide information on land reclamation activities.</p> <p>Video</p> <p>Outsourced videos on a land reclamation activities such as filling ditches left from mining activities will be obtained from other external agents or projects in the country or internationally.</p> <p>Exposure Trip</p> <p>-Trips will be organised to areas where previous degraded lands had been revegetated. The trips will enhance linkages with NGO s and other resource users.</p> <p>Practical activity</p> <p>-Filling ditches with soil and planting of plant species that can with stand pollution.</p> <p>Learning Outcomes</p> <p>LSBAT</p> <p>-demonstrate knowledge on land reclamation.</p> <p>-relate land reclamation to development</p> <p>Key questions</p> <p>-What are the social and economic benefits of land reclamation activities?</p> <p>Entrepreneurship</p> <p>Learning outcome</p>	<p>Short and simple, fact sheets and flyers will be used to provide information on land reclamation activities.</p> <p>Video</p> <p>Outsourced videos on land reclamation activities such as filling ditches left from mining activities be obtained from other external agents or projects in the country or internationally. Locally produced videos can be very effective since they address local issues with local people.</p> <p>Practical activity</p> <p>-Filling ditches with soil and planting of plant species that can with stand pollution.</p> <p>Learning Outcomes</p> <p>LSBAT</p> <p>-demonstrate knowledge on land reclamation.</p> <p>-Explain the social and economic aspect of Land reclamation activities.</p> <p>Key questions</p> <p>-What are the social and economic benefits of land reclamation activities?</p> <p>Entrepreneurship</p> <p>Learning outcome</p>
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<p>LSBAT</p> <p>-Explore possibilities of turning reclaimed areas into tourism attraction places.</p> <p>Key questions</p> <p>-What are the social and economic benefits of tourism in Kankoyo area?</p> <p>Stakeholders (Pollution i.e. water, air and land)</p> <p>Mulonga Water And Sewage Company .Will provide expertise on ways of identifying polluted water.</p> <p>ECZ . Organize and conduct training and capacity development activities .Will provide posters and pamphlets depicting effects of polluted water on living organism. .Will provide information on environmental legislation, enforcement and compliance.</p> <p>Youth Coordinators . Will organise residents so that all could be given an opportunity to be actively involved at all level in working towards land reclamation in Kankoyo Township.</p> <p>Mufulira Municipal Council . Will facilitate release of constituency funds.</p> <p>Kankoyo residents .Learners and active participants in all EE activities to promote the value and necessity of local cooperation in prevention and finding solutions to environmental problems in Kankoyo Township.</p> <p>Mopani Copper Mine .Will provide resources such as funds and transport.</p> <p>Mwekera Training College and Agricultural extension officers</p>	<p>LSBAT</p> <p>-Explore possibilities of turning reclaimed areas into tourism attraction places.</p> <p>Key questions</p> <p>-What are the social and economic benefits of tourism in Kankoyo area?</p> <p>Stakeholders (Pollution i.e. water, air and land)</p> <p>Mulonga Water And Sewage Company .Will provide expertise on ways of identifying polluted water.</p> <p>ECZ .Will provide expertise on ways of identifying polluted water. .Will provide information on environmental legislation, enforcement and compliance. .Will provide posters and pamphlets depicting effects of polluted water on living organism.</p> <p>Resident Development Committee members .Will organise residents so that all could be given an opportunity to be actively involved at all level in working towards land reclamation in Kankoyo Township.</p> <p>Mufulira Municipal Council .Will facilitates release of constituency funds.</p> <p>Kankoyo residents .Learners and active participants in all EE activities to promote the value and necessity of local cooperation in prevention and finding solutions to environmental problems in Kankoyo Township.</p> <p>Mopani Copper Mine .Will provide resources such as funds and transport.</p> <p>Mwekera Training College and Agricultural extension officers</p>
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.Will provide expertise on how to grow plants and which plant species would withstand pollution.	.Will provide expertise on how to grow plants and which plant species would withstand pollution.
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5.6 Reflections on the Extent to Which Research Questions Were Addressed

The study set out to answer the following research questions:

- (a) Does any organisation or company provide EE among residents of the Township?
- (b) What type of EE is provided to residents of Kankoyo Township?
- (c) In what ways could EE provided be improved upon for the future?

The first research question above in (a) has been addressed in items 4.3.3.

The second research question above in (b) has been addressed in items 4.3.4 to 4.3.10.

The final research question above in (c) has also been addressed in item 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5 and 5.5.

Summary

This chapter discussed the findings of this research study and presented a designed EE programme to address negative impacts of copper mining. The findings were discussed in the order they were presented and were further analysed. The next chapter is going to deal with the conclusion of the study, recommendations on the study and further research recommendation.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter summarises the general impression generated by the data obtained from all the informants and presents some recommendations.

6.2 Conclusion

This study has brought out different important points concerning the provision of EE in Kankoyo Township of Zambia's Copperbelt region. The study established that EE was offered to Kankoyo residents. However, it was noted that all the respondents were unable to identify the characteristics of EE that was made available to them. Furthermore, all of the respondents understood the term environment in one context and that few understood the phrase EE. With regard to the above situation, it can be conclusively stated that EE provided to Kankoyo residents was superficial in nature.

It was revealed that ECZ and MMC claimed to be providers of EE to the people of Kankoyo Township. The analysis of these claims to those of Kankoyo residents, provided evidence that only MMC provided EE to them (Kankoyo residents).

Another important aspect that was highlighted is that pollution of water, air and land from copper mining activities and cholera outbreak were serious environmental issues in Kankoyo area. Nevertheless, hygiene to avoid cholera was the sole topic covered in the EE programme. This led to the conclusion that there was need for the introduction of an improved version of EE that should be able to address the negative impacts of copper mining in the area.

The findings seem to suggest that teaching methodology, assessment strategies and community participation in all EE activities play an important role in enhancing learning. With regard to the present investigation, it can be conclusively stated that the application of varied teaching and learning methods, assessment strategies and community participation will definitely enhance the quality of EE programmes for Kankoyo residents.

6.3 Recommendations

In order to have effective provision of EE activities to Kankoyo residents, the following approaches and recommendation may have to be taken into consideration.

Environmental Council of Zambia and Other EE Providers

1. The findings of the study indicated that EE activities taking place in the area were superficial in nature and lacked community participation in all EE activities. Arising from this, it is recommended that learning and development of EE activities should be with active participation of Kankoyo residents. Furthermore, the content of the EE programmes should be revisited so that it incorporates all the characteristics of EE.
2. The findings of the research also showed that no issues relating to negative impacts of copper mining were covered in the EE offered to Kankoyo residents. There is need therefore, to include environmental issues related to the negative impacts of copper mining in the EE programmes. This will enhance localization of the curriculum to make EE relevant.
3. The study's findings revealed contradiction on who the actual EE providers were. In view of such a finding, EE providers should effectively provide EE to the people by direct interaction and networking with the learners.

The Zambian Government and Cooperating Partners

4. The findings of the study indicated that the majority of Kankoyo residents were Unemployed accounting for 51.7 per cent. Arising from this, it is recommended that the Government should reintroduce and enforce windfall tax that should be ploughed back into the Kankoyo community in order to make EE responsive to a combination of economic, social and environmental crises that make everyday life in Kankoyo Township difficult.
5. The study findings suggested that more learning and teaching materials will be needed in the execution of EE. In this regard, more funds should be allocated to the

provision of EE. Documentation and publications from different EE institutions be availed to members of the Kankoyo residents.

6.4 Suggested further Research

1. An investigation into professional training programmes on the social, economical and biophysical impacts of mining.
2. Evaluation of the need for EE to be included as a component in all formal and informal training for all miners.

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APPENDICES

Appendix 1: Interview Guide for Environmental Education Providers

Date.....

Name of Institution.....

Position held.....

Sex.....

1. Have you been trained in Environmental Education?
2. Which institution trained you?
3. What are your institution guidelines on Environmental Education
4. Does such guidelines include Environmental Education
5. What type of Environmental Education do you offer if any?
6. Does it include Environmental Education on the negative impacts of copper mining?
7. What mode of teaching do you use?
8. What methods do you employ?
9. What topics are covered?
10. What methods are used to evaluate the learning and teaching activity?
11. What hiccups are experienced in delivering Environmental Education?
12. Is any positive change in behavior of the people seen?
13. How well are people informed?

END OF INTERVIEW

Appendix 2: Interview Guide for Residents Development Association Member.

Personal data

Respondent sex

Age.....

Section

Questions

1. Have you been to school?
2. What is your occupation?
3. What environmental problems do you experience in your area?
4. What do you know about Environmental Education?
5. Does any company or organization offer any Environmental Education in your area?
6. What mode of Environmental Education is employed?
7. What are the characteristics of Environmental Education that offered in your area If any?
8. What topics are covered?
9. How informed are the locals on the environmental problems faced in your area through the education offered if any?
10. Is there any positive change in behavior to that effect?
11. Do you face any problems from the providers of EE?

END OF INTERVIEW

Appendix 3: Questionnaire for Kankoyo Residents

Your have been selected to participate in the research in which we wish to obtain an understanding of current practice of Environment Education in Kankoyo Township. Your responses will help the research to suggest to the providers of Environmental Education and their institutions to effectively provide EE programs. There is no right or wrong answer, therefore feel free to answer the questions.

Instructions: Please, answer by ticking and filling in the spaces provided

Section A: Personal Information

1. Gender Male [] Female []
2. Age: 20-25 [] 26-30 [] 31-35 [] 36-40 [] 41-45 [] 46-50 [] 51+ []
3. Period of stay in the study area: > 1 [] 1-5 [] 6-10 [] 11<
4. Education Level attained: Primary [] Secondary [] Tertiary []
5. What is your occupation?
.....

Section B: Information about Environmental Education Activities

6. What do you understand by the environment?
.....
7. What environmental problems do you experience in your area?
.....
8. What do you know about Environmental Education?
.....
9. Does any company or organization offer Environmental Education in your area? Yes [] No []
10. What mode of Teaching Environmental Education is employed?
.....
11. What topics are covered?

.....
12. Mention environmental issues, which providers of EE have taught you about your area.

13. What language/s do they use in teaching you?

14. Do you participate in EE activities?

Yes [] No []

15. What type of EE activities do you participate in your area?

16. Are you involved in planning for the learning activities?

Yes [] No []

17. If yes, please explain how you are involved

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

18. Does the EE provided cover ways of avoiding impacts of mining? Yes [] No []

Section C Educational Implication

19. If Environmental Education on negative impacts of mining were to be introduced, would you be willing to be involved in the teaching and learning process?

20. Which issues would you like to be covered?

21. What mode of teaching would you like to be implored?

23. What type of teaching resources would be best for such type of education?

22. What would be the best way of evaluating the achievements of such type of education?

END OF INTERVIEW

Appendix 4: Unstructured Observation Guide

Kankoyo residents' activities

- Scavenging in Mine dump sites
- Quarrying
- Water sources used for domestic purposes

Physical environment

- Physical inspection in relation to the physical environment of Kankoyo Township
- Observation of gestures made by respondents during interviews