INTEGRATING ENVIRONMENTAL SUSTAINABILITY ISSUES IN THE ZAMBIAN 2013 REVISED SCIENCE CURRICULUM AT JUNIOR SECONDARY SCHOOL LEVEL

BY

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DECLARATION

I declare that “integrating environmental sustainability issues in the Zambian 2013 revised science curriculum at junior secondary school level” is my own work and to the best of my knowledge ithas never been presented or submitted elsewhere by anyone else for academic credit. I also declare that all the sources that I have used or quoted have been indicated and dully acknowledged by means of complete references.

Sign: ……

Name: Chilufya TheresaDate: 03/11/2014

CERTIFICATE OF APPROVAL

This dissertation for the Master of Education in Environmental Education degree has been approved bythe Board of Examiners at the University of Zambia.

Examiner's signature: Date:

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DEDICATION

This piece of work is dedicated to

my husband and children

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ABSTRACT

This paper seeks to report on the research undertaken to determine the extent to which environmental sustainability issues had been integrated in the Zambian 2013 science education curriculum at junior secondary school level(grades 8 and 9).

The research followed a descriptive survey employing both qualitative and quantitative approaches.This descriptive survey sought to determine the extent of integration of the 15 environmental sustainability issues as identified by the United Nations agenda 21 (section I and II). The researcher collected primary data using interview guide and questionnaires; a semi- structured interview guide was used. Secondary data was collected through the review of documents such as the curriculum, educational policy, curriculum framework and other curriculum documents, related to the study. The major areas in the science curriculum at junior level (grade 8 and 9) were divided into two major categories: Category A, integrated science with two sub categories; integrated science grade eight and integrated science grade nine; Category B, agricultural science with two subcategories; agricultural science grade eight and agricultural science grade nine. The research followed content analysis as a principal technique.

The literature review revealed that integrating 'environmental' learning into main stream education is an important counter measure to address challenges to the sustainability of the earth and children's integrated development. Furthermore, literature review revealed that a new way of educating our learners is required; one that empowers them with the capabilities and skills to seek out and examine their own frameworks for thinking. The new way is sustainability education. As sustainability is needed, it brings with it the need to change educational approaches by not just infusing issues in different subjects or curricular but as an inter-disciplinary course. The evidence from the literature review also indicatedthat if we are to achieve sustainable development, then science education must have a role in encouraging ecological thinking.

Results showed that the three pillars or building blocks of sustainable development were dully represented in the 2013 science curriculum. However, more work had been done on topics dealing with ecological issues, social and economic and a bit on political issues. Additionally, more sustainability issues had been integrated in the

agricultural science curriculum compared to integrated science curriculum. Furthermore, the curriculum had highly been re- arranged and learning levels raised. Results also indicated that stakeholders and pupil- respondents had knowledge on environmental sustainability issues. However, the knowledge they had was associated only with the ecological environment. Varied teaching methods had been identified. However, classroom-based approaches occupied proportionally more space and have remained the dominant modes of delivery across the two categories. It was also clear that there were little or no teaching and learning resources for both the old and the revised curriculum. Results also showed that environmental sustainability issues would highly be beneficial to learners and society at large once in the curriculum. Furthermore, the curriculum seemed to be bulk but a good and detailed guiding tool for the teacher, presenting clearly, the knowledge, skills and values needed to be passed on to the learner.

The descriptive survey focused only on stakeholders and pupils in Central Province and on the information that was obtained through interviews and questionnaires.The research also focused on information from experts at CDC and review of curriculum documents such as the framework, syllabi for both integrated science and agricultural science and the policy document on education. Therefore, the findings of this study may not be a true representative of all other provinces in Zambia.

The research indicated that within Zambia's science education curriculum, a balance of issues (social, economic, ecological and political issues) on environmental sustainability is needed to develop learners' potentials, values and skills. It also implies that environmental sustainability issues should be evenly distributed into the topics and sub- topics of the curriculum. The research also indicated the need to create innovations in delivery methods. Therefore, it is time to move beyond rhetoric and implement policies and programs that will allow Zambian schools realise the goal of creating "sustainability literate" and responsible learners.

The research has addressed integration of environmental sustainability issues in the science education curriculum at junior level in Zambia and hasthus opened up various opportunities. It has also provided a starting point for investigations into activities that may have been missed by the current research. More importantly, it provides a base for the exploration of the 2013 revised curriculum.

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LIST OF ACRONYMS/ABBREVIATIONS

AIDS Acquired Immune Deficiency Syndrome

ASTA Austrian Science Teachers Association

CDC Curriculum Development Centre

CER Community Ecological Responsibility

CSO Central statistics Office

DEBS District Education Board Secretary

E E Environmental Education

EEASA Environmental Education Association of South Africa

EFA Education For All

ELMS Energy and Land Management Systems

ESI Environmental Sustainability Issues

ESD Education for Sustainable Development

FNDP Fifth National Development Plan

GER Global Environmental Responsibility

HIV Human Immune Virus

HOD Head Of Department

ICT Information andComputer Technology

MESVTEE Ministry of Education Science, Vocational Training and Early Education

MTENR Ministry of Tourism Environment and Natural Resources

NCCRS National Climate Change Response Strategy

NEAP National Environmental Action Plan

NGO Non - Governmental Organisation

NISTICO National In- Service Teachers' College

PEO Provincial Education Officer

REEP Region Environmental Education Programme

REDD Reducing Emission from Deforestation and Degradation

RDP Reconstruction and Development Programme

SADC South Africa Development Community

SARE Southern Africa Reforms on Education

SEEN Supporting Environmental Education in Namibia

SEPSchool Environmental Policy

SBCPD School Based Continuing Professional Development

UN United Nations

UNCED United Nations Conference on Environment and Development

UNDESD United Nations Decade for Education for Sustainable Development

UNEP United National Environmental Programme

UNESCO United Nations Educational, Scientific, and Cultural organisation

UNZA University of Zambia

WCED World Commission on Environment and Development

WCSTE World Conference on Science and Technology Education

WWF World Wide Fund for Nature

ZANEEP Zambia Network of Environmental Educators and practitioners

ZEEP Zambia Environmental Education Project

ZEP Zambia Environmental Project

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter focuses on the background, statement of the problem and purpose of the study, significance, limitations, research questions and research objectives.

"Since the late 1960s, Zambia has pursued, a policy of limited diversification in its secondary schools, with pupils in Grades 8 and 9 being able to choose a limited number of practical and technological subjects (from industrial arts, agricultural science, a commercial subject, and home economics). Pupils take one of these subject areas plus environmental science in accordance with programme availability, personal aptitudes, and interest",(Ministry of Education, 1996:36). The choice of subject is limited in smaller schools, particularly in Primary Schools. Furthermore, "teaching and learning in these subjects is theoretical and bookish, without opportunities for the hands-on practical experience that is of its essence", (Ministry of Education, 1996:36). As a result learners graduate without critical thinking skills and responsibility for their immediate and distant 'environment'. A more diversified and interdisciplinary science education is needed if we are to produce learners who are responsible and action oriented.In Australia, environmental education initially entered school curricula in the early 1970s through science education (Gough,1997) withits aims concerned with stimulating a sense of individual responsibility for the physical and aesthetic quality of the total environment (Gough,1997). Additionally, even in Zambia we have to bear in our minds that today's learners have different priorities and interests from those of the past. Traditional science education is becoming a threatened species because of its static practices thus the need for a new way of learning, sustainability learning.

The state of the environment affects every individual both directly and indirectly, (Loubser, 2011). As a result, it is important that learners are made aware of environmental issues, if only to sensitise them to aspects that may directly affect them, for example poverty, pollution, overpopulation, human health, human settlement, deforestation, desertification, conservation, agriculture and rural development, biodiversity, solid wastes and sewage to mention but a few through

teaching and learning activities in science. Loubser, 2011:3, confirms that,“few learners realise the importance of the variety of living and non-living thingsin our environment”, thus the need for environmental sustainability issues in the science curriculum at junior level.This will help to correct the current situation or we risk facing serious consequences in future.Furthermore, it is important to note here that science and technology have a far-reaching impact on Zambia's economy and that of the world on the way of life of almost all the people(Ministry of Education, 1996). With environmental sustainability issues in the science curriculum learners graduate with a greater understanding of, and responsibility for, and about the ‘environment’ and critical thinking and awareness about scientific changes and how to catch up with the changes.Increasingly, the ability to think scientifically and to understand scientific processes is becoming a condition for survival in present day world (Ministry of Education, 1996). The scientific outlook is becoming the trademark of the approach to problem-solving(Ministry of Education, 1996). As such learners need to be equipped with life skills that will enable them solve problems in society. National progress largely and critically depends on the ability to adapt and use scientific and technological developments and to generate new developments(Ministry of Education, 1996). These come with critical thinking, responsibility and awareness about, in, and for the ‘environment’. The curriculum for grades 8 and 9 education must take this into account. More recently, UNESCO has emphasized the link between environmental education and science education by changing the subtitle of its publication Connectfrom the ‘UNESCO-UNEP environmental education newsletter’ (as it was from 1976 to 1996) to the ‘UNESCO international science, technology and environmental education newsletter’ (since 1997). In its early formulations, the explicit aims of environmental education were often concerned with stimulating a sense of individual responsibility for the physical and aesthetic quality of the total environment based on knowledge of general ecological principles, an understanding of the impact of human society on the biosphere, and an awareness of the problems inherent in the environmental change.

Therefore,Ministry of Education, Science, Vocational Training and Early Education (MESVTEE) prime goal for science teaching at grades 8 and 9 is to “help develop processes of scientific thinking in children”,(Ministry of Education, 1996:36).Scientific thinking demands for learners’ full involvement in the learning

process. For this, “it is not sufficient that pupils are told about certain processes, or even that they can observe them. It is necessary, in science as in all other subjects, for pupils to be enabled to apply their own ideas, use their own hands, and conduct their own investigations,however simple”, (Ministry of Education, 1996:36). As such, a contemporarycurriculum shouldbalance the content of what pupils learn in science with the processes by which they learn; it also implies an enhanced role for guided discovery teaching-learning methods and to a larger extent an interdisciplinary curriculum. Learners should explore and manipulate all that is in the environment to sustain and enhance their skills, knowledge and understanding.

Theextent to which environmental sustainability issues have been integrated in the 2013 science education curriculumis the focus of this study. The study advocatesfor science education to house environmental sustainability issues if we are to produce “sustainability literate”learners who are responsible and action oriented in all the four dimensions of the ‘environment’ that is, social, economic, ecological and political environment.

1.2 Background to environmental sustainability

According to Walsand Jickling (2000:123), as cited in Loubser(2000:117), “Sustainability is a highly relevant, controversial, emotionally charged and debatable topic at the crossroads of science, technology and society”. It is one of the issues of great national concern. Education for sustainability (which in this study will alternatively be termed as environmental education) emerged from a series of global policy pronouncements at conferences and summits where influential people agreed on how to tackle the issues of the 21stcentury. Issues such as depletion of natural resources, climate change, land use and management, deforestation, desertification, poverty, population increase, diseases, solid waste and sewage management, water, land, air and noise pollution, mass extinction of species to mention but a few were identified (UNESCO, 1976). The need to protect the environment ensures maintenance of quality life not only for humans but for biodiversity too. Education for sustainability recognizes the importance of investigating the environment within the context of human influences, incorporating an examination of economics, culture, political structure, and social equity as well as natural processes and systems (UN, 1992). To this effect, conferences, summits and seminars have been held at global, national and local levels to create environmental awareness about people’s lifestyles

and their impact on the environment. TheUnited Nations Conference on Human and Environment held in Stockholm in 1972 was the first international conference that focused on global environmental problems and has since given birth to a number of other conferences that promote sustainable use of the earth's natural resources. For example, the Tbilisi, USSR conference of 1977, the conference recommended, that environmental education is the result of reorientation and fitting together of different disciplines and educational experiences which facilitate an integrated perception of the problems of the environment, enabling more rational actions capable of meeting social needs to be taken. Other global conferences include the United Nations Conference on Environment and Development (UNCED, 1992). The conference key outputs were Rio declaration of Agenda 21and the commission of sustainable development.Agenda 21 is document with 40 chapters grouped under four broad sections: (I) Social and economic dimensions; (II) Conservation and management of resources; (III) Strengthening the role of major groups; and (IV) Means of implementation. Agenda 21 activities are organised under environment and development themes; quality of life, efficient use of natural resources, protection of global commons, management of human settlements and sustainable economic growth. Agenda 21 the Rio declaration recognises education as a key tool of sustainable development (UN, 1992). Chapter 36 of Agenda 21 states that education is critical for achieving environmental and ethical awareness, values, attitudes and behaviour consistent with sustainable development and for effective public participation in decision making (UN, 1992). It was made plain at the UNCED conference that we can no longer think of environment and economic and social development as isolated fields but as an integral whole.

This study focuses on issues addressed in Agenda 21.Issues addressed in Agenda 21 and identified for analysis fall under Chapter 36, section I (Social and economic dimensions) and section II (conservation and management of resources) and include combating poverty, changing consumption patterns, population and sustainability, protecting and promoting human health.It also includes sustainable human settlement, making decision for sustainable development, protecting the atmosphere, managing land sustainably and combating deforestation.Combating desertificationand drought, sustainable agriculture and rural development,conservation of biodiversity andmanagement of biotechnology were

included. Protecting and managing fresh water, managing solid wastes and sewage,were also among the issues identified (UN, 1992). Another conference is the World Summit on Sustainable Development held in Johannesburg in August 2002 with a major concern on poverty alleviation. Whatever way sustainable development has been conceptualized there is a general agreement that education plays an essential role as we move towards more unsustainable relationships throughout the world. According to Saylan(2011), environmentalism is not an option like choosing one's religion or political affiliation. It is a responsibility and fundamental aspect of cohesive society, like respect for law. It is not something we should debate teaching.

Local influences on environmental sustainability include the National Policy on Education known as 'Educating Our Future'(Ministry of Education, 1996) which places emphasis on the production of a learner who is capable of "participating in the preservation of the ecosystem in one's immediate and distant environments" (Ministry of Education, 1996:5). This implies that at the end of their formal education learners should acquire skills on how to contribute towards the conservation of the environment. This also calls for individual responsibility because each person has to play a part in protecting the environment near and far.The National Environmental Action Plan also sounded the need for holistic teaching of environmental education.Zambia's Final National Climate Change Response Strategy (NCCRS) emphasises a curricula review to integrate climate change, gender, HIV and AIDS into education systems as well as to incorporate climate change into school curricula at all levels as part of education and public awareness. However, while these documents are consistent with the Tbilisi Declaration(UNESCO, 1978), they are advisory only and neither enforceable nor are accountable in science education curriculum reforms at national level.

If well formulated, the curriculum can help prepare for the learning that will be needed over time by individuals and institutions, both as a resource for living and further learning(William, 2002). Different groups use ideas about sustainability to argue for particular learning and social goals (William, 2002). Although there can be no single way of learning about sustainability, it is argued that there are strong grounds for working through subject teaching(Scott, 2002). Because civil society is crucial to achieving sustainability, it is in all our interests that schools become openly engaged in sustainability issues such as forest conservation, waste management and

arguments (Scott, 2002). Scott argues yet again that sustainable development might helpfully be viewed as a process through which we can (if we choose) learn to build our capacity to live more sustainably.

Sustainability or education for sustainability (in education approach), encapsulates meanings such as sustainable development, sustainable living, environmental education, education for sustainable development and education for environment and sustainable development(Loubser, 2005). It is very clear from the above assertion that sustainability has no single and agreed meaning. As such, "it takes on meaning within different political ideologies and programs underpinned by different kinds of knowledge, values, and philosophy", (Huckle et al 1996:3). However, a clear distinction in meanings is shown with sustainability as a goal and sustainable development as a process (Scott, 2002). The Brundtland Commission,World Commission on Environment and Development (WCED) of 1987 as cited in Scott (2002) stressed that sustainable development is a process of change with the future in mind .A process where the exploitation of resources, the orientation of technologicaldevelopment and institutional change, are made consistent with future as well as present needs**.** According to Wals and Jickling (2000:123), as cited in Loubser (2000:117), "Sustainability is a highly relevant, controversial, emotionally charged and debatable topic at the crossroads of science, technology and society".

Science education is important as sustainability depends on appropriate environmental management, which requires scientific and technological understandings and skills (UNDESD, 2006). Science in Education for Sustainable Development presents challenges to educators as there is inadequate expertise in science, environmental science and sustainability science in Southern Africa (UNDESD, 2006). Therefore, there is need for curriculum orientation towards sustainability science to catch up with a fast-changing and challenging socio-economic, political, technological and natural environment. New scientific facts are discovered at a rapid pace. Also scientific findings are often controversial and scientific strategies often call for field work and / or equipment which are not easy to access in resource-poor environments (UNDESD, 2006). Therefore, curriculum reorientation is needed to include such skills as observation, enquiry, classification, experimentation, problem solving, investigation and reflexivity needed for critical thinking(UNDESD, 2006).Huckle(1999:38) asserts that "critical education for

sustainability is not based on a single preferred construction of sustainability, but rather it is a process of critical reflection and action on those forms of technology and social organisation that allow us to live sustainably with one another and the rest of nature" (in Loubser, 2006:116). However, we must recognize here that "many influential people in political, economic, social and educational arenas still have little or no interest in or awareness of sustainability issues, or the potential of education to address them", (Huckle et al 1996:19).

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) are designated as the lead agency for the promotion of the Decadeof Education for Sustainable development.The lead agency for promoting the United Nations Decade of Education for Sustainable development (UNDESD, 2005-2014), has emphasized that "there is an urgent need to re-examine the nature and structure of schooling in a more critical way to address education for sustainable development"(UNESCO, 2005:59). Integrated approaches to Science on Education for Sustainable Development have much to offer as they respond to needs and sustainability issues and ensure relevance and real-life contexts for Science learning(UNESCO, 2005). Much of the curriculum in Zambia has been shaped and reshaped over a number of times for various reasons but without much change towards 'environmental' concerns. Beyond doubt, a serious reorganization of the school curriculum to mainstream environmental sustainability issues is needed.

1.3 Problem Statement

Like any social activity, education goes through phases of change fundamentally affecting how it operates. Priorities for change may be intrinsic as new ways of doing things are sought in response to some perceived need of practitioners or may be extrinsic as society imposes content, methods or structure that it perceives will 'improve' education. On page 56 of the 1996Policy Document on Education,the Policy expounds education for responsible citizenship; it emphasizes, inter alia, the school system to produce individuals with knowledge and appreciation of values for human liberties, human rights and awareness of their responsibility to themselves, to others and to society in general(Ministry of Education,1996).It further places emphasis on the production of a learner who is capable of "participating in the preservation of the ecosystem in one's immediate and distant environments"(Ministry of Education, 1996:5). Most certainly, there isclear

emphasis in this Policy Document on the need for the school system to produce citizens with individual responsibility towards environmental sustainability issues including the natural environment. Despite these goals being consistent with the Tbilisi Declaration(UNESCO, 1978) they seem to be advisory only and are neither enforceable nor accountable in science education curriculum.As a result there is still resistance anda drag to implementing environmental education resulting in science education practices being static. It is for the same reason that there is a declining state of the ecological and social environment and declining student interest in studying traditional science subjects. Itis time to reconsider the integration of environmental sustainability issues in the science education curriculum.Gough (2002) suggests thatif we are to achieve sustainable development, then science education must have a role in encouraging ecological thinking.

The researcher appreciated the current revision of the curriculum, particularly the junior science education curriculum;however, the extent of integration of environmental sustainability issues in the revised curriculum had not been clarified or documented anywhere in Zambia. This constitutes a problem because if environmental sustainability issues are not integrated the school system would continue to producelearners without individual responsibility for the 'environment' ("sustainability illiterate" learners). Currently, signs of environmental sustainability illiteracy are vividly indicated by the state of our streets; unabated deforestation due to charcoal burning and timber logging; the dirt in the cities and the depletion of wildlife stocks as well as hunger in most parts of the country. The concern of this research is that the MESVTEEshould reorient the education system to incorporate environmental sustainability issues of Agenda 21 in the school curriculum so that the school system produces learners with individual responsibility across all four dimensions of the 'environment', that is; political responsibility, economic responsibility, social responsibility and ecological responsibility to help solve the above mentioned problems. It is against this background that this study sought to establish the extent to which environmental sustainability issues had been integrated in the 2013 revised science education curriculum at junior secondary level in Zambia.

1.4 Purpose of the Study

The purpose of this study was to establish the extent to which environmental sustainability issues as defined by Agenda 21 (section I and II) had been integrated in the 2013 revised science education curriculum at junior secondary school level (Grades 8 & 9) in Zambia.

1.5 Specific Objectives

Effortto try and determine the extent to which environmental sustainability issues had been integrated in the science curriculum was done in view of the following objectives:

1. To examine the existing content in the 2013 science education curriculum in terms of incorporation of environmental sustainability issues of Agenda 21;
2. To establish knowledge of Environmental Sustainability Issues (ESI) among selected secondary school teachers, pupils and school managers in Central Province;
3. To determine teaching methods provided in the 2013 revised science education curriculum;
4. To determine benefits of incorporating environmental sustainability issues of Agenda 21 in the Zambian science education curriculum.

1.6 Main Research Question

What is the extent to whichenvironmental sustainability issues of Agenda 21 are addressed in the revisedZambian science education curriculum of 2013?

1.7 Specific Research Questions

The study sought to answer the following specific questions:

1. How had the existing content of the 2013 science education curriculum incorporated environmental sustainability issues of Agenda 21?
2. What knowledge didstakeholders and pupils of selected secondary schools in Central Province have on Environmental Sustainability Issues (ESI)?
3. What teaching methods had been provided in the 2013 revised science education curriculum?
4. What was the benefit of incorporating environmental sustainability issues of Agenda 21 in the science education curriculum?

1.8 Significance of the Study

This study may help curriculum developers and policy makers in future to plan curricular reforms of new policies more cautiously, taking into consideration international agreements, technology, social, political, economic and environmental concerns. This study may also help to provide a basis for potential partners and faith organisations to work with science teachers in attaining environmental sustainability at school, society and national level. The findings of this study may also contribute to the existing body of knowledge. It may also help fill gaps aboutthe knowledge on environmental sustainability issues and its integration in the science education curriculum.

1.9 Limitations of the Study

The study focused only on stakeholders and pupils in Central Province and on the information that was obtained through interviews and questionnaires. The research also focused on information from experts at CDC and review of curriculum documents such as the framework, syllabi for both integrated science and agricultural science and the policy document on education. Therefore, the findings of this study may not be a true representative of all other provinces in Zambia.

1.10 Delimitations

The study was conducted in selected secondary schools in Central Province. Six secondary schools were targeted. These included five secondary schools within the province (one pilot school) andthe sixth was outside Central Province (pilot school-Lusaka Province). Curriculum expertswere also targeted for this study.

1.11 Operational definitions of terms

Stakeholders	Refers to school managers, Head of department, and teachers
Junior secondary school level	Refers to Grades 8 and 9
Education for sustainability	Refers to Environmental education
Pupils	Refers to learners

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

The Zambian education system needs to incorporateenvironmental sustainability issues of Agenda 21 in the school curriculum so that the school system produces pupils with individual responsibility across all four dimensions of the 'environment', that is; political responsibility, economic responsibility, social responsibility and ecological responsibility.

Imagine how the world would be, if each one of us, individually, learners inclusive, were ecologically responsible, politically responsible, socially responsible and economically responsible. If each one of us was literate about environmental sustainability issues and made sure we did not carelessly pollute the rivers with chemicals, pollute and over-fish our oceans, rivers and lakes, if we did not cause trees to be cut down carelessly for timber damaging forests and woodlands through logging and agricultural clearing, if we made sure we did not damage prime agricultural and cultivated land through the use of unsustainable farming practices or polluted the air we breathe by using so much of environmentally unfriendly fuels. It would be a very different world from the one we see around us today, in which our environment is subjected to continual degradation because of our individual and collective reluctance to take responsibility. With environmental sustainability issues in the school curriculum learners would graduate with individual responsibility and consciousness in all the dimensions of the 'environment'. Once learners act with individual responsibility, they could turn to the world of industry and commerce, society, and work to promote the ideas of Community Ecological Responsibility (CER), and to governments and nations to promote the ideas of Global Environmental Responsibility (GER).

Deforestation is a major problem in Zambia, with deforestation rates being as high as between 250,000 to 300,000 hectares per year (ILUA 2005-2008). The main causes of deforestation include; i) charcoal and wood fuel use (for domestic, commercial and industrial uses); ii) timber production; and iii) unsustainable agricultural methods and other land use practices, primarily, shifting cultivation, such as the 'Chitemene' system (UN REDD)REDD - Reducing Emissions from Deforestation and

Degradation , Readiness Programme, (National Programme Document Zambia, 2010). Alarming rates of deforestation of such magnitude as these mentioned above calls for both individual and collective responsibility to arrest the situation. The Ministry of Education launched a new basic Education curriculum in 2003 which is more in line with the national and community aspirations. The curriculum, at the basic education level has had long standing problems such as being overloaded, highly compartmentalized, examination oriented and not attuned to the needs of the Zambian people. Thus there is need for environmental sustainability issues to be incorporated in the science education curriculum to encourage environmental awareness and responsibility towards the 'environment'.

2.1 Environmental Sustainability issues and the education curriculum

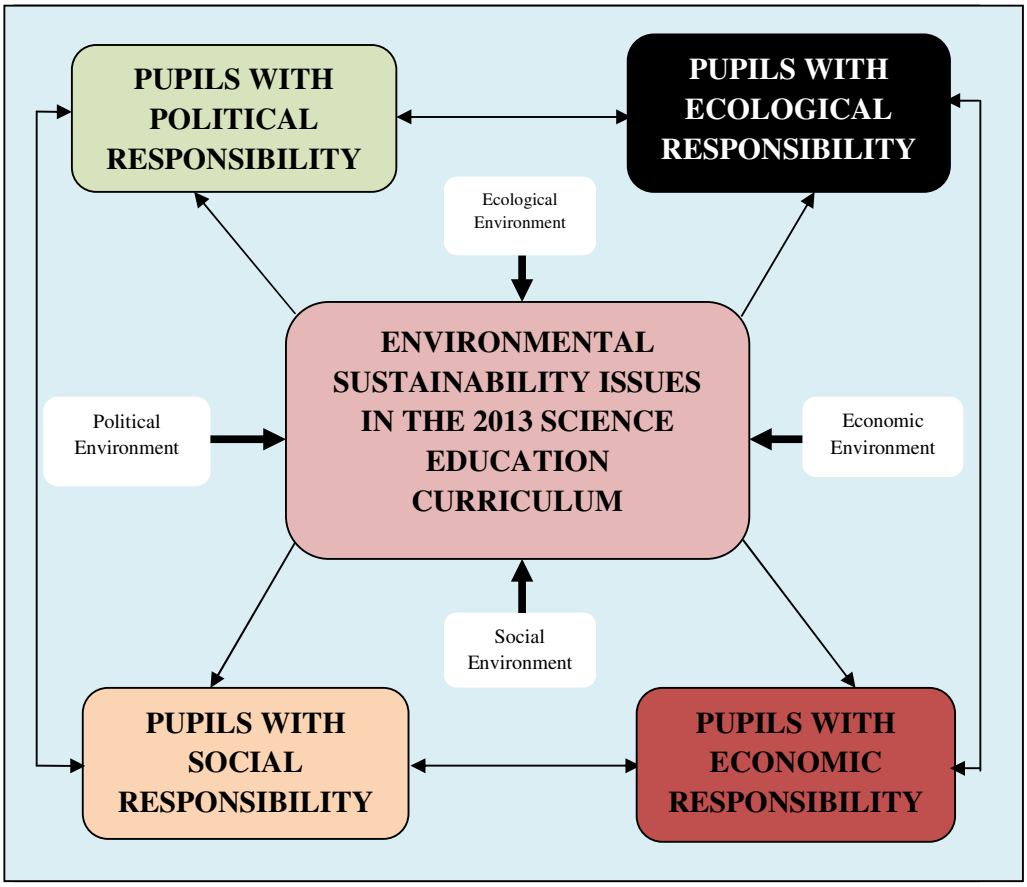


Figure 1: A proposed model of IntegratingEnvironmental Sustainability Issues in the Science Education Curriculum.

Integrating environmental learning into main stream education is an important counter measure to address the challenges to the sustainability of the earth and children's integrated development (Baohua, 2009). To adequately address the social

and environmental problems, we currently face, a new way of educating our learners is required; one that empowers them with the capabilities and skills to seek out and examine their own frameworks for thinking. The new way is sustainability education(integration of environmental sustainability issues in the curriculum).Sustainability changes the skills and competencies of learners, and subsequently differs from traditional approaches to educationin its structure, content and pedagogy. As sustainability is needed, it brings with it theneed to change educational approaches, as discussed by the work of Sterling (2001),Fien et al. 2004, and Holdsworth et al, 2008. Not just infusing issues in different subjects or curricular but as an inter-disciplinary course. SMEEC (1973) indicated that thesolution to environmental challenges is not an add-on class in sustainability, environmental science, social theoryor business ethics, but an "interdisciplinary study" [that would] permeate all areas of thecurriculum, kindergarten to grade twelve and beyondHoldsworth et al(2008).Fien(2001)in Holdsworth et al (2008)considered that education should provide learnerswith an understanding of theworld, the ability to reason, and the growth of character and personality; it needs to beincorporated into daily activities in an inter-disciplinary and inter-cultural setting. This change can only be achieved through changes tothe science education curriculum (Fien, 2001).

The extent to which there is a problem and the degree to which we (individually or collectively) can do something about it, are linked by our perspectives on nature and by our ideological disposition towards socio-economic (and hence environmental) issues, in other words, by our social construction of reality. Hamm and Muttagi (1998:2) in their book on sustainable development and the future of cities, put it like this:

> *Sustainability is not a concept referring to some static paradise, but rather a capacity of human beings to continuously adapt to their non-human environments by means of social organisation.Hamm et al 1998 :2made a crucial distinction, however that: "Sustainable development is essentially not about the environment, but rather about the capacity of human society to enact permanent reform in order to safeguard the delicate balance between humans and their natural life-support system." Therefore, there is need for the country to develop an enlightened citizenry who love care for themselves as they do for the "environment".*

Harvey (1976) said much the same thing in his PhD thesis:

> *Environmental Education is the process of developing an environmentally literate, competent, and dedicated citizenry which actively strives to resolve values, conflicts in the human-environment relationship, in a manner which is ecologically and humanistically sound, in order to reach the superordinate goal of a homeostasis between quality of life and quality of environment.*

Different people have different views on what counts to be an environmental issue. These views are influenced by available information, emotions, economic interest, culture, education, and many other factors (O'Donoghue, 1995).
O' Donoghue emphasizes the relationship amongst the four different dimensions; ecological, economic, social and political. He encourages people to look at environment from all perspectives responsibly.

Education for sustainable development has come to be seen by the world as a process of learning how to make decisions that consider the long-term future of the economy, ecology and equity of all communities. This represents a new vision of education, a vision that helps people of all ages better understand the world in which they live, addressing the complexity and interconnectedness of problems such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, health, conflict and the violation of human rights that threaten our future.

This vision of education emphasizes a holistic, interdisciplinary approach to developing the knowledge and skills needed for a sustainable future as well as changes in values, behaviour, and lifestyles, Draft framework for the Decade of Education for Sustainable Development(UNESCO, 2003) in Huckle(2006). It involves learning how to make decisions that balance and integrate the long-term future of the economy, the natural environment and the well-being of communities, near and far, now and in the future(Extracts from the report of the 19th Special Session of the General Assembly of the United Nations (June, 1997) A/S-19/29, paragraphs 105-106). The core themes of education for sustainable development (sustainability) include lifelong learning, interdisciplinary education partnerships, multicultural education and empowerment. In doing so it takes into consideration the social, economic, and environmental contexts of a particular place and shapes the curriculum or program to reflect these unique conditions (Extracts from the report of

the 19th Special Session of the General Assembly of the United Nations (June 1997) A/S-19/29, paragraphs 105-106).

2.2 The need for environmental sustainability issues in education curriculum in Zambia.

Multiple perspectives examine the way different groups view and use ideas about sustainability in order to focus on widely different learning and/or on social goals, and explore different ideas about whether social and ecological unsustainability can be cured by contemporary society, or rectified by means of appropriate learning (Scott, 2008). The natural resources , the biosphere, the earth's raw materials, and solar energy, is transformed through science and technology into built and human possessions (tools, machines, processed materials, and human skills and know-how), and then through the political economy into consumer goods, communications, education, transport, health, wealth, and the like (Scott, 2008). Therefore the need for environmental sustainability issues in science education curriculum in Zambia is imperative if we are totransform our vast natural resources responsibly and sustainably. As stated earlier integrated approaches to Science on Education for Sustainable Development have much to offer as they respond to needs and sustainability issues and ensure relevance and real-life contexts for Science learning (UNESCO, 2005). With sustainability issues in the science curriculum the country is assured of producing learners who are equipped with the knowledge and responsibility on how to transform the country's natural resource without destroying the environmental. Learning becomes useful and knowledge acquired then becomes meaningful to real life situation.

2.3 Zambia's Position Regarding Environmental Sustainability Issues

2.4.1 Southern African Region

At this level, environmental education is organised through the Southern African Development Community Regional Environmental Education Programme (SADC REEP). This started as the SADC Energy and Land Management Systems (ELMS). SADC REEP runs EE courses and production of EE materials of which Zambia is a beneficially.

2.4.2 Zambian level

At the local level this has been organised through the following programmes:

1. WWF ZEP. This started as The Zambia Environmental Education Project (ZEEP) in 1989 to do the following:
    a. to address Zambia's need for a comprehensive E E Programme as identified in the National Conservation Strategy of 1985.
    b. to contribute to the achievement of WWF's global Conservation objectives.
2. Chalimbana (National In-Service Teachers' College - NISTICOL). The following have been some of the activities that NISTICOL has been involved in:
    a. production of EE materials.
    b. development and delivery of an In-Service Module 5 in EE to the basic school teachers who wish to up-grade their professional qualification from Teachers' Certificate to Basic School Teachers' Diploma.
3. Mufulira College of Education. The following were some of the EE activities by the EE project in Mufulira:
    a. development and delivery of a pre-service EE course component module for the basic school colleges of education in Zambia.
    b. development of basic school lesson guides in EE.
4. Livingstone Environmental Education Project. This project has been involved in the development of the School Environmental Policy (SEP).
5. Serenje Environmental Education Project has been involved in greening of basic schools and planting of trees.
6. Zambia Network of Environmental Educators and Practitioners (ZANEEP). This was launched on 14th December 2002 and its secretariat is found at Environmental Council of Zambia in Lusaka. In 2011 the council was renamed; Zambia Environmental Management Agency. It coordinates all the EE activities in Zambia
7. Sefula EE Centre,(MTENR, 2005)

2.4.3 Global concern on environmental sustainability and education curriculum

In mid-2007, on the west coast of Australia, the World Conference on Science and Technology Education released its Perth Declaration on Science and Technology Education where participants committed themselves to ensuring that learners are scientificallyand technologically literate and able to contribute to sustainable, responsible, globaldevelopment in their respective nations. There was no

acknowledgement that scienceeducation's lack of incorporation of environmental or sustainability education might be linkedto the "global decline in the level of interest in science" Australian Science TeachersAssociation (ASTA) (2007) cited in Gough, (2008).About the closest acknowledgement of something that might hint at this deficiency is in the last key reason for the global decline noted by the Australian Science Teachers Association in its media release on the Declaration, that is, "Perceived lack of relevancy of modern science curricula resulting in student disengagement" ASTA (2007) cited in Gough, (2008). In the Declaration itself this is phrased differently, as "a widespread lack of student interest in current school science and technology education and of its relevance to them" World Conference on Science and Technology Education [WCSTE](2007). What we do know from numerous surveys and research studies is that learners are interested in the environment, yet this is generally not reflected in science curricula in schools they noted,Australian Science TeachersAssociation[ASTA] 2007 cited in Gough, (2008).

Gough comments that none of the actions for governments around the world included in the Perth Declaration addressed the bringing together of science education and environmental or sustainability education beyond:

• Promoting critical awareness of the contribution of science and technology to personal, social, economic and environmental wellbeing through building partnerships with national stakeholders and the media.

• Calling on UNESCO to integrate its science and technology education endeavour as fundamental to achieving educational, environmental, cultural, social and sustainable development goals" WCSTE 2007 cited in Gough, 2008. The only curriculum action was to initiate revisions of the curriculum for school science and technology that will increase student interest in and recognition of the roles of science and technology in society[WCSTE](2007)cited in Gough, (2008).

One of the programme areas of Agenda 21 chapter 36 part (a) talks about re - orienting education towards sustainable development. Reorient the curricula**:** From pre-school to university, education must be rethought and reformed to be a vehicle of knowledge, thought patterns and values needed to build a sustainable world (UNESCO, 2009). Agenda 21 provides a comprehensive plan of action to be taken globally, nationally and locally by UN agencies, governments and major organizations (NGOs, CSOs and networks) to reduce the human impact on the

environment (UNESCO, 2009). This was a call made at the Rio conference to all states to reorganise the education system to promote and improve the quality of education. The aim is to refocus lifelong education on the acquisition of knowledge, skills and values needed by citizens to improve their quality of life. This international agreement developed a strategy for addressing sustainable development throughout the world by calling for increase community participation in addressing environmental, social, political and economic concerns that affect their community. Although there was much debate about approaches for sustainable development, there was near universal support for the need to provide improved educational opportunities for students that allows them to develop valuable life skills such as communication and critical thinking. The importance of providing students with opportunities to develop these skills is a valuable component in educational reform. By developing a curriculum that stresses interaction and inquiry with the human and natural resources of a community, it is possible to develop the skills which students will need to address future concerns. This call was later reaffirmed by a Strategy of Education for Sustainable Development in Sub-Saharan Africa which was developed in 2006 (UNESCO2006 a). The strategy encourages states to adopt policies and practices to ensure the mainstreaming of education for sustainable development (ESD) in education.

However mainstreaming education for sustainable development requires developing, revising, reorganizing and adapting curriculum and learning materials for teachers and learners. As curriculum re-orientation takes root, it is the content, the methods and organization which must receive the greatest attention (Kelly 1999). These aspects embrace meaningful change in the curriculum leading to its enrichment and being made more relevant to the needs and aspirations of the individual and society. Education reform has the potential to include the world's youth on many facets of sustainable development, and to give them the tools necessary to overcome many of the challenges faced in the future.

Youths may play an important role in meeting the objectives of Agenda 21. Agenda 21 looked at youth's vital role in the realization of sustainable development, focusing on their right to receive a secondary education that is innovative and aimed at building practical problem solving skills (United Nations 1992).

Countries were encouraged to incorporate sustainability issues in the school curriculum to help youths develop problem solving skills. Environmentally related topics are included in Sri Lankan schools as part of the school curriculum. Palmer (1998) indicates that environmental related topics are included in subjects such as agriculture science, science, social studies and English language. The need to protect both plants and wild life are emphasized. An emphasis is also placed on the relationship between various species: human, animal and other forms of life (Palmer 1998). At higher education environmental topics are included in the curriculum in 'principles of education', 'population education' and studies on the 'family in environmental development', to mention a few (Palmer 1998:215).

In 1987 Uganda had a major curriculum reform in the primary science syllabus. In this particular review, some aspects of environmental topics were incorporated into the curriculum and are being taught to about 3-6 million children. Similarly, more and more environmental topics are being integrated in the curriculum and other subjects (Palmer 1998). A continuation of these low- key efforts exerted at the primary level of education is systematically being emulated at the secondary and tertiary institution.

2.4 Integration of environmental sustainability issues in Southern Africa

2.5.1 Environmental sustainability issues in Swaziland

Swaziland has, for a number of years, been implementing environmental education policies in both formal and non-formal education sectors. It has also well-developed policies for other ESD related issues such as population and HIV and AIDS education. A case study of progress in Swaziland was presented by Dr Irma Allen, illustrating that progress in ESD is not only confined to formal education, but should reach beyond the mainstream education. Efforts to include ESD training in a range of different sectors are under way. It has not, as yet, developed a national ESD strategy, but ESD is being discussed at national level (UNESCO, 2006).

2.5.2 Environmental sustainability issues in Zimbabwe

Zimbabwe has developed various policies on education for sustainable development priorities such as an environmental education policy and an HIV and AIDS policy. Zimbabwe participated in the ESD consultation process of the SADC REEP in 2005. This country has now begun the formal process of integrating these diverse focus

areas under the auspices of ESD and a national consultation was hosted by the Ministry of Education to consider the implications of the ESD for Zimbabwe. The workshop discussed ESD and existing initiatives, ESD and future initiatives, national priority sustainable development issues, and opportunities for mainstreaming ESD. The meeting also established a draft vision and mission and a National ESD Forum and task force, to be chaired by the Ministry of Education, to take the process further (UNESCO, 2006).

2.5.3 Environmental Sustainability issues in Mozambique

Mozambique has recently undertaken a process of curriculum reform after 20 years without curriculum change. The new curriculum is focussed on addressing the needs of society and it introduces new subjects and innovations. For example, bilingualism has been introduced in teaching (Portuguese and own language), and mother tongue instruction is encouraged up to Grade 3. Civic education has been introduced as a subject which addresses issues of human rights, religious diversity, culture, democracy, moral and civic education. A key innovation has been the introduction of 20% local curriculum content, which is decided upon by the school community. Secondary school reforms are now underway, and initiatives are being developed to support vocational education and training through a process of reforming technical and professional teaching. No national ESD strategy has been developed as yet (UNESCO, 2006b).

2.5.4 Environmental Sustainability issues in Angola

Angola, like Mozambique, is undergoing a process of social reconstruction following years of war. Curriculum reform initiatives are being implemented. There are a number of NGOs and other groups, including the Ministry of Environment, which are promoting ESD practices in various ways. Angola hosted a national multi-stakeholder ESD workshop under the auspices of the SADC REEP in 2005. No national ESD strategy has been developed as yet. The national curriculum allows for contextual applications of content. Angola is also implementing a policy that allows for use of local languages in teaching (UNESCO, 2006a).

2.5.5 Environmental Sustainability issues in South Africa

The of environmental affairs and tourism and the environmental education association of southern Africa(EEASA) decided to start a process to establish Environmental Education in the formal set up. As a result, a number of formal

educationists gathered in 1993 to launch the process, which soon became known as the environmental education policy initiativePalmer 1998:206. Eventually, at a workshop held at Dikhololo near Brits in August 1993, the idea of including environmental education in formal education was discussed by leaders of all the major agencies involved. These agencies included all the education departments of the education system at the time (17 in total) (Palmer 1998). Members of the working committee ensured that environmental education was mentioned in the document on the reconstruction and development programme (RDP) (ANC, 1993), as well as the ANC discussion document on education 1994, and finally in the White paper on education South Africa, (1995a:18) in (Palmer 1995). Prior to 1995 environmental education had merely been mentioned in passing as a possible cross – curricular theme in the curriculum (Palmer, 1995). At present, negotiations are on to determine the exact role and place for environmental education in the formal curriculum. A cross – curricular approach seems to be favoured, (Palmer 1995). It is clear then that South Africa has been implementing a number of projects and initiatives that address ESD goals such as environmental education (through the National Environmental Education Project), population and HIV and AIDS education, human rights education and policies exist to guide inclusivity, HIV and AIDS education and the incorporation of local languages into the education system. The new National Curriculum Statement is oriented towards sustainable development and considers the relationships between human rights, social justice, inclusivity, and a healthy environment. Indigenous knowledge has also been incorporated into the curriculum. It has a number of universities that offer post-graduate training in ESD related courses. The National Skills Development Strategy has not yet integrated ESD appropriately into the training system. The Department of Education, in partnership with the SADC REEP hosted a national ESD consultation in 2005. Work has started on the development of a national ESD Strategy, and a draft of this Strategy has been produced for further internal consideration in the DoE (UNESCO, 2006).

2.5.6 Environmental Sustainability issues in Namibia

Namibia has been implementing a number of projects and initiatives that address sustainable development issues such as environmental education (through the Supporting Environmental Education in Namibia (SEEN) Project) and population education projects. Namibia has an HIV and AIDS education policy and is

implementing various HIV and AIDS education programmes. Through the SEEN project Namibia developed a model to support ESD through whole school development and through curriculum implementation. Namibia has also developed an ESD training programme for non-formal education, and there are a wide range of stakeholders working on ESD type education activities. Namibia also hosted a national ESD consultative workshop under the auspices of the SADC REEP in 2005. No national ESD strategy has been developed as yet, but there is some co-ordination of ESD type priorities through the NIED (UNESCO, 2006).

2.5.7 Environmental Sustainability issues in Lesotho

Lesotho has been implementing a number of projects and initiatives that address education for sustainable development goals such as environmental education (through the Lesotho Environmental Education Support Project), and the Population/Family Life Education Project. A mechanism for co-ordinating these initiatives exists in the National Curriculum Development Centre. Other government departments are actively supporting ESD priorities. A national consultation was held under the auspices of the SADC REEP's 'bottom up' consultation process in 2005. No national ESD strategy has been developed as yet (UNESCO, 2006b).

2.5.8 Environmental Sustainability issues in Botswana

Botswana has incorporated environmental education and other sustainability issues such as HIV and AIDS education into its revised national policy on Education 1994, and into its Vision 2016. It has adopted an infusion model to ensure that sustainability issues (such as environment, human rights etc.) are incorporated (UNESCO, 2006).

2.5 Environmental sustainability issues in Zambia's curriculum

Generally, Zambia's curriculum policy supports 20% local context/content to be implemented by schools and teachers. This provides an opportunity for ESD priorities to be included in mainstream curriculum interventions. Teacher education colleges have introduced a compulsory module on environmental education in all colleges. Zambia has policies and programmes in place to address other sustainability issues such as HIV and AIDS. A national consultation on ESD was held under the auspices of the Environmental Council of Zambia then and the SADC REEP in 2005. However no national ESD strategy has been developed as yet (UNESCO, 2006). This picture does not indicate the extent to which environmental

sustainability issues have been incorporated in the science education curriculum at junior secondary level or how these can be incorporated by schools.

In Zambia a study was carried out in by Kasaji (2012) on the topic ‘‘Relevance of the Upper Basic School Curriculum to the Life Experiences of Learners’’ in Lusaka district in 2012 and among the findings were the following; that the time allocated to practical subjects was not enough and that practical subjects should be compulsory. The study also mentioned that schools needed more teaching and learning materials. The research further proposed the introduction of ICT in upper basic schools. The comment on environmental science was that it was relevant for the appreciation of nature and for national development and concluded by saying that most of the subjects were relevant to the life experience of learners. Among the recommendations were the following that the Ministry of education should comprehensively review and revise the upper basic school curriculum in order to come up with one which best suits the Zambian situation. The study recommended for the localization of the curriculum and the provision of equipment to facilitate implementation of all curriculum subjects. However, the research was very silent on the inclusion of environmental sustainability issues in the curriculum, including environmental education thus providing a gap for this research.

Another research was carried out by Kamocha (2011) on “A proposed sustainability curriculum to address effects of shifting cultivation on school going children of Kasempa District in Zambia’’. The research revealed that the act of shifting cultivation was perpetuated in the quest for fertile soil due to lack of money to purchase fertilizer. It also revealed that the practice was part of their culture. Furthermore, the study revealed that shifting cultivation affected the school going children by reducing on enrolment, increasing on absenteeism, raising the levels of dropouts and that the practice lead to children covering long distances. The research did not acknowledge that the lack of ecological responsibility and knowledge about the environment was also a reason to the problem of shifting cultivation. Consequently, shifting cultivation leads to reduced enrolment, increasing absenteeism, high levels of dropouts and children covering long distances. In one of the recommendations to the Ministry of Education the study indicated that there was need to promote environmental education in schools to reduce the ignorance about

the effects of shifting cultivation practice both on the environment and education. I commend this realization. However, the study was not clear whether to include environmental education in the science curriculum or as a stand-alone subject creating room for this study. Education has been seen as a critical tool in the transformation towards sustainability (UNESCO,2005; Huckle and Sterling, 1996).

Yet another research was conducted in Zambia by Santambo (2010) on the ‘‘Effects of the Subject Integrated Curriculum in Basic Colleges of Education on Quality Education’’ at Solwezi college of education. The research brought out issues about the grouping of subjects into learning areas and was observed that this can help to reduce the number of teachers required per school because few teachers can run the whole school curriculum. However, differentiated curriculum was found to be unsuitable for the age of the learners. Integrated science constituted contributory subjects such as environmental science and agriculture science. Except for the format of mathematics and social spiritual and moral education study areas, it was discovered that the rest did not correspond with the format found in the lower middle/basic schools (Santambo , 2010). This implies that the curriculum offered at Solwezi College of Education did not match with that of the needs of the middle basic schools. The study looked at the effects of a subject integrated curriculum on quality of education. The study was conducted on an integrated curriculum at college level. However, this research looked at the extent to which environmental sustainability issues of Agenda 21 had been integrated in the revised science education curriculum at junior secondary level.

The general impression in Zambia is that, though the country’s curriculum policy is believed to support 20% local context /content to be implemented by schools and teachers, the extent of integration of environmental sustainability issues in the science education curriculum at junior secondary is not known. Furthermore, Zambia has not fully integrated sustainability issues both in the mainstream curriculum and science education curriculum. There is less emphasis on environmental sustainability issues in the science curriculum at junior secondary as compared to primary school curriculum.At primary school, the 1996 policy document on education proposes a curriculum for Grades 1-7 which comprises a number of full subjects together with modules on important sustainability issues and areas that can be offered either

independently or within the framework of an appropriate subject (Ministry of Education, 1996).A cross-cutting issue is never treated as an examinable subject matter and because it is not examined, it is not taught by teachers, many of whom consider the subject as an extra-curricular activity for which they demand to be paid an extra allowance. As a result it is not taught in enough depth and detail but merely glossed over. Therefore teachers, policy-makers and pupils cannot appreciate the full benefits and strength of sustainability education in our changing world.

Taking into consideration the above aspects, this research sought to establish the extent of integration of environmental sustainability issues as defined in agenda 21, the UN's action plan on sustainable development in Zambia 's revised science curriculum of 2013 at junior secondary school level.

2.6 Link between environmental sustainabilityand quality(Issues)

Science education's lack of incorporation of environmental or sustainability education might be linkedto the "global decline in the level of interest in science" and consequently responsibility for the environment(Ahmedabad conference, 2007). The call worldwide is that education must be rethought and reformed to be a vehicle of knowledge, thought patterns, values and skills needed to build a sustainable world. The enlightenment paradigm is based on the ideas that progress is rooted in science and reason, and that science and reason can unravel the mysteries of nature. It encourages us to 'know' nature in order to use, transform and consume it for our insatiable needs (Ahmedabad conference, 2007). As a result of environmental changes, today, science needs to be integrated to be able to create, transform and apply knowledge in all spheres and at all levels to transform societies towards 'environmental' sustainability through responsible action.

2.8 Review of relevant documents

Formulation of the Zambia Education Curriculum Framework is based on the many policy documents that are in existence in the country of which some are law, policy guidelines, official directives and circulars as well as international agreements. The 1966 Education Act paved a way for a number of curriculum reforms which saw the teaching of Agricultural science come into reality. Another reform was the teaching of science in a practical manner (Ministry of Education, 2013).

2.8.1 National Policy on Education; Educating Our Future (Ministry of Education 1996)

The current national policy on education, Ministry of Education (1996) recognises the primacy of integral development (in the education of the child, teacher and society at large) of values inherent in physical, emotional, rational, aesthetic, ethical and spiritual wellbeing for all. Further, the policy notes unreservedly, that there cannot be quality education without the availability and use of textbooks and other educational materials Ministry of Education, (1996). 'Although considerable improvements have been made in recent years in the provision of educational materials, these still remain critically short in many schools' (Ministry of Education, 1996:40). The policy and strategic frameworks earlier alluded to notably the curriculum framework (2013) and the Strategic Framework for implementation of Education for All (EFA) 2005 testifies to that fact. Additionally, data collected from interviews and questionnaires also show virtually, the extent of non-availability of teaching and learning materials.

The policy desires producing a learner capable of developing an analytical, innovative, creative and constructive mind. Further, the policy is concerned about producing a learner capable of appreciating the relationship between scientific thought, action and technology on the one hand, and sustenance of the quality of life on the other. The policy places emphasis on the production of a learner who is capable of 'participating in the preservation of the ecosystems in one's immediate and distant environments and rationalizing resource mobilization and utilization' (Ministry of Education, 1996:5). The national action plan also sounded the need for holistic teaching of environmental education.

Further the policy endeavours to promote the development of a curriculum that is comprehensive, balanced, integrated, diversified and relevant to the real needs of both the learner and society, a curriculum that will provide a learner with knowledge and appreciation of the social, cultural and physical environment.

Furthermore, the policy clearly spells out the fact that 'the curriculum should not be unduly fragmented or overloaded', hence, several areas and issues, instead of being offered as independent subjects, will be integrated across the curriculum, (Ministry of Education, 1996:32).

To ensure comprehensive and flexible coverage while avoiding overload, the policy pledges the curriculum for Grades 8 and 9 to comprise a number of full subjects together with modules on important issues and areas that can be offered either independently or within the framework of an appropriate subject. It also proposes that the science syllabus, for all schools, should contain a core of environmental science, dealing with issues that are relevant to pupils in every part of Zambia. However, modules may possibly not be used thus making the process of integration a better option for important issues.

2.8.2 Curriculum Framework

The 2013 Curriculum Framework acknowledges keeping the curriculum up to date by reviewing it every ten (10) years. This is in order to respond to change drivers which include political, economic, social, technological, ecological as well as legal factors (Ministry of Education, 2013). Ministry of Education, (2013) recognises the fact that quality education requires the availability and use of educational materials which are currently not available in secondary schools for effective teaching and learning. One of the main objectives of the Fifth National Development plan (FNDP); is to provide relevant educational materials. Ministry of Education, (2013) in addition acknowledges the fact that most of the teaching and learning is done theoretically, even for Practical and Science subjects (Ministry of Education, 2013). Further, the major focus of the new Education Curriculum Framework (Ministry of Education, 2013) is among others to "incorporate current areas of social, economic and technological developments in the curriculum; integrate some subjects with interrelated and similar competences and content into learning areas in a bid to avoid curriculum overload and fragmentation; review the teacher-learner contact time; review the teaching content in all the subjects and learning areas and; incorporate major national concerns (Cross Cutting Issues) in the curriculum", (Ministry of Education, 2013:8). Major national concerns incorporated in the science education curriculum are as outlined under grade 8 and 9 integrated science and agricultural science. Additionally, Ministry of Education (2013) desires to produce a learner who appreciates the relationship between mathematical and scientific thought, action and technology on the one hand and sustenance of the quality of life on the other; and also a learner who participates in the preservation of the ecosystem in one's immediate and distant environments and for future generations. Like the National

Environmental Action Plan (NEAP) (1994), Ministry of Education, (2013) advocates for the learning of environmental education and Education for Sustainable Development (ESD) at all levels of education.

2.8.3 National Environmental Action Plan (NEAP)

The 1994 National Environmental Action Plan (NEAP) advocates for environmental education at all levels of education.

2.8.4 Content for integrated science

First and foremost, the revision of the curriculum had five clear aspects for this category; the number of topics for grade 8 was reduced from 10 to 5, while that for grade 9 was reduced from 9 to 5; new topics were added, others re-arranged and the content of some of the existing topics was highly modified in such a way that they properly addressed current economic, social, cultural and ecological problems. Consequently, 3 and 6 subtopics were newly added to grade 8 and 9 curriculum respectively; 3 subtopics were moved from grade 9 to grade 8 and another 3 from grade 8 to 9. Furthermore, 9 and 8 subtopics for grade 8 and 9 respectively were modified and 2 topics were removed from grade 8 while 1 was removed from grade 9 curriculum. Contact time for agriculture science has beenincreased from six to twelve periods allowing more time for practicals.

Table 1: Major areas in integrated science offered at G8 level

Category A	Title	Status	Methods of teaching suggested
Topic 1	**The human body**		
8TI/1	Human Reproductive System and Puberty	modified	Identify, Explain
88TI/2	Fertilization and Embryo development	old	Describe, Explain
Topic 2	**Health**		
8TII/1	Nutrition	modified	Describe, Identify
Topic 3	**The Environment**		
8TIII/1	Water, Air and Land Pollution	From G9, modified	Identify, Describe, Explain
Topic 4	**Plants and animals**		
8TIV/1	Plant Cells	old	Examine, Describe, Identify
8TIV/2	Plant Growth and Nutrients	Modified	Demonstrate, Investigate, Explain, Identify
8TIV/3	Animal Cell	New	Identify, Describe
Topic 5	**Materials and Energy**		

8TV/1	Composition of Matter	New	Demonstrate, Identify, Describe
8TV/2	Physical Change of State	Modified	State, Identify, Describe
8TV/3	Mixtures	From G9, modified	Explain, Identify
8TV/4	Mass and Weight	New	Measure, Distinguish, Calculate, State
8TV/5	Density	Old	Explain, Describe,
8TV/6	Heat transfer	Modified	Investigate, Describe, Demonstrate
8TV/7	Heat and expansion of substances	Old	Describe, Demonstrate, Explain
8TV/8	Reflection and refraction of Light	From G9, modified	Explain, Describe, Investigate, Identify
8TV/9	Composition of Air	Modified	Describe, Investigate, Identify

Table 2: Major areas in integrated science offered at G9 level

Category A	Title	Status	Suggested Methods
Topic 1	**The human body**		
9TI/1	Circulatory System	From G8, modified	Illustrate, Describe, Identify
9TI/2	Respiratory System	From G8, modified	Demonstrate, Describe, Identify, Explain
Topic 2	**Health**		
9TII/1	Sexually Transmitted Infections (STIs)	New	Describe, Identify, Explain
Topic 3	**The Environment**		
9TIII/1	Cycles in the Biosphere	New	Describe, Identify, Explain
9TIII/2	Water Management	New	Describe
Topic 4	**Plants and animals**		
9TIV/1	Conservation of animals and Plants	Modified	Describe, Identify, Explain
9TIV/2	Photosynthesis	Split, modified	Relate, Identify
9TIV/3	Transpiration	Split, modified	Investigate, Describe, Explain
Topic 5	**Materials and Energy**		
9TV/1	Chemical reaction	New	Classify, Describe, Explain, Demonstrate
9TV/2	Light and its nature	Modified	Describe, Explain, Demonstrate
9TV/3	Electric Current and Voltage	Modified	Describe,

	in Circuit		Explain,Demonstrate
9TV/4	Pressure	New	State, identify
9TV/5	Energy and its conservation	Modified	Describe, Explain, Identify
9TV/6	Communication	Old	Identify, Describe
9TV/7	Digital and Analogue Transmission	New	Identify, Describe
9TV/8	Satellite Communication	Old	Describe, Explain

2.8.5 Content for agriculture science

Table 3: Major areas in agricultural science offered at G8 level

Category B	Title	Status	Methods of teaching suggested
Topic 1	**Agriculture in Zambia**.		
8AI/1	Agriculture practice and industry	Modified	Explain, state, describe
8AI/2	Agricultural activities in Zambia	Modified	Identify, outline,
8AI/3	Factors that influence Agricultural Development	Modified	Identify, Explain
8AI/4	Farmer Support	Modified	Investigate
8AI/5	Types of farmers	Modified	Identify, Explain
Topic 2	**Soil science**		
8AII/1	Soil formation	Modified	Explain, describe
8AII/2	Composition of soil	Modified	Explain, demonstrate
8AII/3	Soil profile	old	Identify, Explain, relate
8AII/4	Soil texture	New	Explain
8AII/5	Types of soil	old	Identify, demonstrate
8AII/6	Organic(manures) and chemical (artificial) fertilisers	Modified	Explain, identify, determine distinguish, interpret
Topic 3	**Crop production**		
8AIII/1	Classes and varieties of vegetables	old	Identify, name
8AIII /2	Site for Vegetable growing	Modified	Explain, list
8AIII/3	Vegetable garden	Modified	Explain, state
8AIII/4	Seedbed preparation	old	Demonstrate
8AIII/5	Planting vegetables	old	Demonstrate
8AIII/6	Weed Control	Modified	Demonstrate, describe, explain, observe
8AIII/7	Pest Control	Modified	Demonstrate, describe, explain
8AIII/8	Disease Control	Modified	Explain, identify
8AIII/9	Harvesting and	Modified	Demonstrate, describe,

	marketing		identify
Topic 4	**Forestry**		
8AIV/1	Importance of trees in soil management	New	Explain, identify
8AIV/2	Selecting a site for growing trees	New	identify
Topic 5	**Conservation farming**		
8AV/1	Mixed cropping	New	Describe, Explain
8AV/2	Inter cropping	New	Describe
8AV/3	Mixed farming	New	Describe, state
8AV/4	Land clearing and preparation	New	Describe, Demonstrate
8AV/5	Chemical fertiliser and manure application	New	apply
8AV/6	Planting and weed control	New	Demonstrate
8AV/7	Soil Erosion Control	New	Demonstrate
Topic 6	**Livestock production**		
8AVI/1	Importance of livestock	old	Describe
8AVI/2	Parts of Digestive systems	Modified	Describe, identify, compare
8AVI/3	Parts of the reproductive systems	Modified	Explain, identify
8AVI/4	Breeds	Modified	List, name
8AVI/5	Brooder house	Modified	List, state
8AVI/6	Incubation of eggs and Brooding	Modified	State, recall
8AVI/7	Pests and diseases	Modified	Explain, identify, prescribe
8AVI/8	Records and Marketing	Modified	Demonstrate
Topic 7	**Farm structure**		
8AVII/1	Storage of vegetables	Modified	Demonstrate, describe
8AVII/2	Poultry houses	Modified	Describe, construct
Topic 8	**Farm Machinery**		
8AVIII/1	Hand tools	old	Demonstrate, identify
8AVIII/2	Sprayer	old	Identify
8AVIII/3	Animal drawn implements	old	Explain, identify
8AVII/4	Storage for farm machinery	Modified	Demonstrate, describe
Topic 9	**Farm management**		
8AIX/1	Farm management	old	Describe
8AIX/2	Agricultural economics	Modified	Describe
8AIX/3	Opportunity cost and production decision	Modified	Describe, explain
8AIX/4	Types of credit	Modified	Describe
8AIX/5	Interest	Modified	Explain

8AIX/6	Records	Modified	Explain
8AIX/7	Enterprise	Modified	Describe, explain
8AIX/8	Grading and Standardisation	Modified	Explain

Table4: Major areas in agricultural science offered at G9 level

Category B	Title	Status	Methods of teaching suggested
Topic 1	**Agriculture in Zambia**		
9AI/1	Agriculture practice and industry	Modified	Identify, investigate
9AI/2	Effects of human population on Agriculture	Modified	Describe, explain
9AI/3	Farming areas in Zambia	Old	Describe,
Topic 2	**Soil Science**		
9AII/1	Characteristics of soils.	Modified	List
9AII/2	Soil structure	Modified	Identify, explain
9AII/3	Plant nutrients	Old	Classify, describe
9AII/4	Manures and ashes	Modified	Explain, investigate, compare
9AII/5	Soil reaction	Modified	Explain, demonstrate
9AII/6	Soil erosion	Modified	Explain, describe
Topic 3	**Crop Production**		
9AIII/1	Importance of the crop	Modified	Investigate, List
9AIII/2	Ecological requirements of the crop	Old	List
9AIII/3	Varieties and propagation	Modified	List, Identify
9AIII/4	Site suitable for the crop	Modified	Identify
9AIII/5	Crop rotation	Old	Explain
9AIII/6	Land preparation	Old	Demonstrate
9AIII/7	Manure and fertiliser application	Modified	Explain
9AIII/8	Sowing and planting materials	Modified	Demonstrate
9AIII/9	Plant population	Modified	determine
9AIII/10	Weed Control	Old	Demonstrate, Explain
9AIII/11	Insect pests	Modified	Identify
9AIII/12	Diseases	Old	Identify, Explain
9AIII/13	Harvesting	Modified	Identify, interpret
9AIII/14	Yield	Modified	State , compare
9AIII/15	Storage	Modified	State, Identify
9AIII/16	Handling and Marketing	Modified	Not given
Topic 4	**Forestry**		
9AIV/1	Soil and water conservation	New	Explain
9AIV/2	Importance of trees in soil management	New	Identify, Explain

Topic 5	**Conservation farming**		
9AIV/3	Tillage	New	Describe
9AIV/4	Land clearing	New	Investigate
9AIV/5	Seedbed preparation	New	Explain
9AIV/6	Sowing and planting	New	Demonstrate
9AIV/7	Manure and chemical fertilisers	New	Demonstrate, Explain
9AIV/8	Weeding	New	State
9AIV/9	Pest Control	New	Demonstrate, Explain
9AIV/10	Crop Rotation in conservation farming	New	Explain
9AIV/11	Manure	New	State, Identify
Topic 6	**Livestock production**		
9AV/ 1	Importance of livestock	Modified	State, analyse
9AV/ 2	Digestive system in live stock	Old	Identify, Explain
9AV/ 3	Rations	Old	Compare, distinguish
9AV/ 4	Conversion ratio	Old	Calculate
9A V/5	Reproductive systems	Old	Describe
9A V/6	Fertility and Characteristics of common breeds	Modified	Identify, list
9A V/7	Livestock improvement	Old	Describe
9A V/8	Management practices on young animals	Old	Observe
9AV/9	Pastures	Modified	Compare, explain
9AV/10	Parasites and diseases	Modified	Describe, identify
9AV/11	Marketing	Modified	Demonstrate
Topic 7	**Farm structures**		
9AVI/1	Storage for grains	Old	Describe, identify
9AVI/2	Storage for fruits	Old	Describe, identify
9AVI/3	Rabbit houses	Modified	List
9AVI/4	Pigsties	Modified	List, Describe
9AVI/5	Goat houses	Modified	List
9AVI/6	Cattle houses	Modified	List
9AVI/7	Drainage pen	Modified	Describe, state
9AVI/8	Concrete mixtures	Modified	State, demonstrate
Topic 8	**Farm Machinery**		
9AVII/1	Power drawn implements for soil preparations	Modified	Identify
9AVII/2	Power drawn implements for sowing/planting	Modified	Describe, Identify
9AVII/3	Storage for farm machinery	Modified	Describe
Topic 9	**Farm Management**		
9AVIII/1	The farm	Modified	Identify, explain
9AVIII/2	Entrepreneurship	New	Describe, explain

2.8.6 Integrated science grade 8

The curriculum analysis showed that five subtopics (accounting for 31.25%) of all the subtopics in grade 8 integrated science carried a section on sustainability issues. Notable ones were health and nutrition, pollution (that is, water, air, land, dust, fumes and smoke), management of waste, garbage, management of effluents from chemical industries and chemical fertilizers as well as untreated sewage. These mainly covered social and ecological issues. Nine subtopics in this sub category were modified, four were retained from the old curriculum and three were newly introduced in the curriculum that is, Animal Cell, Composition of Matter and Mass and Weight.

2.8.7 Integrated science grade 9

The curriculum analysis revealed that six subtopics (accounting for 37.5%) of all the subtopics consisted environmental sustainability issues. Notable of the issues captured were health, HIV/AIDS, balance of nature (carbon, nitrogen and oxygen cycle), water management, plant and animal conservation and energy conservation. Eight subtopics in this subcategory were modified. Two subtopics were retained from the old curriculum while six subtopics were newly introduced in the curriculum. Topics such as population, mammals and the universe were discarded.

2.8. 8Agricultural science grade 8

Agricultural science is an applied science or a technology. As such it was expected to include a number of issues compared to integrated science. The analysis showed that the revision of the curriculum in this category aimed at re-arranging and modifying the topics. All in all thirty one subtopics (accounting for 60.8%) of the total number of subtopic were modified. Ten subtopics were retained from the old curriculum while another ten were newly introduced under the topics; forestry, conservation farming and soil texture

2.8.9 Agricultural science grade 9

The curriculum analysis showed that twenty subtopics (accounting for 39.3%) of the total number of subtopics were modified. Twenty subtopics were newly included while eleven subtopics were retained from the old curriculum.

2.8.10 Integration of sustainability issues

Table 5: Integration of sustainability issues into different topics in integrated science

Issues from agenda 21		Category of topics						Specific topics
Section/ chapter	Issue	TI*	TII*	TIII*	TIV*	TV*	TOTAL	
1/3	Combating poverty	1	0	0	0	0	1	8TII/1***
1/4	Consumption patterns	0	0	0	0	0	0	
1/5&1/7	Population & human settlements	0	0	0	0	0	0	
1/6	human health	1	1	0	0	0	2	8TII/1, 9TI/2, 9TII/1***
1/8	Making decisions for sustainable development	0	0	0	0	1	1	9TIV/1
II/9	Protecting the atmosphere	0	0	1	0	0	1	8TIII/1
II/10 &II/14	Land, agriculture and rural development	0	0	1	1	0	2	8TIV/2, 9TIII/1
II/11& II/12	Combating deforestation, desertification and drought	0	0	0	0	0	0	
II/15	Conservation of biological diversity	0	0	1	1	0	2	9TIII/1, 9TIV/1
II/16	Management of biotechnology	0	0	0	0	0	0	
II/18	Protecting and managing fresh water	0	0	2	0	0	0	8TIII/1, 9TIII/2
II/21	Managing solid waste and sewage	0	0	1	0	0	0	8TIII/1
	Total	1	2	6	2	1		

TI* (Integrated science topic I) The human body

TII* (Integrated science topic II) Health

TIII* (Integrated science topic III) The environment

TIV* (Integrated science topic IV) Plants and animals

TV* (Integrated science topic V) Materials and energy.

8TII/1***: The topics and sub topics as given in Table 7.

9TII/1***: The topics and sub topics as given in Table 8.

Table 6: Integration of sustainability issues into different topics in agricultural science

Issues from agenda 21		Category of topics										Specific topics
Section /chapter	Issue	AI*	AII*	AIII*	AIV*	AV*	AVI*	AVII*	AVIII	AIX*	TOTAL	
1/3	Combating poverty	2	0	0	1	0	0	0	0	0	3	8AI/1*** 8AVI/1, 9AIII//1
1/4	consumption patterns	0	0	0	0	0	0	0	0	0	0	
1/5&1/7	Population & human settlements	1	0	0	0	0	0	0	0	0	1	9AI/2
1/6	human health	0	0	0	0	0	0	0	0	0	0	
1/8	Making decisions for sustainable development	0	0	1	0	0	0	0	0	3	4	8AIX/2, 9AI/1*** 9AIII/16, 9AIX/2
II/9	Protecting the atmosphere	0	0	0	0	0	0	0	0	0	0	
II/10 &II/14	Land, agriculture and rural development	0	1	2	1	5	0	0	0	0	9	8AII/6, 8AIII/3, 8AIII/6, 8AIII/7, 8AIV/1, 8AV/9 8AIV/1,2 9AII/4, 9AIV/2 9AV//1,2 ,5,8
II/11& II/12	Combating deforestation, desertification and drought	0	0	0	1	0	0	0	0	0	1	8AIV/1,2

II/15	Conservation of biological diversity	0	0	0	1	0	1	0	0	0	2	9AIV/19 AVI/1
II/16	Management of biotechnology	0	0	0	0	0	1	0	0	0	1	9AVI/4
II/18	Protecting and managing fresh water	0	0	0	0	0	0	0	0	0	0	
II/21	Managing solid wastes and sewage	0	0	0	0	0	0	0	0	0	0	
	Total	3	1	3	4	5	1	0	0	3		

AI* (Agricultural science topic I) Agriculture in Zambia

AII* (Agricultural science topic II) Soil science

AIII* (Agricultural science topic III) Crop production

AIV* (Agricultural science topic IV) Forestry

AV* (Agricultural science topic V) Conservation farming

AVI* (Agricultural science topic VI) Livestock production

AVII* (Agricultural science topic VII) Farm structure

AVIII* (Agricultural science topic VIII) Farm Machinery

AIX* (Agricultural science topic IX) Farm management

8AI/1*** the topics and sub topicsas given in Table 9

9AI/1*** the topics and sub topics as given in Table 10

Table 7: Delivery methods suggested in integrated science curriculum

s/n	Method	Frequency	%
1	Identify, describe and explain	5	55.5%
2	Identify and describe	1	11.1%
3	Illustrate and relate	1	11.1%
4	Identify, describe, explain, examine, demonstrate and investigate	1	11.1%
5	Identify, describe, explain, demonstrate, distinguish, calculate, measure, investigate, classify and state	1	11.1%
	Total	9	100%

Table 8: Delivery methods suggested in agricultural science curriculum

s/n	Method	Frequency	%
1	Explain, describe, identify, outline, and investigate	2	20%
2	Explain, describe, identify, demonstrate, relate, distinguish, interpret, determine, classify, and investigate.	1	10%
3	Explain, describe, Identify, demonstrate, list, state, observe, calculate and investigate	1	10%
4	Explain, identify and state	1	10%
5	Explain, describe, demonstrate and state	1	10%
6	Explain, describe, identify, demonstrate, compare, list, state, prescribe, analyse, distinguish, and recall	1	10%
7	Describe, demonstrate and construct	1	10%
8	Explain , describe, identify, demonstrate and prepare	1	10%
9	Explain, describe, demonstrate, and prepare	1	10%
	Total	10	100%

A wide-range of teaching/learning methods have been suggested in the 2013 revised science curriculum just as it were in the old curriculum. However, most of these methods are classroom – based. This may pose a challengeto both teachers and learners when teaching sustainability issueswhich are field – based and practice oriented. This calls for the MESVTEEto step up on school based continuing professional development (SBCPD)as well as in- service training for the teaching staff to create innovations in delivery methods to help solve the anticipated problems.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the research design and methodology, population, sampling, data collection, and analysis and measures for ensuring reliability.

Research Design

A research design is a "plan or structured framework of how one intends conducting the research process in order to solve the research problem and to expand knowledge and understanding"Kombo& Tromp, 2006;Orodho, 2003). Kothari (2003) in Kombo and Tromp (2006) defines the research design as the conceptual structure within which research is conducted. It constitutes the blueprint for the collection, measurement and analysis of data.Muzumara (1998)in Chiyongo (2007:93)defines research design as;

> *…the organisation, plan, or procedure by which an investigator intends to answer research questions. The design is also intended to control errors of procedures and interpretation: the structure of the design specifically delimits the kind of observations which can be made, the persons from whom data can be collected, and the kind of analysis it is possible to make within the framework and the form of the data.*

Qualitative and quantitative approaches were applicable to the study. A qualitative approach was employed in order to satisfactorily answer the research questions posed in this study (see section 1.7). According to Leedy and Ormrod (2005: 133) to answer research questions, "we cannot skim across the surface. We must dig deep to get a complete understanding of the phenomenon we are studying. In qualitative research, we do indeed dig deep: we collect numerous forms of data and examine them from various angles to construct a rich and meaningful picture of a complex, multifaceted situation".

A descriptive survey was used as a research design to this study entitled Integration of Environmental Sustainability Issues in the 2013 Science Education Curriculum at Junior Level. A descriptive survey was used because the study aimed at giving a detailed description of the 2013 revised scienceeducation curriculum and because

survey methods allow the researcher to collect data on attitudes and opinions from large numbers of people (Laverne, 1995).

3.1.1 Qualitative research

"Qualitative research is a means of establishing the depth, richness, and difficulty inherent in phenomena"(Burns & Grove, 1999:339). It is concerned with the analysis of ideas and/or words rather than numbers. The qualitative research methodology was chosen to facilitate the systematic collection and analysis of more subjective and narrative material without compromising the researcher's impartial position. More so because qualitative research is appropriate for descriptive studies. It chooses to use researchers as instruments of data collection (Lincoln &Guba, 1981). The qualitative researcher is interested in understanding how things occur and how meanings and interpretations are negotiated with human data because it is participants' realities that the researcher tries to construct (Creswell, 1994).

In general, qualitative research has significant characteristics that distinguish it from quantitativeresearch, namely:

- commitment to discovery through the use of multiple ways of knowing, various methods were used to obtain information.
- commitment to the participants' views, thus using the language of participants to describe the aspects under study. The researcher remained committed to the participants' views during interviews thus using their language to describe the aspects under study during report writing and analysis.
- allowing extensive searching of documents and articles of importance to understand the background ofwhat is under study. The researcher critically examined documents and articles of importance to understand what had been changed in the curriculum.
- acknowledgement of the researcher's participation in the research, thus he/she may be used as adata collection instrument, the researcher was part of the research.
- conveyance of an understanding of aspects of interest by reporting in a literary style, thus allowingfor a narrative approach to writing research findings (Streubert& Carpenter, 1999:9), the researcher described and reported the state of affairs as it existed.

All the above attributes of qualitative research guided the researcher in the present study.

3.1.2 Descriptive research

The major purpose of descriptive research is description of the state of affairs as it exists (Kombo& Tromp, 2006). Kerlinger(1969) in Kombo and Tromp 2006 points out that descriptive studies are not only restricted to fact findings, but may also result in the formulation of important principles of knowledge and solution to significant problems. Description also relates to the logical relationship among categories and processes in the discussion of different categories. Descriptive studies are aimed at making clear characteristics of phenomena Polit&25Hungler 1999:16. Descriptive survey isa method of collecting information by interviewing or administering a questionnaireto a sample of individuals (Orodho, 2003).

In the present study the researcher employed descriptive survey by collecting information using interview schedules and administering questionnaires to participants. The researcher also discussed emerging categories carefully and logically. Further, the descriptive approach was chosen to elucidate the extent of integration of environmental sustainability issues in the 2013 science education curriculum, knowledge about the issues, the teaching methods, teaching and learning resources, benefits as well as challenges.

3.1.3 Population

A population is a group of individuals, objects or items from which samples are taken for measurement. It refers to an entire group of persons or elements that have at least one thing in common. Population also refers to the larger group from which the sample is takenKombo&Tromp, 2006). Bless and Achola(1988) also agree that a population is the entire set of objects and events or group of people which is the object of research and about which the researcher wants to determine some characteristics.

3.1.4 Study sample

Central province comprises of 34 secondary schools with an estimated number of 204 science teachers(CSO, 2010). The respondents for the study were drawn from 6 schools. The respondents included two curriculum experts from Curriculum Development Centre (CDC), 51 stakeholders, nine interviewees and 52 pupils giving in total 114 respondents.

3.1.5 Sampling Techniques

Sampling is the procedure a researcher uses to gather people, places or things to study. It a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group Orodho and Kombo, (2002)in Kombo and Tromp, (2006). Webster, (1985)in Kombo and Tromp,(2006) defines a sample as a finite part of a statistical population whose properties are studied to gain information about the whole. When dealing with people a sample is defined as a set of respondents selected from a larger population for the purpose of a survey. Bless and Achola (1988) define a sample as the sub-set of the whole population which is actually investigated by a researcher and whose characteristics will be generalized to the entire population. The present research used a set of respondents selected from selected secondary schools in Central Province.

The researcher used probability and non- probability sampling as sampling designs in order to fully understand the way in which environmental sustainability issues were integrated in the 2013 science education curriculum. Heterogeneous purposive sampling and simple random sampling were used to identify the respondents. Simple random sampling was used to pick the sample of pupils. Using a portion of names from a list, the researcher made sure respondents were balanced in cases were boys and girls were involved. Simple random sampling was chosen because it provides equal opportunity for selection for each element of the population. Respondents have an equal and independent chance of being selected as a member of the sample. Heterogeneous sampling was used in order to include all opinions or views, and because the researcher was not concerned about representing these views proportionately. Heterogeneous sampling wasusedbecause the researcher's primary interest was in getting broad spectrum of ideas. The researcher noted that in purposive sampling, rich information rather than the number of participants was important, (Simuchimba&Luangala 2007). In effect, what the researcher was sampling was not people, but ideas. Obviously, in order to get all of the ideas, and especially the unusual ones, the researcher needed to include a broad and diverse range of participants.In this case, the researcher purposely targeted a group of people believed to be reliable for the study. Therefore, the sample for this study was selected in such a way that the research questions which sought to establish the extent to

which environmental sustainability issues were integrated in the 2013 science education curriculum (see section 1.7) could be properly answered.The power of purposive sampling lies in selecting information related to the central issues being studied (Kombo& Tromp 2006).

3.2 Methods of data collection

According to (Kombo and Tromp 2006), data collection refers to the gathering of information to serve or prove some facts. In research, the term 'data collection' refers to gathering specific information aimed at providing or refuting some facts (Kombo and Tromp 2006). In the present study, the researcher used interviews, questionnaires and document reviews as data collection strategies. Interviews are the most common data collection methods in qualitative studies. They are mainly used to give more detailed insights into interpreting the situation so that the researcher sees things as they really are. The combination of interviews and content review as qualitative data collecting techniques are likely to yield the most needed information about the topic under investigation. Primary data wascollected usinginterview guide and questionnaires; semi-structured interview guide was used.Secondary data was collected through the review of documents such as the curriculum,educational policy, curriculum framework and other curriculum documents, related to the study. In this study the researcher reviewed additional documents related to integration of environmental sustainability issues in the science education curriculum. Documents such as syllabi for integrated science grade 8 and 9, agricultural science grade 8 and 9, NEAP and Education for All. As a way of collecting more facts on the integration of environmental sustainability issues, as well as verifying data from the curriculum, the researcher collected more data using questionnaires backed by interviews.

3.2.1 Interviews

McMillan and Schumacher (2006)explain that interviews are response questions to obtain data from respondents about how they conceive and give meaning to their world and how they explain events in their lives. Qualitative interviews may take several forms: the informal conversational interview, the interview guide approach, and the standardized open-ended interview. These types of interviews vary in terms of structure and comparability of responses in data analysis. According to Leedy and

Ormrod(2005), interviews in a qualitative study are rarely as structured as the interviews conducted in a quantitative study. Instead, they are either open-ended or semi-structured, in the latter case revolving around a few central questions. Unstructured interviews are, of course, more flexible and more likely to yield information that the researcher hadn't planned to ask for; their primary disadvantage is that the researcher gets different information from different people and may not be able to make comparisons among the interviewees. Semi-structured interviews were used in the present study.

3.2.2 Semi-structured interviews

Generally speaking, semi- structured interviews are based on the use of an interview guide. An interview guide is a list of questions or topics that need to be covered by the interview Kombo and Tromp (2006). An interview guide also refers to the pre-written questions that the interviewer may ask during the interview session. Pre-determined questions are necessary, especially for novice researchers Chiyongo(2007). Semi-structured interviews were employed as data collection technique with CDC officials and some stakeholders. In this regard, the researcher was aware of key issues on which to gain information. It should be noted here that in the semi-structured interview the general outline to be followed was indicated but within each section the questioning was free according to the choice of the interviewer Sidhu(2003).

3.2.3 In-depth semi-structured individual interview

Cohen and Manion(1997) in Muzumara(1998), define an in-depth semi-structured individual interview as "a two-person conversation initiated by the interviewer, for the specific purpose of obtaining research-relevant information as specified by research objectives of systematic description, or explanation".

In-depth individual interviews played a significant role in this study. The researcher interviewed stakeholders, and CDC officials(See Table 1. in section 3.2.4).

Interviews were generally adopted as a method to make up for the limitations of the questionnaire(Kombo and Tromp, 2006). Instead of writing the response, the interviewee gives the needed information verbally in a face-to-face relationship. People are usually more willing to talk than to write. With a skilful interviewer, the interview is often superior to other data gathering devices. After the interviewer

gains rapport, or establishes a friendly relationship with the respondent, certain types of confidential information may be obtained that an individual might be reluctant to put in writing.

The views ofcurriculum specialists and HODs who have been in science education and curriculum review and implementation respectively for quite some time assisted the researcher to validate responses from teachers and learners.

The interviews were held in respondents setting with one person at a time so the respondents were free to express themselves fully and truthfully.

Focused interviews were used in the present study to intensively investigate the 2013 revised curriculum.Focused interviewsaim at gaining a complete and detailed understanding of the topic (Kombo and Tromp, 2006). They are flexible and give the researcher an in-depth and detailed understanding of the issue under research. As such they were appropriate for this research.

3.2.4 Details of the conducted interviews

The following table provides fundamental data pertaining to each of the 9 interviews conducted.

Table9:Fundamentals of the interviews

No. of interview	Date of interview	Type of interview	Interviewee/s	No. of interviewee/s	Duration of the interview/minutes
1	11/03/2014	Semi-structured (individual)	Deputy head Kafue	1	40
2	12/03/2014	Semi-structured (individual)	Headteacher Mumbwa	1	35
3	12/03/2014	Semi-structured (individual)	Section head Mumbwa	1	30
4	12/03/2014	Semi-structured (individual)	Teacher Mumbwa	1	45
5	13 /03/2014	Semi-structured (individual)	Teacher Mkushi	1	20
6	14/03/2014	Semi-structured (individual)	Biology specialist CDC	1	30
7	16/06/2014	Semi-structured (individual)	HOD Chipembi	1	30
8	17/06/2014	Semi-structured (individual)	Teacher Chipembi	1	40
9	17/06/201	Semi-structured	Principal	1	45

	4	(individual phone interview)	curriculum specialist CDC		

3.2.5 Questionnaire

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Furthermore, a questionnaire isset of printed and written questions for obtaining statistically useful or personal information from individuals. Although they are often designed for statistical analysis of the responses, this is not always the case. “A questionnaire is a good way to gather information from a group of people. You can learn a group's knowledge, opinions and preferences by surveying them through a questionnaire”, (Kombo and Tromp, 2006:89).A questionnaireis alistofquestions,usuallyprinted,submittedforrepliesthatcanbeanalyzedforusableinformation. It is a written set of questions that are given to people in order to collect facts or opinions about something. In the present study the researcher learned from a group, knowledge about environmental sustainability issues, extent of integration, methods of teaching, benefits and challenges of integrating environmental sustainability issues in the curriculum by surveying them through aquestionnaire.

3.2.6 Document review

Document reviews were conducted and supported by information obtained through interviews and questionnaires. Among the documents that were reviewed were grade eight syllabi for integrated science and agricultural science and grade nine integrated science and agricultural science; 2013 Curriculum Frame Work; and 1996 Ministry of Education Policy Document (Educating Our Future), Education for All and other related documents. It was important to analyse the contents of these documents so as to verify the information obtained using other methods of data collection. Chiyongo(2007) explains that triangulation is used in order to verify the responses given during the study. Triangulation is important in ensuring confirmability of results. Triangulation refers to the use of multiple perspectives to collect and interpret data about some phenomenon, to converge on an accurate representation of reality.

The recently revised science education curriculum at junior level was analysed based on the following categories:

Table 10: Categories for analysis

MAJOR CATEGORIES	SUB-CATEGORIES
Category A Integrated science	• Integrated science grade eight
	• Integrated science grade nine
Category B Agricultural science	• Agricultural science grade eight
	• Agricultural science grade nine

Table 11: Category A, Integrated science

GRADE 8 AND 9
Topics
The human body
Health
The environment
Plants and animals
Materials and energy.

Table 12: Category B, Agricultural science

GRADE 8 AND 9
Topics
Agriculture in Zambia.
Soil science
Crop production
Forestry
Conservation farming
Livestock production
Farm structure
Farm machinery
Farm management

Table 13: Environmental sustainability issues identified for analysis.

Section/ Chapter	Sustainability issues/themes
1/3	Combating poverty
1/4	Changing consumption patterns
1/5	Population and sustainability
1/6	Protecting and promoting human health
1/7	Sustainable human settlements
1/8	Making decisions for sustainable development
II/9	Protecting the atmosphere
II/10	Management of land sustainably
II/11	Combating deforestation
II/12	Combating desertification and drought
II/14	Sustainable agriculture and rural development
II/15	Conservation of biological diversity
II/16	Management of biotechnology
II/18	Protecting and managing fresh water
II/21	Managing solid wastes and sewage

Source: United Nations, (1992)

This study identified 15 environmental sustainability issues expected to be included in the 2013 revised science education curriculum at junior level, for analysis from the first (social and economic dimensions) and second (conservation and management of resources) sections of Agenda 21.

3.2.7 Data Analysis

Data analysis is an eclectic process Tesch, (1990) it occurs simultaneously and iterative with data collection, data interpretation and report writing (Creswell, 2002; Miles &Huberman, 1984). It is based on data reduction and interpretation-decontextualisationandrecontextualisation(Marshall &Rossman, 1989; Tesch, 1990).

The research followed content analysis as a principal technique. Content analysis is defined as 'a research technique for objective, systematic and quantitative description of the noticeable content of communication' (Berelson, 1952, in Asgedom, 1998:18 cited in Dalelo, 2010). Content analysis is also defined as 'a careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings' (Leedy&Ormord, 2005; and Neuendorf 2002 in Berg, 2007:303-304), cited in Dalelo(2010). The technique is often accomplished through the use of objective language, categorisation, and systematic surveys (Burns-Bammel et al., 1988, cited in Norris and Jacobson,

1998:39). Rudestam and Newton (1992:31) point out that "qualitative research implies that the data are in the form of words as opposed to numbers". In this qualitative study, the data was reduced to themes or categories. The researcher in the first place transcribed the interviews and questionnaires to provide a complete record of the discussion. Using constant comparative content analysis the researcher then analysed raw data from interviews, field notes and content review in order to reach the most significant themes of the topic under study, (Dey, 1993; Lungwangwa et al, 1995).Content analysis was used because the researcher wanted to establish the extent of integration. In analysing the content of the documents the researcher used the following steps:

Step one(reading/data): Determining analytical categories (This means becoming familiar with the data and identifying main themes in them).

- For example, the major areas in the science curriculum at junior level were divided into two major categories: Category A, integrated science with two sub categories; integrated science grade eight and nine; Category B, agricultural science with two subcategories; agricultural science grade eight and nine. Major topics under category A,considered in this study for analysis were as presented in Table 3. Major topics under category B, considered in this study for analysis were as presented in Table 4.

Step two (describing): Establishing units of analysis (this involves examining the data in- depth so as to provide detailed description of the setting, participants and/ activities).

- For example, specific topics and subtopics related to the two categories, indicated in step one, were used as units of analysis.

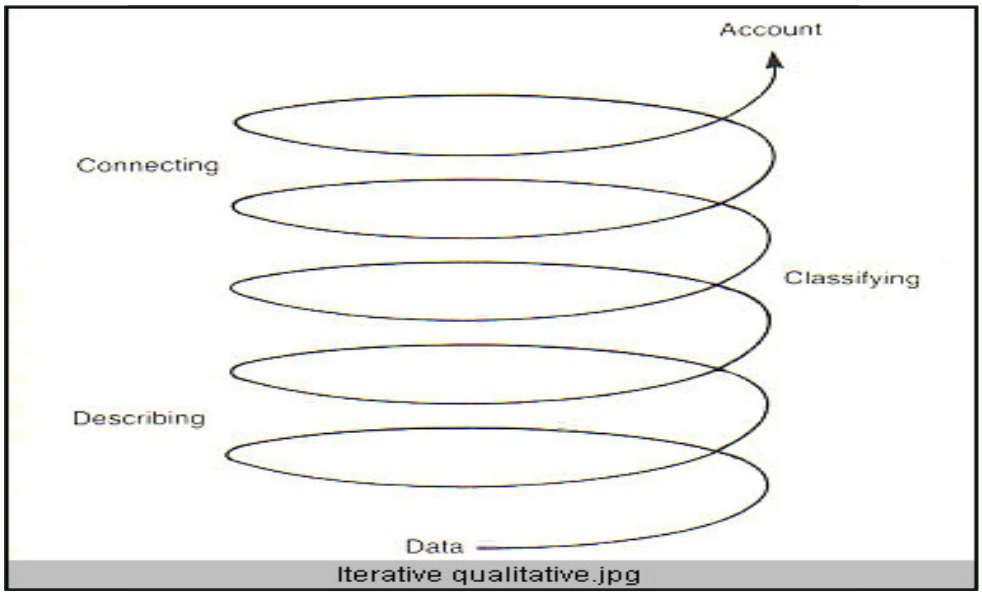
Step three (classifying): Determining criteria for sorting data into analytic categories (this involves categorizing and coding pieces of data and physically grouping them into themes).

- The criterion used is having environmental sustainability issues clearly mentioned in the statements of objectives and corresponding course descriptions. Fifteen such issues were identified as shown in Table 5.

Step four (relating/connecting): Counting the number of entries in each of the twocategories.

- This was carried out by counting specific topics with objectives and/or contents related to sustainability issues.

Step five (account/description): Interpreting and synthesizing the organised data into general conclusions.The step are summarised in Figure 2 below.



Source: Dey(1993)

Figure 2: Steps in analysing qualitative data

The researcher then examined the documents that were purposively selected. In analysing these documents the researcher focused on the content in the 2013 science education curriculum, teaching and learning materials, and methods of teaching, benefits as well as challenges of integration. To remain objective, Tesh's proposed eight steps in data analysis were used as highlighted in De Vos et al (2002:340-343) cited in Dalelo, as well asBabbie& Mouton,(2004:490); and Creswell, (1994:155).

a) Got a sense of the whole. The researcher achieved this by reading selected documents carefully and jotted down ideas that were of interest.

b) Chose one document and read through it, asking what it was about. The researcher considered underlying meanings and wrote ideas of interest in the margin.

c) Made a list of all topics. Clustered similar topics together and then arranged the groups into columns under major and sub-topics.

d) Took the list and went back to the data. Abbreviated the topics as codes and wrote the codes next to appropriate segments of text. There after determined whether new categories and codes emerged.

e) Used descriptive words to categorise topics. Thereafter grouped related topics together.

f) Made a final decision about the abbreviations for each category and alphabetized the codes.

g) Gathered data belonging to each category and did a preliminary analysis.

h) Identified and reflected on relationships between categories, as those were the themes that formed the findings of the extent of integration of sustainability issues.

Descriptive statistical analysis was used to formulate tables, and charts on data from questionnaires. The researcher in this study then organized data, searched for patterns to identify what was important and what was to be learned as well as decided what to tell others as Bogdan and Biklein, (1992) accentuate. Primary and secondary data was then substantiated and integrated to produce data to address the objectives.

3.3 Ethical considerations

The proposed study attempted to stick to the following ethical principles; it respected the rights of individuals to privacy, confidentiality, self-determination, and autonomy. The study also attempted to safeguard individual's identity and data collected would be treated with confidentiality. First and foremost, the study ensured informed consent of respondents through respective offices such as, the Director of CDC, the PEO, the District Education Board Secretary DEBS and the Head-teacher.

3.4 Validation of results

Evaluation of samples is an important methodological aspect. In qualitative research, evaluation includes both that of informants and the data units. Samples should be adequate for the type of study. Adequacy refers to the sufficiency and quality of data; that is, assessment of the relevance, completeness, and amount of information (Chenitz and Swanson 1986). In general, qualitative research strives for trustworthiness (Miles andHuberman 1994). Trustworthiness refers to the establishment of validity and reliability in qualitative research (Streubert and

Carpenter 1999). In this research validity and reliability were maintained through triangulation. Triangulation is important in ensuring confirmability of results. The researcher in this case used different data sources and various methods in data collection and analysis. The study methods were also fully explained. Findings and data analysis was discussed with an expert (supervisor). Triangulation also enhances the credibility of findings by increasing the depth and breadth of the findings, thus emphasizing comprehensiveness. In this study, as stated above, multiple sources of data were triangulated. The following also assisted in making the research valid and reliable. The researcher has taught junior environmental science for 20 years, Literature was review by reading and rereading, different data sources were utilized, integration of data in the research report was done, complete description of researchmethodology supplied, different sources of data utilized and discussions were held with the expert.

CHAPTER 4: PRESENTATION OF FINDINGS

4.1 INTRODUCTION

This chapter presents findings pertaining to integration of environmental sustainability issues (ESI) in the 2013 science curriculum at junior level. The views of the respondents from interviews and information obtained from questionnaires and review of relevant documents constitute the focus of discussion of this chapter.

The presentation follows theobjectives of the study which were to: examine the existing content in the science education curriculum at junior level in terms of incorporation of the environmental sustainability issues of Agenda 21; establish knowledge on Environmental Sustainability Issues (ESI) among selected secondary schools, stakeholders and pupils in central province; determine teaching methods, teaching and learning materialsprovided in the 2013 revised science education curriculum towards teaching environmental sustainability issues; determine benefits of incorporating the key environmental sustainability issues of Agenda 21 in the revised science education curriculum. For interviews, the presentation followed the questions which were formulated in line with the objectives of the study.The discussion of categories which emerged from the answers wasdealt with in Chapter 5.

4.2 Integration of sustainability issues

This section seeks to verify whether sustainability issues were integrated in the science curriculum at junior level.

All the interviewees felt that issues of national concern were incorporated in the science education curriculum at junior level (grades 8 and 9) especially in integrated science. Issues of national concern according to the 2013 curriculum framework include the following; special education needs, careers guidance and counselling, environmental education, life skills, governance, gender, human rights, population and family life education, reproductive healthy and sexuality, HIV/AIDS, health and nutrition, entrepreneurship education and training and climate change. Out of 15 national concerns, seven (46.7%) have been incorporated in either integrated or agricultural science. One interviewee confirmed that ecological issues, HIV/AIDS

and comprehensive sexuality were incorporated in the 2013 science education curriculum at junior level. Portion of pollution have been captured in integrated science. A comment from interviewee # 6 was that:

> *Most issues were captured from the policy such as environmental education and climate change. We have also said that schools should make sure that they come up with activities that will promote the teaching and learning of environmental education. Talking about climate change, it is an ecological as well as a social problem, and both of us I suspect are affected in one way or another. It is for that reason that school curriculum has provided this education so that learners become aware of the ecological aspects, learn about climate crisis and learn how to contribute towards preventing and combating the issue" (*Interviewee # 6). Interviewee # 6 went on to say *"sustainability issues are still treated as cross cutting issues because they cannot be captured as individual subjects. How many subjects can we have because we have so many crosscutting issues? We have integrated some of those like comprehensive sexuality education, HIV AIDS and pollution.*
>
> *Additionally, interviewee number 8 commented that most issues have been integrated, some of which are; agriculture production, both for animals and plant, soil conservation, environment, water management, conservation, all these topicare talking about sustainability. Not much has changed except there is more emphasis on application. They have increased on time in agricultural science and content. It has expanded. They have included a lot of things in both integrated and agriculture science from the senior syllabus (Interviewee # 8).*

4.2.1 Extent of integration

In determining the extent of integration, interviewees were asked to give their views on the degree of integration of environmental sustainability issues in the 2013 science education curriculum. Some interviewees felt that not much work has been done towards incorporation of environmental sustainability issues in the science education curriculum. However, recommendable efforts were made towards standardizing and improving the quality of the curriculum at this level. Others felt that quite a number of issues were integrated. The conflicting ideas come in because

some took a general picture of the whole curriculum instead of just the science curriculum. Comments from interviewee were as follows:

> *So far this is the best curriculum in Zambia at this level. It is a very good curriculum because it cuts across all issues (Interviewee # 2).*
>
> *Interviewee # 3 indicated that, to some extent the curriculum is good but bulky and the gap between grade7 and 8 is too wide. Something should quickly be done to the grade 7 curriculum so that it matches that of grade 8.*

4.2.2 Extent of integration of environmental sustainability issues

In order to assess the extent of integration, stakeholders were asked to state the extent to which environmental sustainability issues were incorporated in the 2013 revised science education curriculum at junior level. This was achieved by respondents ticking from the table an appropriate phrase that best described the extent of integration of environmental sustainability issues of Agenda 21. The following were the responses.

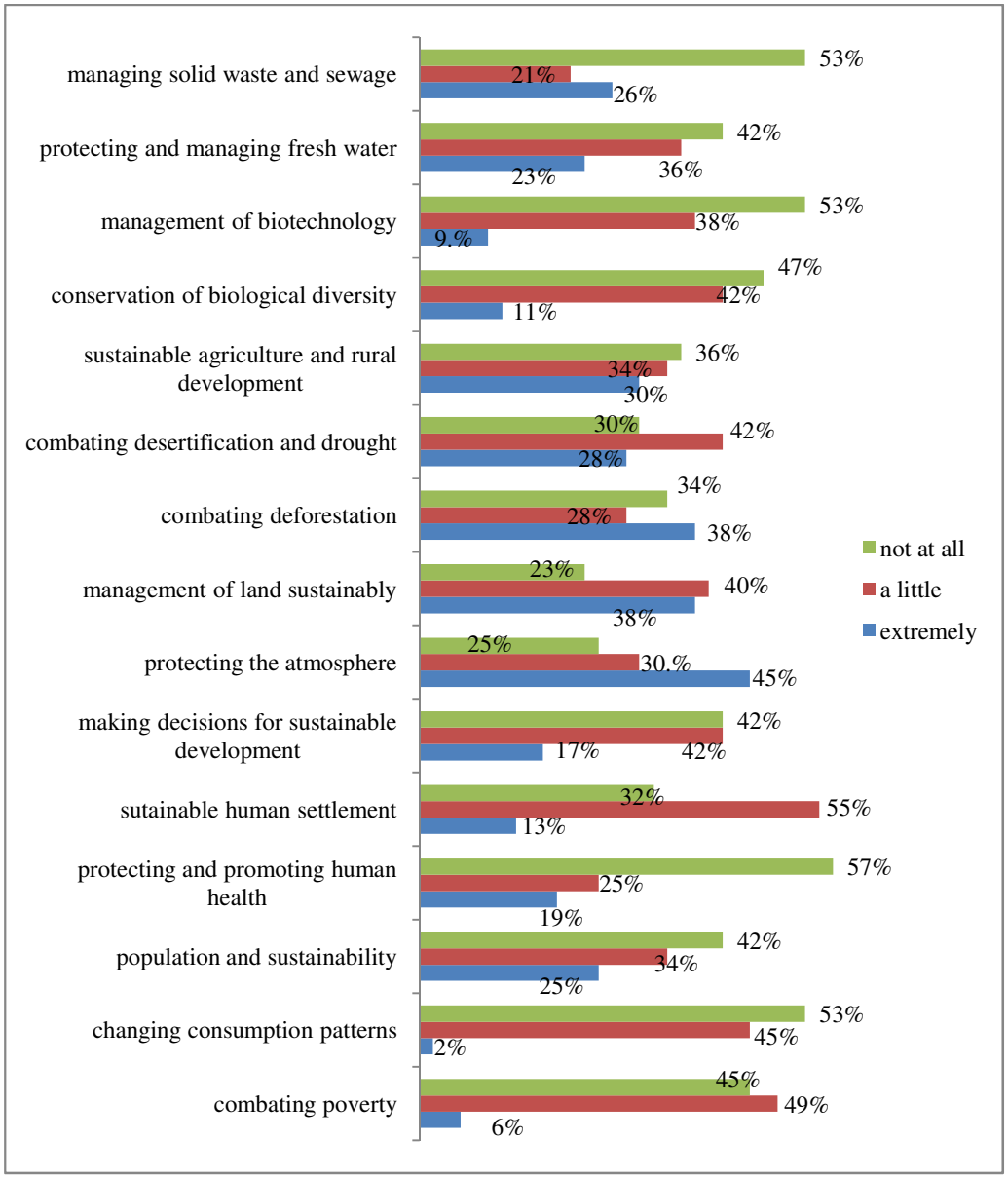


Figure 3: Extent of integration of environmental sustainability issues

The general picture as given by stakeholders was that remarkable efforts were made in the integration of environmental sustainability issues into the 2013 science education curriculum. Among issues fully integrated were the following;24 (45%) protecting the atmosphere; 20 (38%)combating deforestation; 20 (38%) management of land sustainably; 16 (30%)sustainable agriculture and rural development; 15 (28%)combating desertification and drought; 14 (26%)managing solid waste and sewage; 13 (25%) population and sustainability as well as 12 (23%)protecting and managing fresh water. Most of these issues dealt with social and the ecological environment. However, certain issue were not fully integrated. These included;

1(2%)changing consumption patterns; 5 (9%)management of biotechnology; 6(11%)biological diversity; as well as 9 (17%)making decisions for sustainable development. The rest of the information is as presented in Figure 3.

4.2.3 Extent of integration

In order to assess the extent of integration, pupil respondents were asked to state the extent to which environmental sustainability issues were incorporated in the 2013 revised science education curriculum at junior level. This was achieved by respondents ticking from the table an appropriate phrase that best described the extent of integration of environmental sustainability issues of Agenda 21. The following were the responses:

The general picture of majority of pupil- respondents was that most of the environmental sustainability issues were fairly integrated in the 2013 science education curriculum. Among them were the following; 23 (43%) pupil - respondents felt that combating poverty was not fully integrated; 22 (41%)pupil - respondents felt that changing consumption patterns, management of biotechnology as well as managing solid waste and sewage was not fully integrated. However, 29 (55%) pupil - respondents felt protecting and promoting human health was slightly integrated as well as protecting the atmosphere and making decisions for sustainable development. Furthermore, 21 (39%) pupil - respondents felt that conservation of biodiversity was not fully integrated.

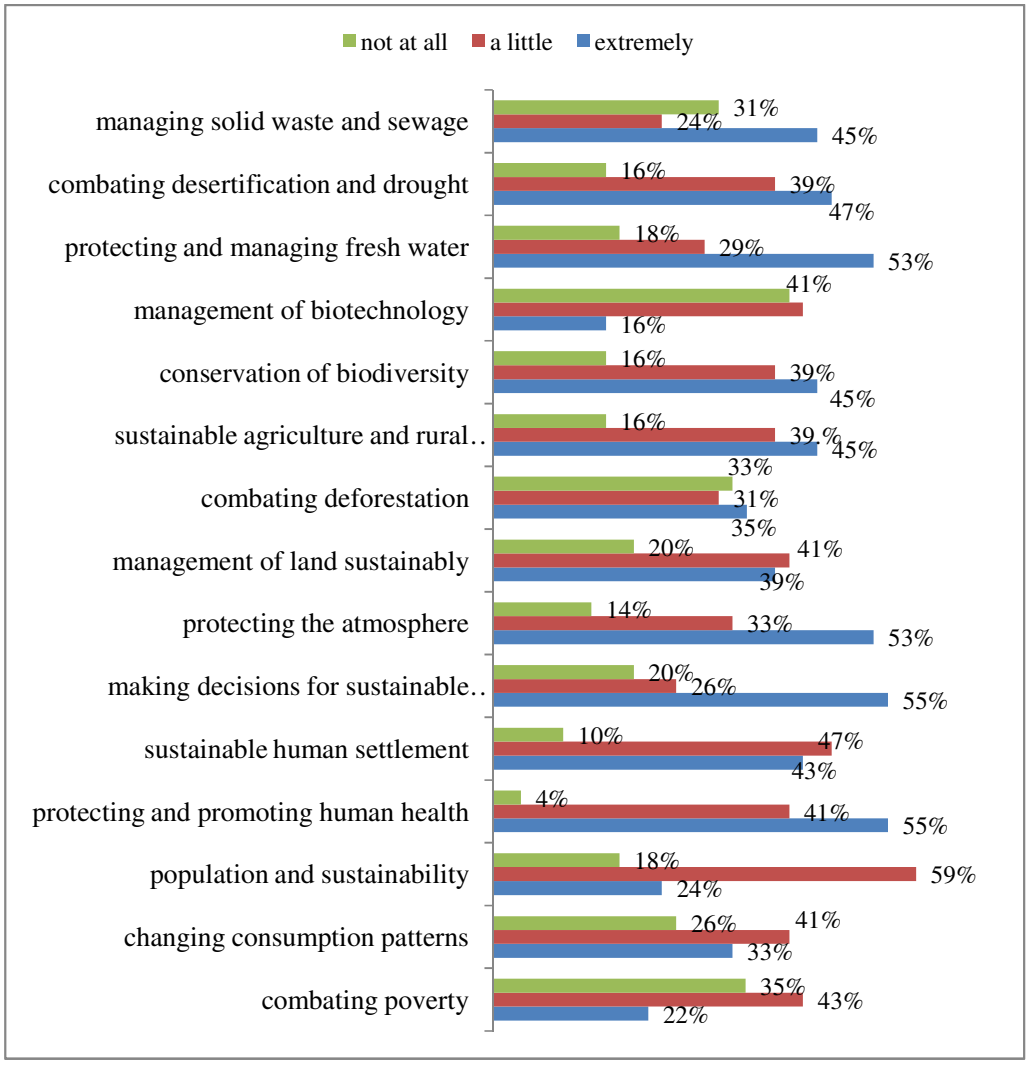


Figure 4: Extent of integration.

4.3 Stakeholders' knowledge on environmental sustainability issues

This section seeks to identify the first direct relationship of respondents with the expression 'environmental sustainability issues'. In this case respondents were asked to give their first direct relationship with the expression 'environmental sustainability issues' by choosing from a list of issues. Figure 5 indicates their responses.

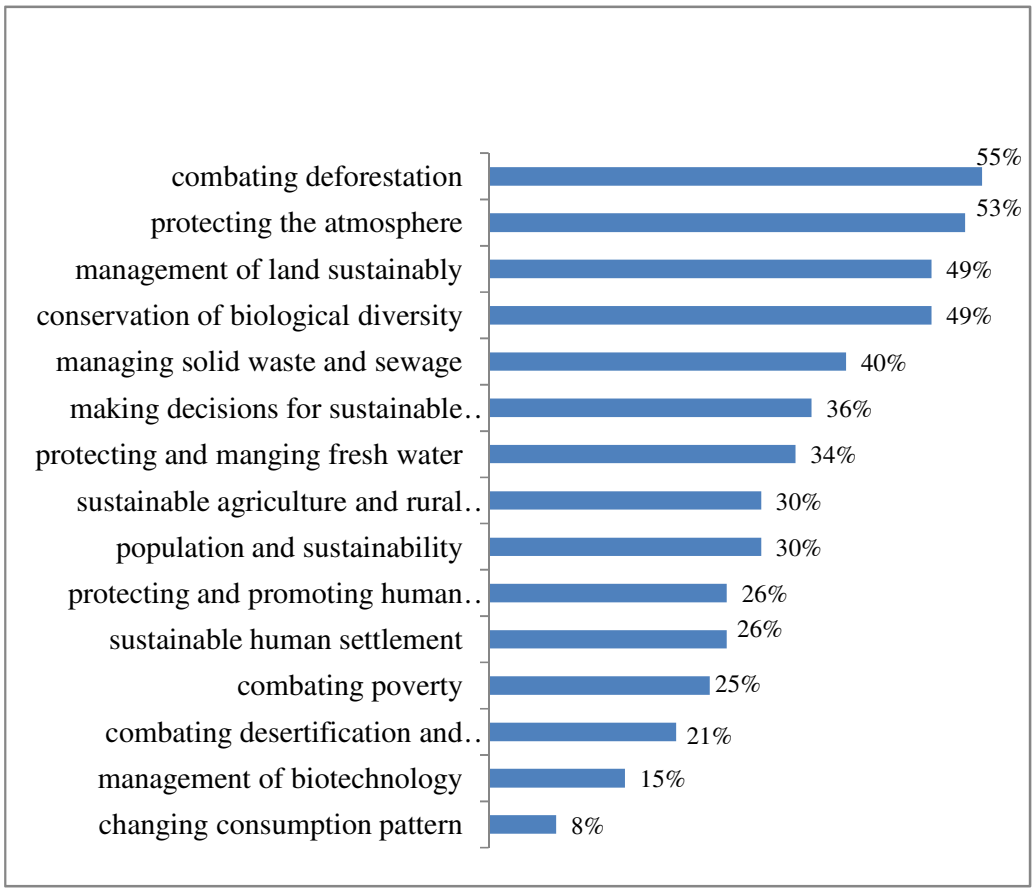


Figure 5: General knowledge about environmental sustainability issues

Four ideas emerged as major in association with environmental sustainability issues: 29 (55%) respondents related environmental sustainability issues to combating deforestation, 28 (53%) respondents associated environmental sustainability issues to protecting the atmosphere, and 26(49%) respondents related environmental sustainability issues to conservation of biological diversity while another 26(49%) related it to management of land sustainably. The four main issues which emerged were related to social and ecological environments. In fifth place 21 (40%) of the respondents related environmental sustainability issues to managing solid waste and sewage. Making decisions for sustainable development was in sixth place with 19(36%). Other responses were as in Figure 4. If this was the knowledge that stakeholders had on sustainability issues, it was then clear that that was the same knowledge they imparted on learners. However, sustainability is more than just social and ecological environment. Moreover, it includes economic and political environment.

4.3.1 Awareness about environmental sustainability issues

To assess respondents' awareness of environmental sustainability issues**, r**espondents were asked to state how often they hear about environmental sustainability issues**.** The results show that respondents were aware of environmental sustainability issues.

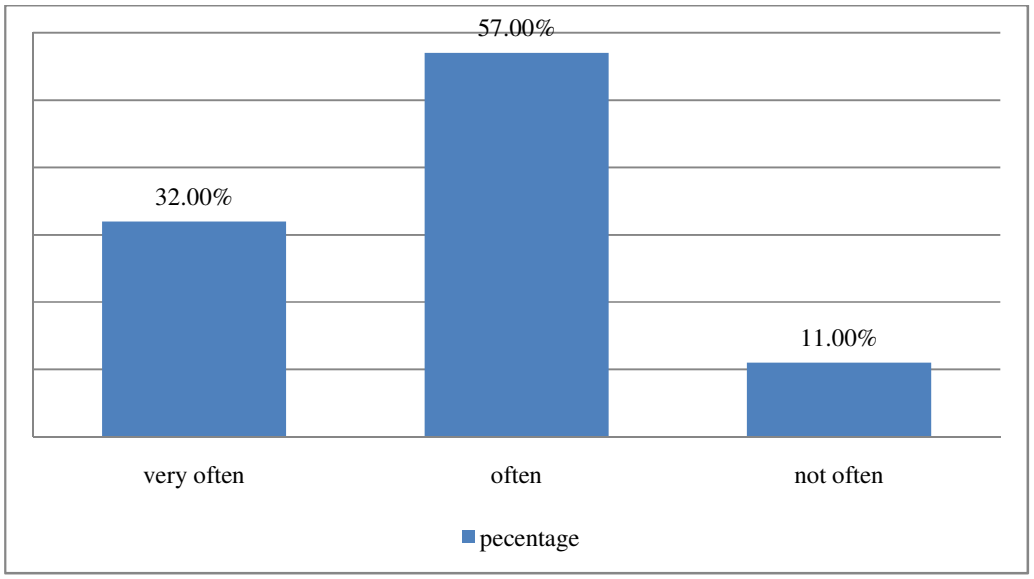


Figure 6: Awareness about environmental sustainability issues

Most of the respondents agreed that they were aware of environmental sustainability issues. Figure 5 indicates that 17 (32%) agreed that they very often hear about environmental sustainability issues while 30 (57%) respondents agreed that they frequently hear about environmental sustainability issues. However, 6(11%) of the respondents stated that they seldom hear about environmental sustainability issues.

4.3.2 Stakeholders major source of information

This section seeks to identify the major source of information onenvironmental sustainability issues knowledge.Figure 7 indicates respondent's responses on the source of information.

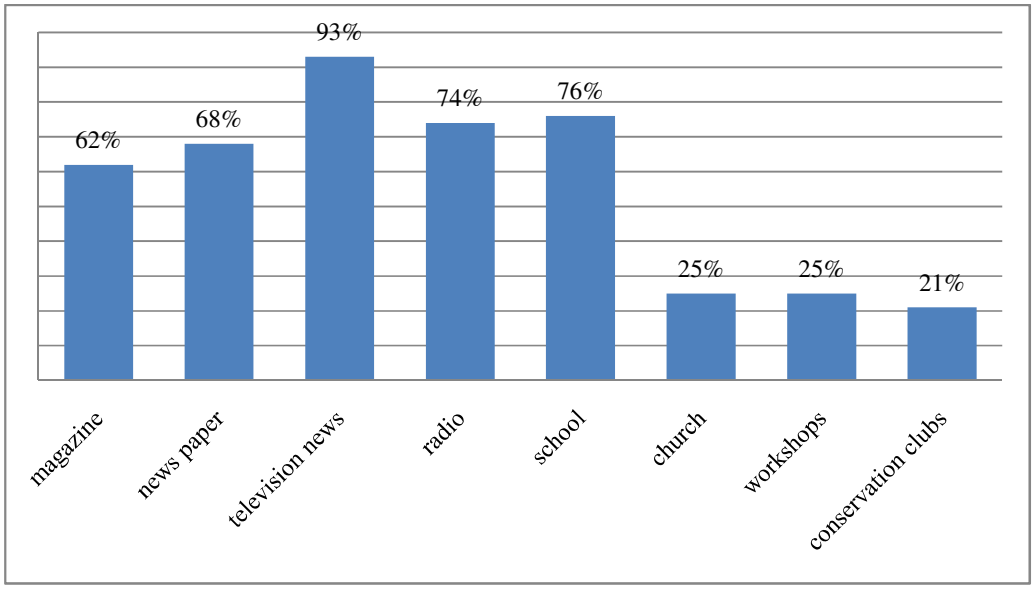


Figure 7: Major source of information

The major source of information on environmental sustainability issues mentioned by majority of respondents was television news 49 (93%); and school was ranked second with 40 (76%), radio in third position with 39(74%), newspaper in fourth place with 36 (68%), magazine 33(62%), church and workshop with 13(25%) each and least was conservation clubs with 11(21%). The researcher conducted further investigation between level of education of respondent and their major source of information about environmental sustainability issues**.**

Table 14: Qualification and major source of information

		Major source of information							
		Church	Magazine	News paper	Radio	School	Television	Workshop	Total
Highest education attended	Certificate	0	1	0	0	0	0	0	1
	Diploma	3	3	10	7	3	6	0	32
	Bachelor's degree	0	1	6	3	3	5	1	19
	Postgraduate diploma	0	0	0	1	0	0	0	1
Total		3	5	16	11	6	11	1	53

Table 14 shows that of the 32 diploma holders, 3 were getting information on environmental sustainability issues form magazines, 10 from newspapers, 7 from radio, 3 from school and 6 form televisions. Furthermore, from the 19 degree holders, 1got information from magazines, 6 from newspapers, 3 from the radio, 3 from school, 5 from television and 1 form the workshop. One certificate holder and 1 postgraduate diploma holder obtained information from magazine and radio respectively.

4.3.3 Course pertaining to environmental studies

Respondents were asked whether they studied a course pertaining to environmental studies. They were also asked to state which particular course(s) they studied. The following were the responses; 29(55%) indicated that they had done a course in environmental studies while 24(45%) had not done any course pertaining to environmental studies.

4.3.4 Knowledge on Environmental Sustainability Issues (ESI) among pupils

The knowledge of pupils was examined based on their relationship with the expression 'environmental sustainability issues'. Pupils were asked to state their association with the phrase environmental sustainability issues. The responses were as presented in Figure 8.

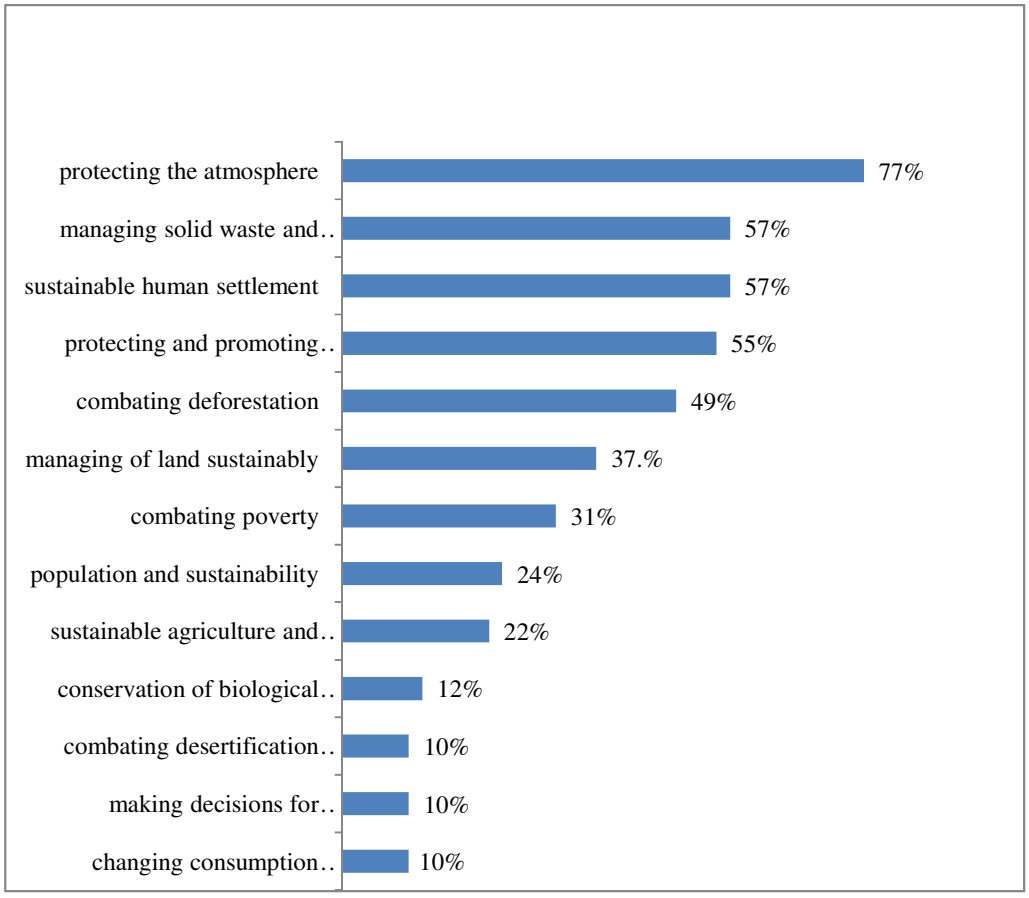


Figure 8: General knowledge about environmental sustainability issues

Five ideas emerged as major in association with environmental sustainability issues. These were: protecting the atmosphere; managing solid waste and sewage; combating deforestation; sustainable human settlement and protecting and promoting human health. Forty (76%) pupil respondents related environmental sustainability issues to protecting the atmosphere , 30 (57%) pupil respondents related environmental sustainability issues to managing solid waste and sewage, another 30 (57%) pupil respondents related environmental sustainability issues to sustainable human settlement, 29 (55%) pupil respondents associated environmental sustainability issues to protecting and promoting human health while 26(49%) pupil respondents associated environmental sustainability issues to combating deforestation. The five main issues which emerged fall under ecological and social environment and relate to current problems about the physical environment in Zambia. In sixth place 20(37%) of the pupil respondents related environmental

sustainability issues to managing land sustainably. Other responses were as in Figure 8.

4.3.5 Pupils' Information on environmental sustainability issues

To assess pupils' awareness of environmental sustainability issues, they were asked to state how informed they were about environmental sustainability issues. Their responses were as presented in Figure 9.

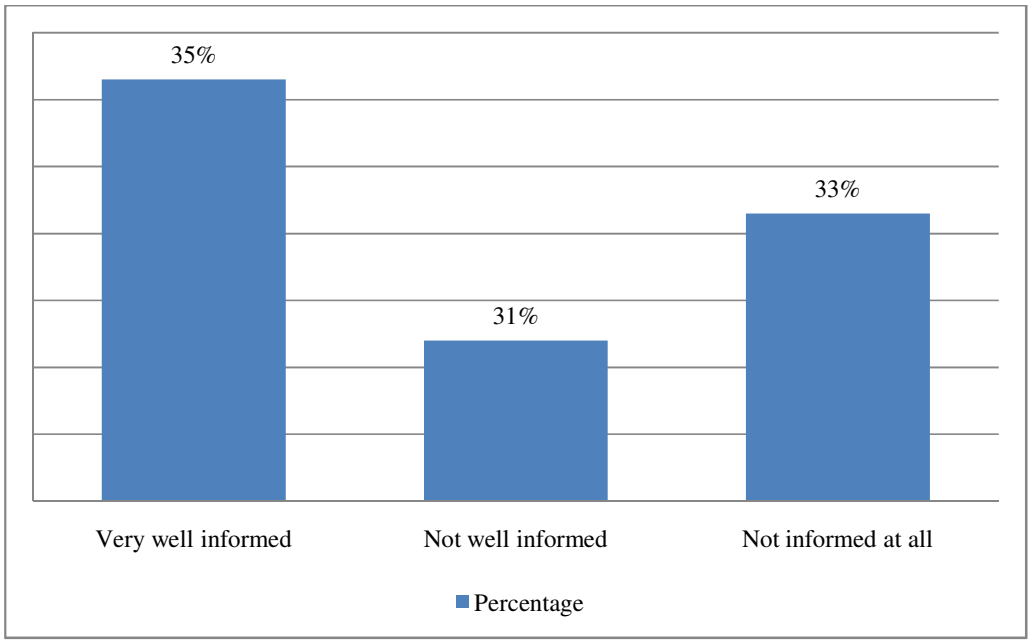


Figure 9: Information about environmental sustainability issues

Nineteen (35%) respondents said they were very well informed, 16(31%) respondents agreed that they were not well informed and 17 (33%)respondents said that they were not informed at all.

4.3.6 Interviewee's interpretation of sustainability

To assess interviewees' knowledge of sustainability, they were asked to state in their own view what sustainability was. From the responses put forward by respondents, it was clear that sustainability was taken to be the ability to carry on. The simple definition,sustainability is improving the quality of human life while living within the carrying capacity of supporting eco-systems, National Policy on Environment: (MTENR, 2005). Sustainability is the capacity to endure. But sustainability is also a call to action, a task in progress or "journey" and therefore political process.The word sustainability is applied not only to human sustainability on Earth, but to many

situations and contexts over many scales of space and time. It implies responsible and proactive decision-making and innovation that minimizes negative impact and maintains balance between social, environmental, and economic growth to ensure a desirable planet for all species now and in the future. One interviewee was frank enough to say the definition for sustainability was not clearly understood because it was heard in every field he had come across. However, it was commonly defined by the various interviewees as:

> *The ability to carry on for sometime*
>
> *The ability to keep something going for a long time (able to be maintained)*
>
> *The ability to last long or long lasting*
>
> *To maintain for a long time*
>
> *Able to maintain*
>
> *To support itself continuously*
>
> *Maintaining ecological balance*
>
> *Interviewee #3 defined sustainability as making use ofnatural resources without destroying the ecological balance of the area while interviewee # 8 said, me I always hear the term sustainability/sustainable in almost everything people say these days but I am not sure of what it really means especially in education. I thought sustainability was just in the business circles and in agriculture where farmers are involved in the cutting of trees and clearing large areas of land.*

From the literature review and interviews, it was clear that sustainability had several meanings and was defined differently depending on a particular place.

The research revealed that stakeholderswere in agreement regarding the meaning of sustainability. One general characteristic of the meaning of sustainability that was common in all the definitions of the interviewees was the ability to last long or long lasting, ability to keepand to maintain.

4.4 Suitable teaching methods

In trying to determine the teaching methods provided in the curriculum, interviewees were asked to indicate by ticking suitable teaching methods for teaching integrated and agricultural sciences in the 2013 curriculum. The general picture was that old

methods of delivery in science can still be used to teach the new curriculum. However, the only problem is that most teachers of science prefer /or are forced to teach theoretically due to non-availability of funds, apparatus and chemicals in schools.

> *The old methods were quite fine except they lacked detail. However, the new methods are very good because the curriculum is very detailed, it guides the teacher where to tough, and it is not like the old one. This one guides the teacher on the knowledge that they have to give to the learners. On that one it is very good. However most of the teaching methods are classroom based (Interviewee #5).*

Commenting on the same question, Interviewee # 8 said:

> *The teaching methods are just the same as in the old curriculum except this time there is more work to be done for practical subjects. We can still use the same methods except there is no money provided for field trips and also there is little time to visit places and sites (Interviewee # 8).*

4.4.1Teaching methods

Stakeholders were asked to pick from a list of items, five education teaching methods they felt were suitable for teaching environmental sustainability issues. Their responses are shown in Figure 10.

Twenty nine (55%) respondents felt that field trip was suitable for teaching environmental sustainability issues; twenty eight (53%) respondents felt that field work as well as problem solving was suitable for teaching environmental sustainability issues. Furthermore, twenty five (47%) respondents felt project work was suitable while 19 (36%) said demonstration was suitable for teaching environmental sustainability issues. The rest of the information was as presented in Figure 10.

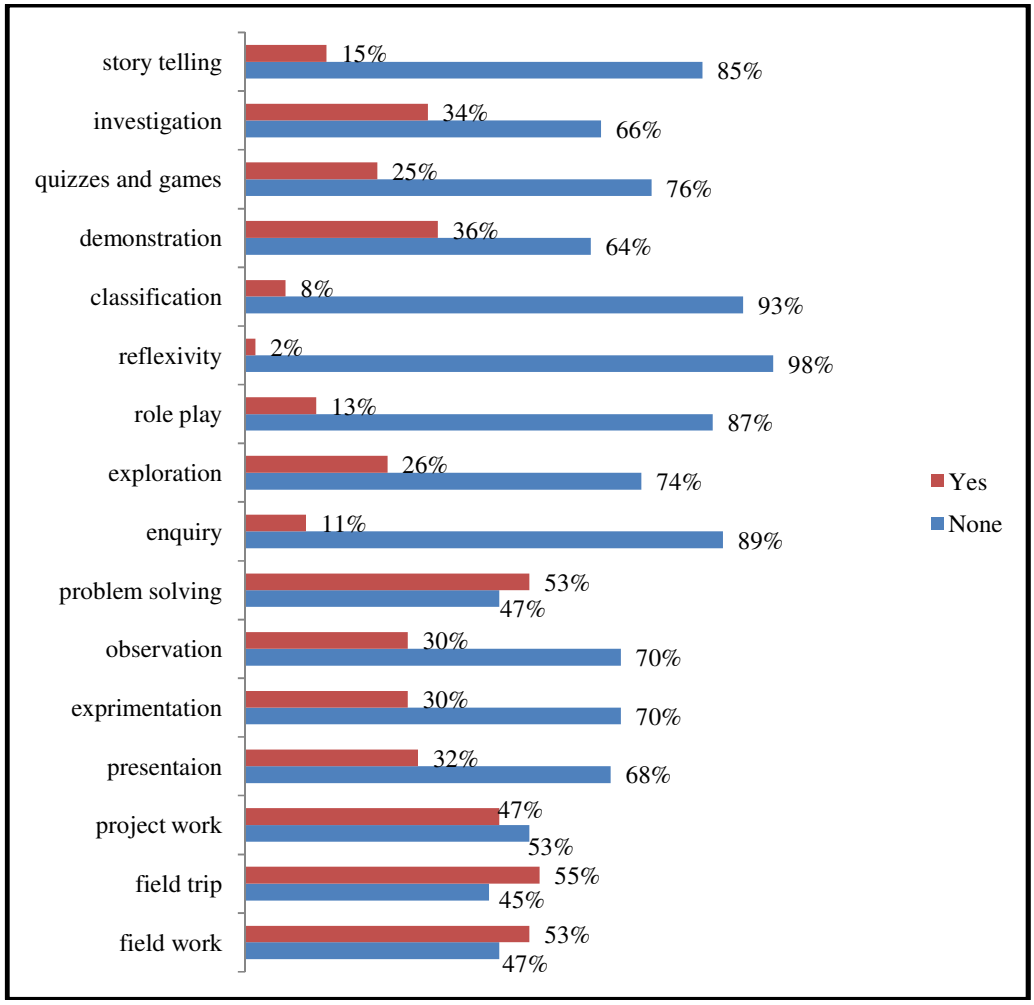


Figure 10: Teaching methods suitable for teaching environmental sustainability issues.

4.4.2Teaching methods suitable for teaching sustainability issues

In this category pupil - respondents were asked to state methods suitable for teaching environmental sustainability issues. Five methods emerged. These were 39 (73%) experimentation, 35 (66%) project work,28 (53%) demonstration,28 (53%) field work and 27 (51%) exploration.

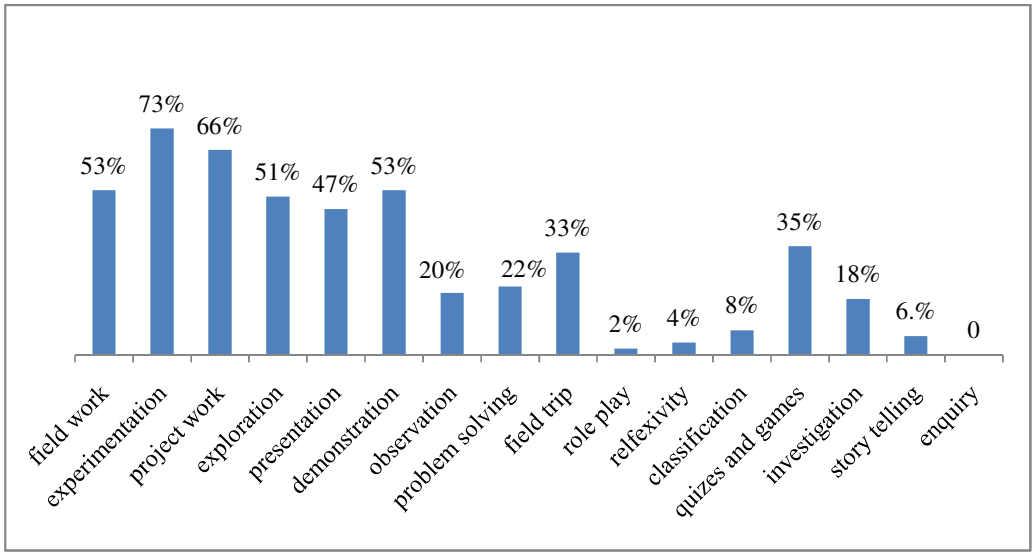


Figure 11: Teaching methods suitable for teaching sustainability issues

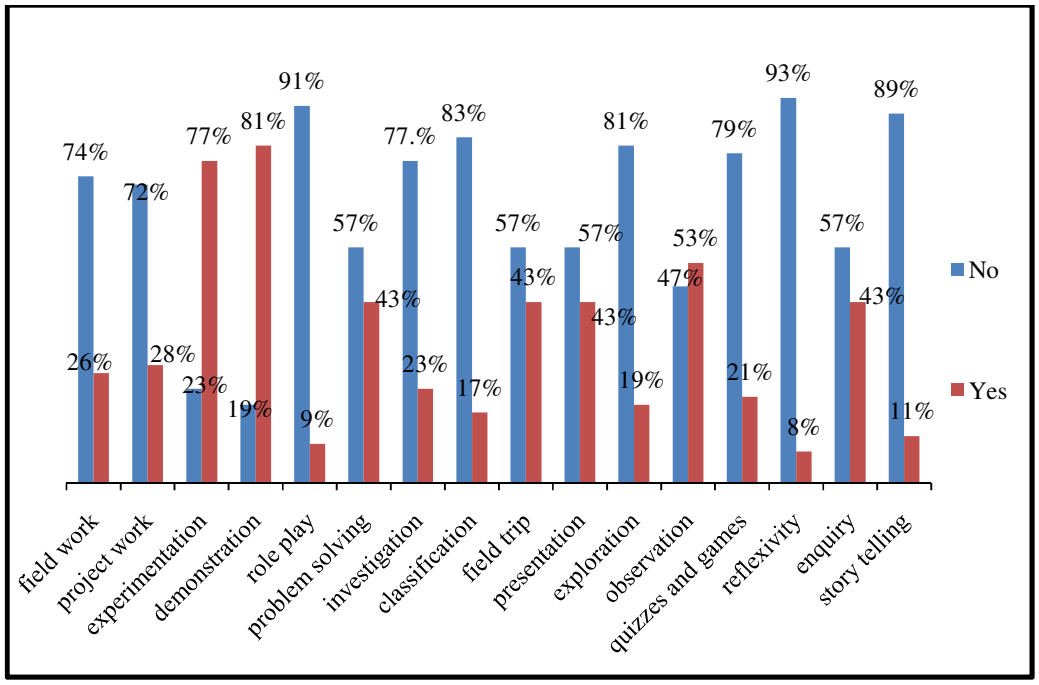


Figure 12: Most used method for teaching science in schools

4.4.3Methods of teaching science in schools

To determine the method most used at junior level in science teaching, respondents were asked to tick from a list methods. Responses were as shown in Figure 12.

Three methods emerged as most used methods in science teaching at junior level; namely; demonstration with 43(81%); experimentation with 41(77%) and observation with 25(47%).

4.4.4 Most used teaching method in science education

In this question pupil - respondents were asked to state methods most used for teaching science. Four methods emerged. These were problem solving, project work, experimentation and role play. Forty one (78%) pupil-respondents mentioned problem solving, 28 (53%) pupil- respondents said project work, 23 (43%)pupil - respondents said experimentation while 24 (45%)pupil-respondents said role play as the most used teaching method in science education.

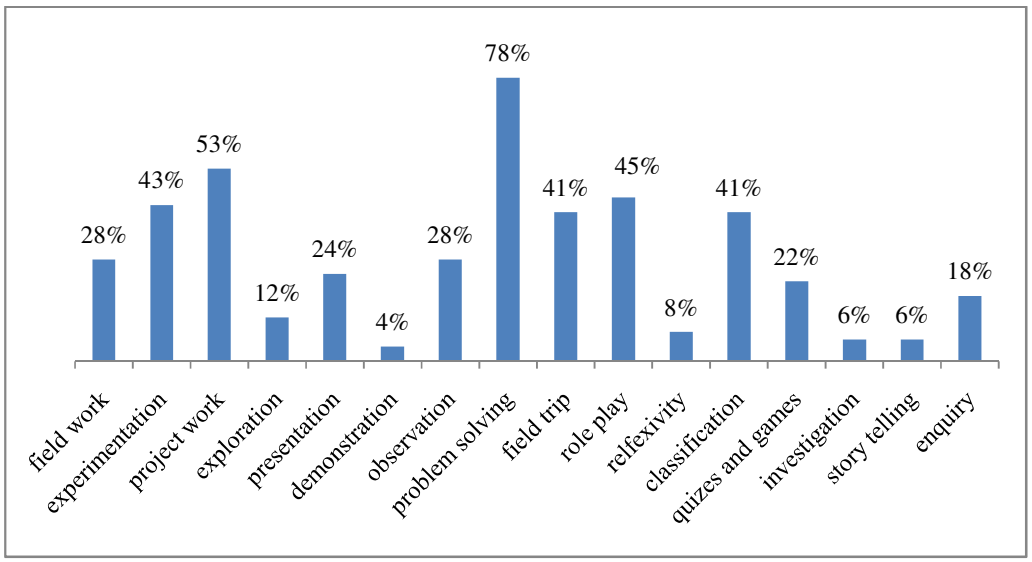


Figure 13: Most used teaching method in science education

4.4.5 Teaching and learning resources

To assess the availability of teaching and learning resources provided towards the teaching of the revised curriculum 2013,interviewees were asked to state what resources were available for both learners and teachers. Thenineinterviewees said that there were no teaching and learning materials so far provided for the teaching of science education in the new curriculum at junior level. One of the interviewees lamented and said that:

> We *are like soldiers at the battle front with guns which have no bullets. I say so because we have no books of any kind for the new curriculum and yet we are already using the new curriculum. How I wish there was a particular*

book for integrated science like it used to be for environmental science for the old curriculum' there are no books for integrated science. This is posing a challenge for teachers especially that teaching integrated science involves several other subjects, such as, chemistry, ecology, geography, physics and biology all in one.Without a specific book on integrated science, makes it difficult to draw boundaries with the major subject areas, (Interviewee # 7).

*Another one commented to say we are trespassing. We are using senior books especially for grade 8 on atoms and other physics topics (*Interviewee # 3).

Interview number 8 further said teaching and learning materials are not there, it is only that they say a teacher should be resourceful. Any way we are managing using the available resource. The same materials we were using for senior grades we are using them for teaching juniors. (Interviewee # 8).

Shading more light on teaching and learning materials, Interviewee # 6 said:

Teaching and learning materials are produced based on the curriculum and the framework. Whatever is in the syllabus will be written by publishers accordingly. There are so many publishers and they have already taken the draft copies of the curriculum, others have started bringing books for verification. Soon we will have all the books. Since they are many those who will finish fast will sell their books. Government has the money to purchase the books. Books may be ready by June/July2014 he said.

4.5 Benefits of incorporating environmental sustainability issue

This section seeks to find out what benefits learners would get after the incorporation of environmental sustainability. The nine interviewees agreed that environmental sustainability issues bring about acquisition of skills and values as well as awareness and responsibility on issues surrounding them and those found in society. Some of the responses from interviewees are as follows.

Benefits are there for example matters of health for girls, the life of the learner especially in this current generation, learners are supposed to be equipped with enough knowledge to protect themselves from HIV and AIDS, STIs, and other things in life (Interviewee # 7).

Interview number 6 added saying, the benefits are many. Learners develop skills to protect and combat issues in society. Learners develop skills on how to look after themselves. Also learners become aware of the ecological aspects, learn about climate crisis and learn how to contribute towards preventing and combating the issue(Interviewee # 6).

4.5.1Benefits of integrating environmental sustainability issues in the curriculum

To determine benefits of incorporating environmental sustainability issues of Agenda 21 once in the science education curriculum, stakeholders were asked to give their opinion on whether a particular environmental sustainability issue would be beneficial or not once in the curriculum. This was achieved byrespondents using a 3 point scale; not beneficial; fairly beneficial and extremely beneficial. Responses were as in Figure 14.

Results indicated that environmental sustainability issues were extremely beneficial once in the curriculum. Evidence shows that 46 (87%) respondents maintained that combating deforestation was extremely beneficial once in the curriculum; 45(85%) respondents maintained that protecting and promoting human health as well as managing solid waste and sewage were extremely beneficial once in the curriculum; 44(83%) respondents felt that protecting the atmosphere as well as managing land sustainably were extremely beneficial while 43(81%) respondents felt that coservation of biodiversity, protecting and managing fresh water as well as combating desertification were extremely beneficial. For other responses refer to Figure 14.

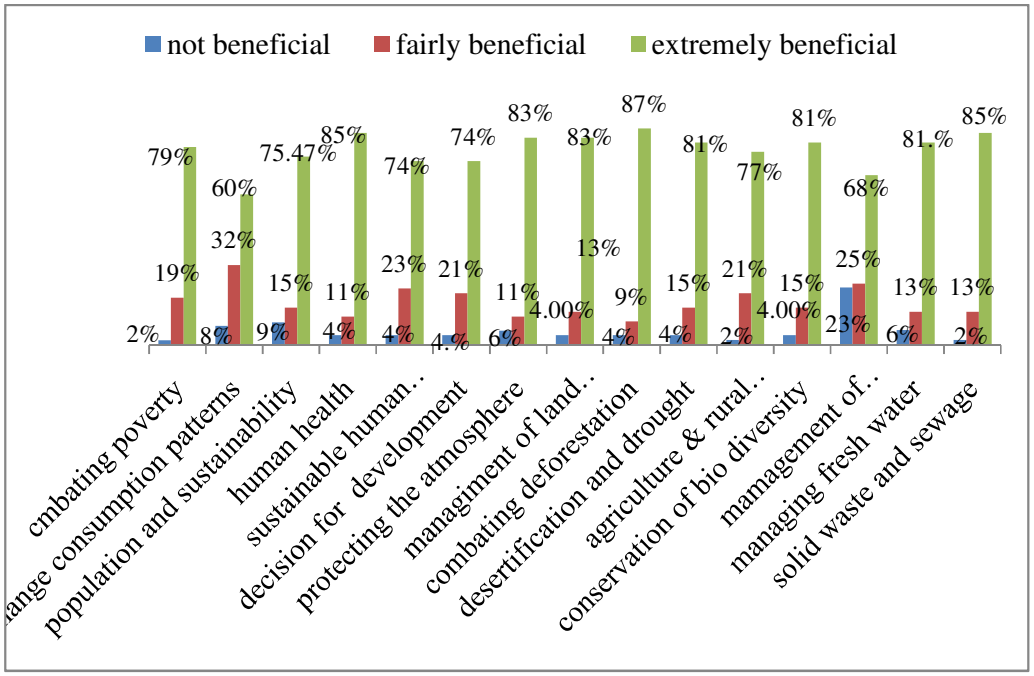


Figure 14: Benefits of integrating environmental sustainability issues in thecurriculum

4.5.2 Benefits of integration

In this question , pupil - respondents were asked to give their opinion on whether a particular environmental sustainability issue would be beneficial or not once in the curriculum using a three point scale; not beneficial; fairly beneficial and extremely beneficial. The following were their responses;

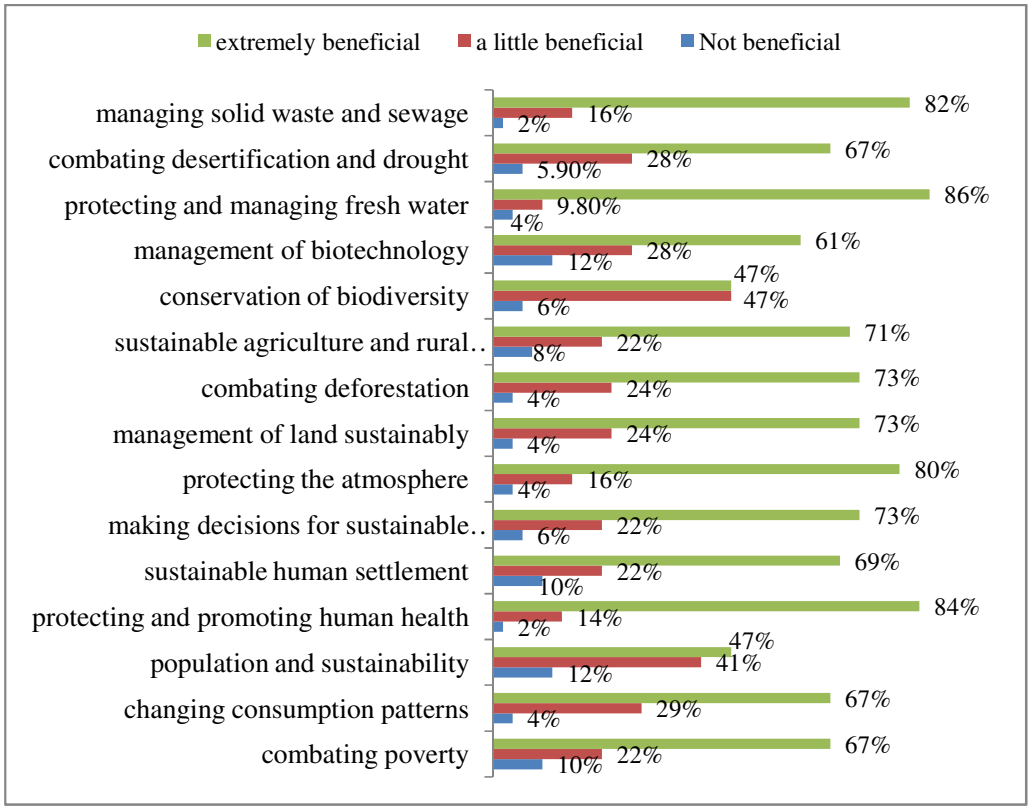


Figure 15: Benefits of integration

The majority of pupil -respondents indicated that environmental sustainability issues were extremely beneficial once in the curriculum. Seventy two percent pupil - respondents maintained that combating deforestation was extremely beneficial once in the curriculum. Fourty five (84%) of pupil respondents mantained that protecting and promoting human health was beneficial once incoroporated in the curriculum.Managing solid waste and sewage were extremely beneficial once in the curriculum. Furthermore, 42 (80%)pupil - respondents felt that protecting the atmosphere as well as managing land sustainably 39 (73%) were extremely beneficial while 46 (86%)pupil - respondents felt that protecting and managing fresh water was extremely beneficial. For other responses refer to Figure 15.

4.5.3Responsibilities to be acquired by learners

In this question stakeholders were asked to rank issues according to how important they felt each was as a benefit of incorporating environmental sustainability issues in the science education curriculum to learners.

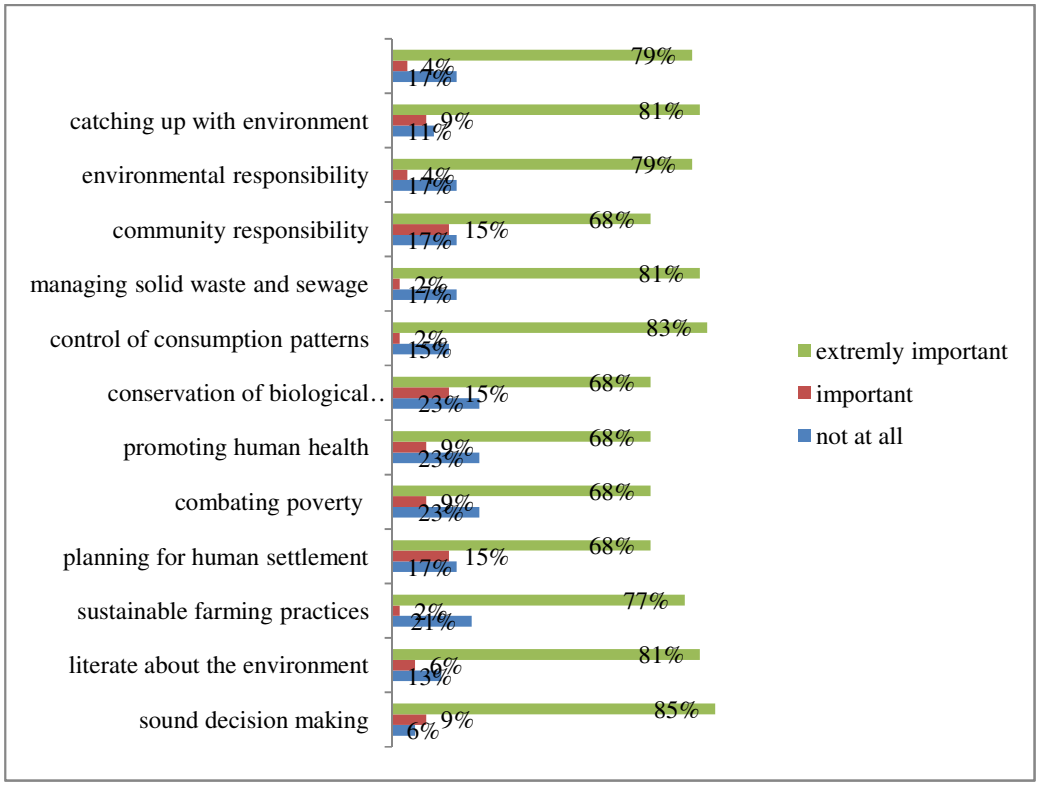


Figure 164: Responsibilities to be acquired by learners

In the first place 45(85%) respondents felt that with sustainability issues in the curriculum the country would catch up with new scientific facts discovered at a rapid pace; followed by 44 (83%) respondents who felt that learners would graduate with social responsibility of protecting and promoting human health through carefull use of fuels and chemicals; in third place 43 (81%) respondents indicated that learner would graduate with social responsibility on how to combat poverty without destroying the environment through timber logging and clearing land for agriculture, that learners would be literate about the 'environment' and that it would help the country to catch up with fast changing and challenging social, economic, political, technological and natural environment. While in fourth place 42(79%) respondents agreed that learners would graduate with socio-ecological responsibility on the use of sustainable farming practices; in fifth place 41(77%) respondents agreed that learners would act with responsibility when employed in government institutions to promote ideas of global environmental responsibility. Sixth and seventh place were as displayed in Figure 16.

4.5.4 Responsibilities to be acquired by learners

In this question pupil - respondents were asked to rank issues according to how important they felt each was as a benefit of incorporating environmental sustainability issues in the science education curriculum to learners. Figure 17 shows the responses.

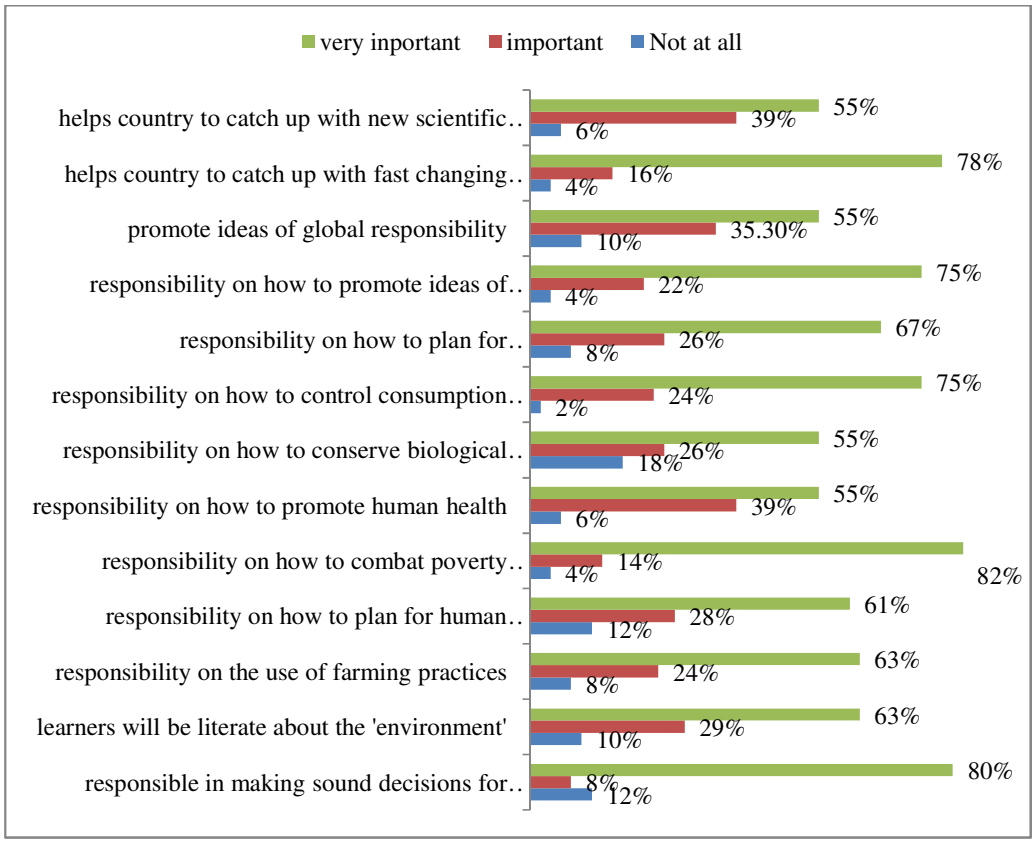


Figure 5: Responsibilities to be acquired by learners

Fourty three (82%) pupil - respondents felt that with sustainability issues in the curriculum learners would graduate with social responsibility on how to comating poverty without destroying the environment through timber logging and clearing land for agriculture. Fouty two (80%)-pupilrespondents felt that with sustainability issues in the curriculum learners would graduate with political responsibility on how to make sound decisions for sustainable. Furthermore, 41(78%) pupil - respondents felt that with sustainability issues in the curriculum the country would catch up with changing and challenging social, economic, political, technological and natural environment. An additional 39(74%) pupil - respondents felt that learners would graduate with social responsibility on how to promote ideas of community,

economic and ecological responsibility as well as protecting and promoting human health through carefull use of fuels and chemicals.

4.6 Challenges encountered

To establish challenges encountered in teaching environmental sustainability issues using the existing science teaching methods, interviewees were asked to state what challenges they faced.

> *The methods are just alright. Mainly there are no text books; the other aspect is lack of guidelines on practicals for integrated science as well as guidelines for continuous assessment. There are no guidelines on how to prepare the learners for practical examinations. The other thing is that the curriculum is bulky and yet examinations are coming early. It is like more work has been added instead of removing. They have reduced on time and increased on work to be done (Interviewee # 7).*
>
> *Another interviewee said, there are no books so we are trespassing. We are using biology, chemistry and physics books except we are just trying to reduce the level to that of grade 8 but all the methods are just alright (Interviewee # 3).*
>
> *Interviewee # 6 said; "time for formulation of curriculum was limited. Also it was a challenge to integrate issues in certain topics as well as subjects. There are so many issues such that they cannot all be made as independent subjects. How many subjects can we have?*

4.6.1Opinion on challenges they facedin integrating sustainability issues

In this question respondents were asked to give their opinion on challeges faced in incorporating environmental sustainability issues in the science education curriculum at junior level. The following were their responses:

Twenty two (53%) respondents agreed that the process of integration was a considerable challenge because it was very expensive on the part of government. Twenty seven (51%) respondents felt that lack of trained teachers in the field of environmental education was a considerable challenge. From the findings 26 (49%) respondents also indicated that it was a considerable challege that teachers of science were few and that they were already over loaded with science periods. Another

26(49%) respondents felt that thinking that there were no environmental problems in Zambia was a considerable challenge; 23(43%) respondents agreed that lack of information, knowledge and skills on most of the 'environmental' issues poses a substantial challenge. Furthermore,11(21%) said that environmental sustainability issues were too involving and thus difficult for grade 8 and 9 learners. The rest of the information was as displayed in Figure 18

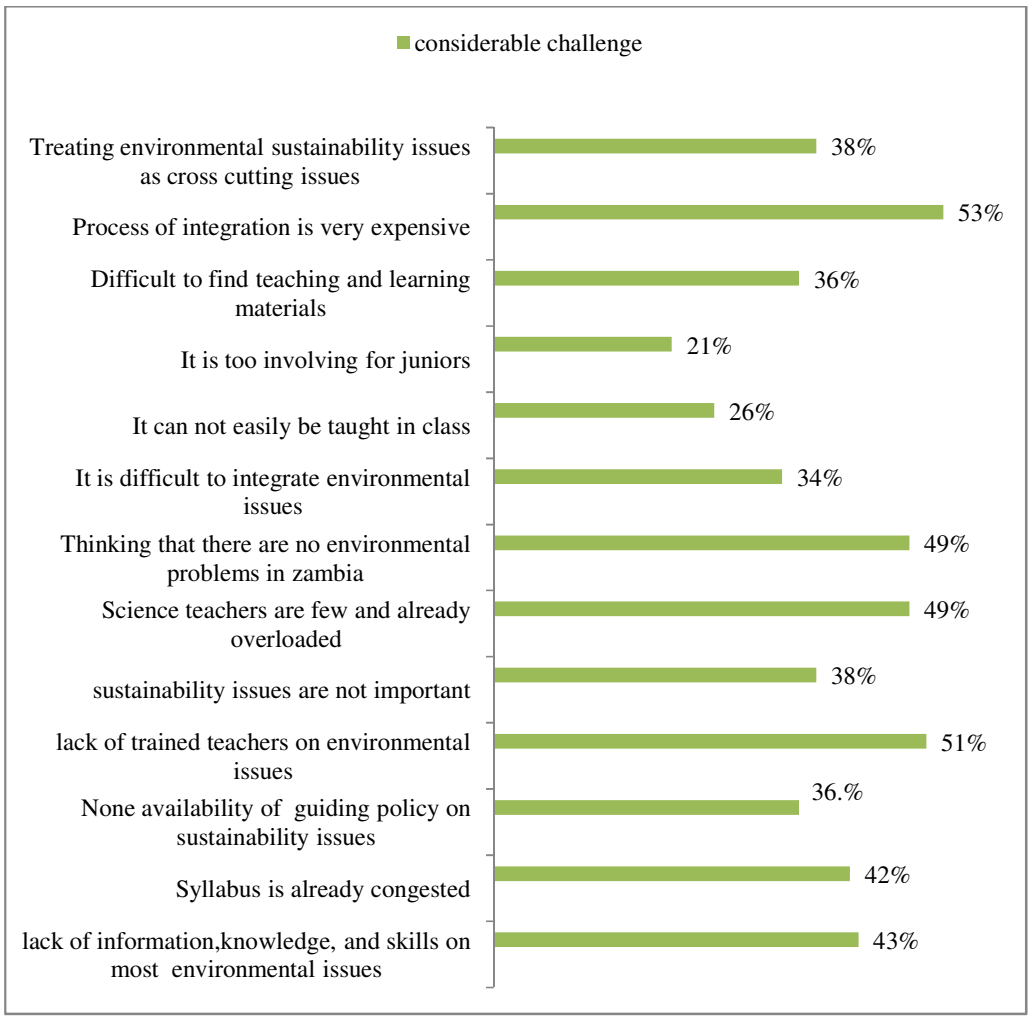


Figure 68: Challenges in integrating environmental sustainability issues

4.6.2 Suggested solutions to challenges

A follow up question was asked to suggest solutions to a list of challenges suggested in section 4.6.1

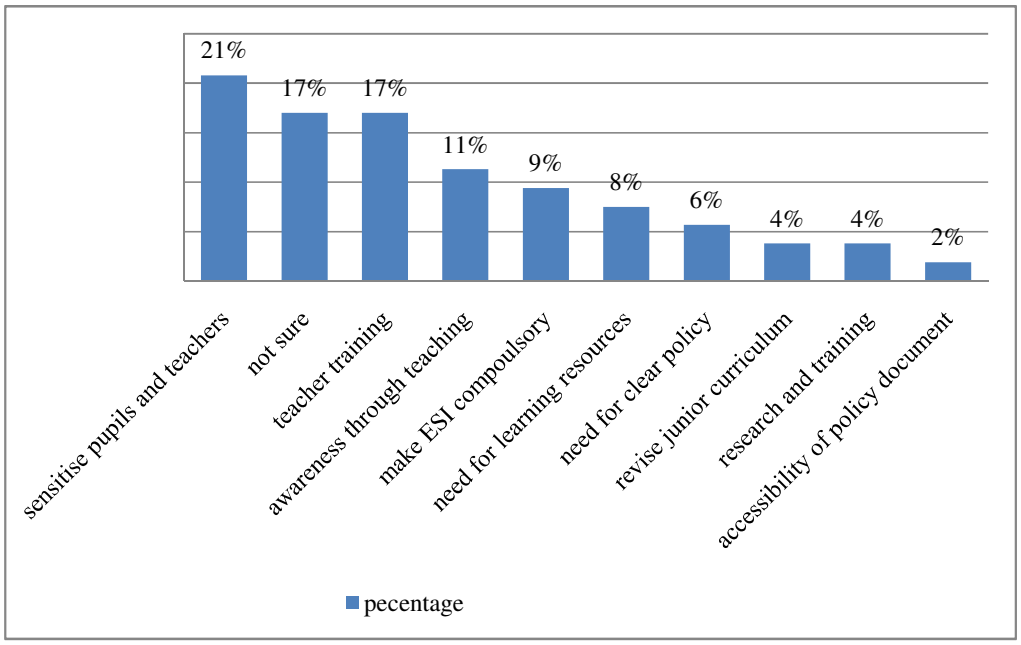


Figure 19: Suggested solutions to challenges listed in section 4.6.1

Eleven (21%) of the respondents felt that challenges would be solved if teachers and pupils were sensitized, 9 (17%) said that if teachers were trained, another 9 (17%) said they were not sure of what to say, 6 (11%) said if there could be awareness through teaching, 5(9%) felt that the solution was to make the learning of environmental sustainability issues compulsory, 4 (7%) felt that there was need for the ministry to provide teaching and learning resources, 3 (6%) of respondents indicated that there was need for a clear policy on environmental sustainability issues, 2 (4 %) said that there was need for research and training into environmental sustainability issues as well as revision of the junior secondary curriculum, while 1(2%) respondents said that there was need for accessibility of the policy document.

4.7Legislative changes

The researcher wanted to find out more onchanges that could have taken place with the aim of mainstreaming environmental sustainability issues in the curriculum. Thirty eight(72%) respondents said yes there were legislative changes that existed with the aim of mainstreaming environmental sustainability issues in the curriculum while 15(28%) respondents said there were no legislative changes that existed.

4.7.1Policy documents influencing the inclusion of sustainability issues

The researcher also sought toconfirm whether environmental sustainability issues were enshrined in any of the policy documents that influence inclusion in the curriculum. Thirty one (58%) respondents felt environmental sustainability issues were enshrined in the policy document (Educating Our Future of 1996); 13(25%) said they were not sure; 4 (8%) said environmental sustainability issues were enshrined in laws; 3 (6%)felt environmental sustainability issues were enshrined in statements while 2 (4%) feltenvironmental sustainability issues were enshrined in regulations.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

This study principally sought to determine the extent to which environmental sustainability issues were integrated in the 2013 revised science education curriculum at junior level in the context of research questions and objectives (section 1.5 and section 1.7). The chapter discusses the 15 issues identified for analysis from agenda 21(Table 5 and 6).

Objective one of this study sought to determine the extent to which environmental sustainability issues were integrated in the 2013 science education curriculum at grade 8 and 9. Table 5 shows that 9out of the 15 issues (Table 13) (60%) were integrated intointegrated science grade 8 and 9. Furthermore, Table 12 shows that 9out of 15 issues (Table 13) (60%) were integrated into agricultural science grade 8 and 9.However, the extent of integration varied from one issue to another.The following issues were not adequately addressed in both integrated and agricultural science curriculum; combating deforestation, combating desertification and drought and consumption patterns.

Integrated science curriculum addressed more of social and ecological issues and to smaller extent political issues. Both pupil and teacher respondents felt that issues on pollution (water, land and air) and health were dealt with adequately in the curriculum.Nine issues were addressed in this category; protecting and promoting human health, protecting the atmosphere, protecting and managing fresh water, managing solid waste and sewage, conservation of biological diversity, managing of land sustainably, sustainable agriculture and rural development, combating poverty and making decisions for sustainable development. The three pillars of sustainable development were represented in the curriculum. This is in line with a study carried on the extent of integration of sustainability issues in the geography curriculum byDalelo (2010). In his study, Dalelo (2010) revealed that the three pillars or building blocks of sustainable development were represented in the geography curriculum, with more courses dealing with social/economic issues. The findings of the present study revealed that more issues on ecological, social and economic were integrated.These findings imply that curriculum developers still have a pendingjob to balance the integration of the four dimensions of the environment in the curriculum if

learners have to develop critical skills needed to stop environmental degradation. A curriculum that affect quality as in incorporating new areas of concern in response to social, economic, political and ecological changes is needed, much more the balance between subject- disciplinary, and the challenges of effective pedagogy. In this case, not only is it important to stress the static nature of science education in the country, but also the lack of both collective and individual responsibility towards the environment in its totality and the consequences of not taking appropriate and immediate actions to stop the process of environmental degradation.Saylan and Blumstein (2011: 1) concerted with the statement saying:

> *A conservative approach would dictate that our societies act expediently to mitigate these potential threats. But this is not happening. Instead, we are all paralyzed by indecision, argument, misplaced politicization of the issues, and a wide spread lack of commitment to change. The pace of 'environmental' degradation, however, is not slowing. This collective inability to act is brought about in part by educational institutions that generally do not provide the tools necessary for critical thinking and for understanding the modern world. Nor do they teach individual responsibility and social engagement, two fundamental tenets of free and democratic societies*Saylan et al (2011:1).

Integrating environmental sustainability issues in thecurriculum is an important step in the direction of improving learner responsibility towards the environment. Science is a living subject and as such it changes with the changes taking place in the environment. Therefore, learner responsibility towards the environment develops when the changes affecting the environment are incorporated into the curriculum.Sanjee, Sayed and Rodriguez (2010)wrote,

> *according to GMR environmental education and education for sustainable development incorporate 'concerns over population and food supplies, depletion of natural resources and ozone layer, the greenhouse effect and possible solutions for such environmental* concerns' (*UNESCO 2005: 150). These issues are vital for countries where natural resources are envisaged as the meansto achieve economic growth. Zambia for example with its abundant natural resources in the form of minerals, land,forestry,natural attractions*

and water, stands a better chance of achieving her vision with proper investments in human capital development(Ministry of Education 2008:4) (SARE, 2010:88).

Therefore, environmental sustainability issues are vital for the curriculum if the country is to safeguard its precious natural resources. The country will need human capital that is responsible and also knowledgeable about environmental issues to carry out certain duties with regard to the environment and to make informed decisions over its natural resources without which the country will continuously be at a loss. However, Saylan et al, (2011:48) says; "effecting changes in behaviour that have positive, significant impact on the 'environment' will take much more than just curricula".

Agriculture science curriculum addressed issues of social, ecological and economic aspects.In this category nine issues were addressed which included; conservation of biological diversity, managing of land sustainably, sustainable agriculture and rural development, making decisions for sustainable development,management of biotechnology, combating poverty, population and sustainability and sustainable human settlement. This is also in line with the views of pupil and teacher respondents and interviewees. Consequently, integrated science addressed the same number of issues as agricultural science curriculum (Table 11 and 12). The extent to which the two courses addressed specific environmental sustainability issues are discussed in the next section. One notable feature about the integration of these issues is that they were clouded in just a few subtopics instead of being spread out through the curriculum(Table5 and 6). In the same vein more ecological, social and economic issues were incorporated compared to political issues. In line with these findings, Ofowono-orecho, (1996) in his study in Uganda revealed that environmental aspects were covered in the various academic subjects in the curriculum. The curricula,however, revealedcompartmentalisation rather than holistic approaches and strategies as well as inadequate co-ordination.

5.2 Extent of integration

This segment of the study presents a comprehensivedescription of how environmental sustainability issues have been addressed in the curriculum.Eachof the

15 issues would be examined following the order in which they are presented in Agenda 21. However, for conciseness' sake some of the issues have been combined.

5.2.1Poverty and consumption patterns

The two issues fall under social environment and economic environment and are very important. Poverty has adequately been addressed in the 2013 revised curriculum while patterns of consumption have not been addressed in both integrated and agricultural science curriculum. Poverty has adequately been addressed in topics such as health in integrated science, agriculture in Zambia, livestock production and crop production in agricultural science. Topics such as vulnerability and food security, patterns of food insecurity and poor households could be considered for future coverage in the curriculum.Dalelo, (2010) revealed that the three pillars or building blocks of sustainable development were represented in the curriculum, with more courses dealing with social/economic issues. This is in line with the present study, social and economic issues were incorporated in the revised science curriculum.

5.2.2 Population and sustainability, human health and human settlement

The three issues fall under the social, economic and ecological environments. Of the three, human health has enjoyed the highest coverage in the revised curriculum. There are a number of topics and subtopics that have addressed this issue both directly and indirectly. Topics such as fertilization and embryo development, respiratory system, sexually transmitted infection and impact of HIV and AIDS on population. Population and human settlement have been lightly covered in agricultural science under the effects of human population on agriculture. Topics for future coverage in this area include population distribution in relation to farming land, patterns of settlement in relation to farming land, changing human-environment relations.

5.2.3 Protecting the atmosphere

This issue falls under the ecological environment. The issue has been highly addressed in the 2013 revised curriculum. The issue has been covered in topics such as the environment, specifically under water, air and land pollution. It has also been covered indirectlyunder cycles in the biosphere. Topics for future consideration include; importance of plants in the production of oxygen, importance of tress in

preventing pollution, ozone layer depletion and relationship between population and pollution.

5.2.4 Management of land, agriculture and rural development

These issues enjoyed the highest coverage in the curriculum. The following topics addressed these issues both directly and indirectly; plant growth and nutrients, organic (manures) and chemical (artificial) fertilizers, vegetable garden, weed control, pest control, importance of trees in soil management and manures and ashes. Topics for future coverage include the following; use of medicinal plants and role of trees in building an economy.

5.2.5 Combating deforestation, desertification and drought

These issues have not been adequately addressed in the 2013 curriculum. These issues have not been covered directly or indirectly in both integrated and agricultural sciences. The only subtopic that has to some extent tried to address deforestation, desertification and drought is importance of trees in soil conservation. Topics for future consideration include; importance of forest areas, climate change, destruction of biological diversity and destruction of habitats.

5.2.6 Conservation of biological diversity

The issue has not been adequately dealt with in the curriculum. There is no topic that has dealt with conservation of biological diversity directly. The few topics that have tosome extent tried to address the issue indirectly comprise; effects of population on agriculture, cycles of the biosphere, conservation of animals and plants, importance of trees in soil management and importance of livestock. There is need for clarity in the curriculum on this issue.Topics for further consideration comprise; impact of man on the environment, the role of man in protection and conservation, function of ecosystem and biodiversity abuse.

5.2.7 Management of fresh water

A subtopic on water management has been introduced in grade 9 integrated science. It is aimed at enabling learners understand the importance of managing water and water management systems. It is also covered indirectly under water, air and land pollution. Topics for further consideration under this section include; basic concepts in water resource management, water scarcity, over-exploitation of ground water.

5.2.8 Solid waste and sewage

The issue has not been adequately dealt with in the curriculum. There is no specific topic that has dealt with solid waste and sewagedirectly. The only topic that has tried to incorporate the issue indirectly is: the environment and specifically on causes of pollution. Topics for further consideration include: planning for improved collection and transportation of waste, drainage system, sewerage, dump sites in institutions and public places as well as treatment and disposal of toxic substances.

5.2.9 Decisions for sustainable development

The issue has not been adequately addressed in the curriculum. However, the topic has to some extent been incorporateunder the following subtopics: conservation of animals and plants, agricultural economics, agriculture practice and industry and entrepreneurship. Topics for further consideration include: relationship between use of natural resources and economic development, interactions among population, environment and natural resources, global issues on environment.

5.2.10 Biotechnology

The issue has not been adequately addressed in the curriculum. The only subtopic that has to some extenttried to incorporate this issue is a topic on breeds (Agricultural science) under chapter four section three.

5.3 General knowledge on environmental sustainability issues

Objective two of this study sought to establish knowledge of environmental sustainability issues among stakeholders and pupils. Charts such as Figures 4 and 13 shows that respondents in the study area demonstrated an awareness of environmental sustainability issues. Both groups showed increasing awareness on issues dealing with social and ecological environment than those issues dealing with economic and political environment.Further, respondents demonstrated increasing awareness of issues related to current environmental problems.Respondents indicated that they got information about environmental sustainability issues from television, radio, newspaper and schools where they were.

5.4Teaching methods

Objective three of this study sought to determine teaching methods used in the 2013 revised science education curriculum. The process of integration of environmental sustainability issues in the curriculum is a vital one however efforts may go to

wastewithout the use of appropriate teaching methods. Availability of teaching and learning resources is equally important. To this effect,Eilam and Trop (2011) inDalelo (2010) strongly suggest that academic learning, inter/multidisciplinary learning, multidimensional learning and emotional learning are four essential principles of environmental education or education for sustainable development pedagogy. Therefore, teaching environmental sustainability issues with existing methods in the 2013 curriculum may pose a challenge to both teachers and learners. Most of the teaching methods suggested in the curriculum are classroom based. This was also confirmed by responses from questionnaires andinterviewsas well as document review.

> *The old methods were quite fine except they lacked detail. However, the new methods are very good because the curriculum is very detailed, it guides the teacher where to tough, and it is not like the old one. This one guides the teacher on the knowledge that they have to give to the learners. On that one it is very good. However most of the teaching methods are classroom based (Interviewee #5).*

Respondents(section 4.4.13)indicated that teaching methods most used in the teaching of science were demonstration 43(81.1%), experimentation 41(77.3%), and observation 25 (47.2%). These teaching methods are not wholly suitable for teaching environmental sustainability issues. Responses from interviewees showed a similar trend. Therefore, curriculum reorientation is needed to include such skills as observation, enquiry, classification, experimentation, problem solving, investigation and reflexivity needed for critical thinking(UNDESD, 2006). Ministry of Education (1996) despises teaching and learning that is theoretical and bookish, without opportunities for the hands-on practical experience that is of its essence. Consistent with Ministry of Education (1996), Curriculum Framework, 2013 acknowledges the fact that most of the teaching and learning is done theoretically, even for practical and science subjects. Thus there is need for an interdisciplinary type of curriculum to developing the knowledge, skills and responsibility needed for a sustainable future as well as changes in values, actions and life. In addition there are no teaching and learning resources provided towards the teaching of environmental sustainability issues included in the curriculum.

5.5 Benefits

The fourth objective of this study sought to determine benefits of incorporating environmental sustainability issues of Agenda 21 in the 2013 science education curriculum. Charts such as Figures: 9, 10, 16 and 17 shows that environmental sustainability issues were imperative, and extremely beneficial once incorporated in the curriculum. Palmer (1998:214) confirms this by saying, " the children, the future 'citizens' of the world, should have at least a basic functional environmental education – only then can an environmentally literate society be created".

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

To adequately address the social, economic and environmental problems we currently face, a new way of educating our learners is required. This new way should empower learners with the capabilities, values and skills to seek out and examine their own frameworks for thinking. This so needed change can only be achieved through changes to the curriculum and the way of teaching. Within Zambia's science education curriculum, a balance of issues on environmental sustainability is needed to develop learners' potentials, values and skills as well as develop greater understanding regarding transformation of resources sustainably. This will then support a much deeper development of curriculum and learning outcomes within the learner's body. It is time to move beyond rhetoric and implement policies and programs that will allow Zambian schools realize the goal of creating "sustainability literate" and responsible learners. Here is a message to education that there is some point in education initiatives focused on environment and sustainability issues. But just how what we do affects (and helps effect) development towards sustainability remains an open question, and more research is needed to help model our understanding of how science education can contribute to sustainable development – and to explore the probable and necessary limits of such contributions.Thus, schoolsneed to exercise their ecological, social, political and economic responsibility and explore with learners what sustainabledevelopment might be. In conclusion, my contribution is that schools and teachers should be interested in sustainable development and in sustainability even though they may not be skilled to effectively handle it. Science is an action oriented subject and can remain practical and live if we choose to get fully involved with sustainability issues. Leaders in Government, at CDC and MESVTEE should use their political will power to enforce the teaching of sustainability issues at all levels of education in Zambia for a 'sustainability literate' and responsible citizenry.

6.2 Summary and recommendations

The researcher considered in this study an official curriculum which wasofficially launched,a binding document containing all the requirements for learners to complete their two year course in integrated science and agricultural science. The topics examined in this curriculum were all compulsory although agricultural science is

taken by most schools as an optional subject. They were taught to all learners taking integrated science while in some schools, agricultural science was an optional subject. More work is needed by CDC to fully incorporate sustainability issues in the science curriculum.However, the 2013 curriculum is the first of its kind which has attempted to incorporate environmental sustainability issues in the science subjects (integrated and agriculture science), though, the way each of the subjects is taught, and the effectiveness then depends on a number of reasons, including knowledge of the subject content and capability of the subject teacher to interpret the curriculum as well as availability of teaching and learning materials.This study, therefore, recommends that the MESVTEE fully integrates environmental sustainability issues into the science curriculum for learners to realize the full benefits. In the same vein, MESVTEE should ensure a balance of issues on environmental sustainability in the curriculum to develop learners' potentials, values and skills as well as develop greater understanding regarding transformation of resources sustainably. To increase knowledge levels and awareness among the teaching staff MESVTEEshould intensify school based continuing professional development (SBCPD) as well as in-service training. Furthermore, MESVTEE should heighten SBCPD for the teaching staff to create innovations in delivery methods. For effective teaching and learning MESVTEE should look into the provision of teaching and learning resources towards the teaching of integrated and agricultural science.There is also an urgent need for a follow - up study in order to assess the effectiveness of the revised science education curriculum in achieving its stated objectives and factors that affect its effectiveness especially on sustainability issues. Such a study, if and when conducted, should pay special attention to the balance between the four dimensions of the environment; social, economic, political and ecological environment and the four essential principles of environmental education pedagogy (academic learning, inter/multidisciplinary learning, multidimensional learning and emotional learning).

In addition, MESVTEE should ensure that the testing techniques emphasise exposure to the environment if skills and values needed have to be achieved. Furthermore, CDC wasto quickly provide guidelines for practical examinations in agricultural science. As well as provide guidelines for continuous assessment for both integrated science and agricultural science at junior level.

Some of the questions that remain unanswered are as follows:

How can quality science education be assured in inconsiderate conditions as the ones weare in today were there are no apparatus, chemicals and books in most schools, few or no teachers of science? How can new areas of knowledge of sustainability befully integrated in the science curriculum without overloading and unbalancing the curriculum?Can there be reconciliation between economic development and environmental conservation? Is it possible to put in place any understanding of environmental concerns within asocio economic and political context? Is it possible to combine environment and development concerns?

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APPENDICES

Appendix 1: Researcher's introduction
RESEARCH TITLE:
INTEGRATION OF ENVIRONMENTAL SUSTAINABILITY ISSUES IN ZAMBIA'S 2013 REVISED SCIENCE EDUCATION CURRICULUM AT JUNIOR SECONDARY SCHOOL LEVEL.

E-MAIL: chilufyatheresa@yahoo.com
Date:

INTRODUCTION

My Name is Chilufya Theresa. I am a postgraduate student of Environmental Education at the University of Zambia (UNZA). I am conducting an Academic Research which is in partial fulfilment of my masters' degree qualification.

I would like to get your views on the extent to which sustainability issues have been integrated in the 2013 science education curriculum at junior secondary school level in Zambia. I will treat your responses confidentially. Your honesty is very critical and paramount in potentially assisting our country to produce environmentally responsible citizens of the future.

Yours faithfully,

Chilufya Theresa.

Appendix 2: Questionnaires

INTEGRATION OF SUSTAINABILITY ISSUES IN ZAMBIA'S 2013 REVISED SCIENCE EDUCATION CURRICULUM AT JUNIOR SECONDARY SCHOOL LEVEL.
SECTION- A BIO- DATA

Kindly answer the following questions, tick and circle where appropriate.

1. Position held at place of work_____

2. Work experience in years. How long have you been working in your current position?

Below 5 [ ] 6 – 10 [ ] 11 – 15 [ ] 16 – 20 [ ] Above 21 [ ]

3. Sex Male [ ] Female [ ]

4. Age 21 – 30 [ ] 31 - 40 [ ] 41 - 50 [ ] Above 51 [ ]

5. What is your qualification?

Master's Degree [ ] Postgraduate Diploma [ ] Bachelor's Degree [ ] Diploma [ ] Certificate [ ]

Others please specify……

SECTION: B – General knowledge of environmental sustainability issues as defined by Agenda 21.

Kindly read the statements below and give your best judgement about environmental sustainability issues.

6. When people talk about "environmental sustainability issues," which of the following do you think of first?

Combating poverty [ ] Changing consumption patterns [ ]

Population and sustainability [ ] Protecting and promoting human health [ ]

Sustainable human settlements [ ] Making decisions for sustainable development [ ]

Protecting the atmosphere [ ] Management of land sustainably [ ]

Combating deforestation [ ] Combating desertification and drought [ ]

Sustainable agriculture and rural development [ ] Conservation of biological diversity [ ]

Management of biotechnology [ ] Protecting and managing fresh water [ ]

Managing solid wastes and sewage [ ]

7. How often have you heard about environmental sustainability issues?

Very often [ ] Fairy often [ ] Often [ ] Not often [ ]

8. From the list below tick five (5) of your major sources of information about environmental sustainability issues. Magazines [ ] Newspapers [ ] Television news [ ] Radio [ ] School [ ] Church [ ] Workshops [ ] Conservation club [ ]

9. Have you studied any courses pertaining to environmental studies? [ ] Yes [ ] No

10. If your answer is yes in 9 above choose from the list below the course(s) you have studied.

Environmental science [ ] Environmental engineering [ ]

Environmental conservation [ ] Environmental communication [ ]

Environmental education [ ] Environmental law [ ]

Natural Resource Management [ ] Environmental management [ ]

Forest conservation [ ]

Others please specify
……

SECTION: C - Integrating environmental sustainability issues of Agenda 21

Below is a list of sustainability issues of Agenda 21. Please read each issue and tick one phrase from the table which is appropriate and that which best describes the extent of integration.

11. To what extent have the following environmental sustainability issues of Agenda 21 been integrated in the 2013 revised science education curriculum at junior secondary?

Environmental sustainability issues	Extremely	To a great extent	Moderately	A little	Not at all
Combating poverty					
Changing consumption patterns					
Population and sustainability					
Protecting and promoting human health					
Sustainable human settlements					
Making decisions for sustainable development					
Protecting the atmosphere					
Management of land sustainably					
Combating deforestation					
Combating desertification and drought					
Sustainable agriculture and rural development					
Conservation of biological diversity					
Management of biotechnology					
Protecting and managing fresh water					
Managing solid wastes and sewage					

SECTION: D – Environmental sustainability issues - teaching and learning resources.

12. From the following list, kindly tick related education resources available for both learners and teachers for teaching and learning environmental sustainability issues in the 2013 revised science education curriculum.

Books on sustainability concerns [ ] Physical sites [ ]

Books on the environment [ ] Charts [ ]

Circulars on environmental sustainability [ ] Videos about the environment [ ]

Others please
specify……

SECTION: E - Environmental sustainability issues – teaching methods

13. From the following list, kindly tick five (5) education teaching methods you feel can be suitable for teaching environmental sustainability issues.

Field work [ ] Field trip [ ] Project work [ ] Presentation [ ]

Experimentations [ ] Explorations [ ] Demonstrations [ ]

Observations [ ] Role play [ ] Quizzes and games [ ]

Problem solving [ ] Reflexivity [ ] Investigations [ ]

Enquiry [ ] Classification [ ] story telling [ ]

14. Which of these methods are frequently used for science teaching in Zambia?

Field work [ ] Field trip [ ]

Project work [ ] Presentation [ ]

Experimentations [ ] Explorations [ ]

Demonstrations [ ] Observations [ ]

Role play [ ] Quizzes and games [ ]

Problem solving [ ] Reflexivity [ ]

Investigations [ ] Enquiry [ ]

Classification [ ] Story telling [ ]

SECTION F I: - Benefits of integration.

15. Below is a series of environmental sustainability issues from Agenda 21. Please read each statement and circle one appropriate number that best indicates your opinion on whether a particular environmental sustainability issue will be beneficial or not once in the curriculum. Use the following five point scale to describe the extent of your opinion.

Extremely not Beneficial Extremely Beneficial

1 2 3 4 5

Environmental sustainability issues	Extremely not Beneficial				Extremely Beneficial
i. Combating poverty	1	2	3	4	5
ii.Changing consumption patterns	1	2	3	4	5
iii.Population and sustainability	1	2	3	4	5
iv.Protecting and promoting human health	1	2	3	4	5
v.Sustainable human settlements	1	2	3	4	5
vi.Making decisions for sustainable development	1	2	3	4	5
vii.Protecting the atmosphere	1	2	3	4	5
vii.Management of land sustainably	1	2	3	4	5
ix.Combating deforestation	1	2	3	4	5
x.Combating desertification and drought	1	2	3	4	5
xi.Sustainable agriculture and rural development	1	2	3	4	5
xii.Conservation of biological diversity	1	2	3	4	5
xiii.Management of biotechnology	1	2	3	4	5
xiv.Protecting and managing fresh water	1	2	3	4	5
xv.Managing solid wastes and sewage	1	2	3	4	5

SECTION F II: - Benefits of integration.

Below is a series of statements regarding the benefits of integrating environmental sustainability issues in the 2013 revised science education curriculum. Please read and rank the statements according to how important you think each is as a benefit of incorporating environmental sustainability issues in the science education

curriculum. Use the following response scale: 1 = not at all, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important

16. How important do think the following benefits are to you as a result of integrating environmental sustainability issues in the 2013 revised science education curriculum?

Benefits of integrating ESI.					
With sustainability issues in the curriculum;	Not at all				Extremely Important
i. Learners will graduate with political responsibility on how to make sound decisions for sustainable development	1	2	3	4	5
ii.Learners will be literate about the 'environment'	1	2	3	4	5
iii.Learners will graduate with socio- ecological responsibility on the use of sustainable farming practices.	1	2	3	4	5
iv. Learners will graduate with political responsibility on how to plan for sustainable human settlement.	1	2	3	4	5
v.Learners will graduate with social responsibility on how to combat poverty without destroying the 'environment' through timber logging and agricultural clearing.	1	2	3	4	5
vi.Learners will graduate with a social responsibility of protecting and promoting human health through care full use of environmentally unfriendly fuels and chemicals.	1	2	3	4	5
vii.Learners will graduate with social and ecological responsibility and consciousness on the conservation of biological diversity, forests and woodlands.	1	2	3	4	5
viii.Learners will graduate with economic responsibilities on how to control consumption patterns which lead to over use of resources.	1	2	3	4	5
ix.Learners will graduate with social and economic responsibility on how to plan for management of solid waste and sewage.	1	2	3	4	5
x.Learners will act with responsibility when employed in the world of industry and commerce to promote the ideas of community, economic and ecological responsibility.	1	2	3	4	5
xi.Learners will act with responsibility when employed in government institutions to promote ideas of global environmental responsibility.	1	2	3	4	5
xii.It helps the country to catch up with fast changing and challenging social, economic,	1	2	3	4	5

political, technological and natural environment. xiii.It helps the country to catch up with new scientific facts discovered at a rapid pace.	

SECTION G: -Challenges in integrating environmental sustainability issues.

17. Below is a list of statements regarding various reasons why it might have been a challenge to integrate environmental sustainability issues in the school curriculum at junior level? Kindly read each statement carefully and check for an appropriate box for each item to indicate whether it would be; 1 = 'not a challenge', 2 = 'somewhat a challenge', 3 = 'substantial challenge'.

How much of a challenge would the following situations be?	Not a challenge	Somewhat a challenge	Considerable challenge
i.Lack of information, knowledge and skills on most the environmental issues.	1	2	3
ii.The junior secondary syllabus is already congested.	1	2	3
iii.There is no guiding policy on environmental sustainability issues.	1	2	3
iv.Lack of trained teachers in the field of environmental sustainability issues in schools	1	2	3
v. Environmental sustainability issues are not important to me as a Zambian and do not affect me in any way.	1	2	3
vi.Teachers of science are already overloaded with excess periods.	1	2	3
vii. There are no environmental problems in Zambia therefore there is no need to learn or teach environmental sustainability issues.	1	2	3
viii.It is difficult to integrate environmental sustainability issues in the curriculum because of its multiple disciplines.	1	2	3
ix.Environmental sustainability issues cannot easily be taught in class.	1	2	3
x.It is too involving and difficult for junior grades.	1	2	3
xi.It is difficult to organise teaching and learning materials for teaching environmental sustainability issue.	1	2	3
xii.The process of integration is very expensive and the government has no	1	2	3

money. xiii.Treating environmental sustainability as a cross-cutting issue.	1	2	3

Others please specify…….

18. Suggest what could be done to solve some of the challenges listed above.

……

19. Are there any legislative changes that exist with the aim of mainstreaming environmental sustainability issues? [ ] Yes [ ] No

20. From the following list, confirm by ticking whether environmental sustainability issues are enshrined in any of the listed policy documents that influence the inclusion of environmental sustainability issues in formal education curricular.

White paper [ ]

Laws [ ]

Regulations [ ]

Circulars [ ]

Statements [ ]

Policy [ ]

Others please specify ……

Thank you

RESEARCH TITLE:
INTEGRATION OF ENVIRONMENTAL SUSTAINABILITY ISSUES IN ZAMBIA'S 2013 REVISED SCIENCE EDUCATION CURRICULUM AT JUNIOR SECONDARY SCHOOL LEVEL.

SECTION A: BIO DATA

Kindly answer the following questions, tick and circle where appropriate.

1. Grade _____

2.
School_____
___

3. Sex Boy [ ] Girl [ ]

4. Age 10 - 12[ ] 13 - 15 [ ] 16 - 18 [ ] Above 18 [ ]

SECTION: B – General knowledge of environmental sustainability issues as defined by Agenda 21.

Kindly read the statements below and give your best judgement about environmental sustainability issues.

5. When people talk about "environmental sustainability issues," which of the following do you think of first?

Combating poverty [ ] Changing consumption patterns [ ]

Population and sustainability [ ] Protecting and promoting human health [ ]

Sustainable human settlements [ ] Making decisions for sustainable development [ ]

Protecting the atmosphere [ ] Management of land sustainably [ ]

Combating deforestation [ ] Combating desertification and drought [ ]

Sustainable agriculture and rural development [ ] Conservation of biological diversity [ ]

Management of biotechnology [ ] Protecting and managing fresh water [ ]

Managing solid wastes and sewage [ ]

6. How informed are you about environmental sustainability issues?

Very well informed [ ] Fairly well informed [ ]

Not well informed [ ] Not informed at all [ ]

7. From the list below, kindly tick five environmental sustainability issues that you are well informed about.

Agricultural pollution (use of pesticides, fertilizers, etc) [ ]

The use of genetically modified organisms in farming [ ]

The impact on our health of chemicals used in everyday products [ ]

The impact of cutting trees for timber, charcoal and for agricultural purposes [ ]

Pollution (air, water, land, noise, etc) [ ]

Depletion of natural resources/ biodiversity [ ]

The impact of unplanned settlements [ ]

Our consumption habits [ ]

Growing solid and sewage waste [ ]

Others please specify ……

8. How often have you heard about environmental sustainability issues?

Very often [ ] Fairy often [ ] Often [ ] Not often [ ]

9. From the list below tick five (5) of your major sources of information about environmental sustainability issues. Magazines [ ] Newspapers [ ] Television news [ ] Radio [ ] School [ ] Church [ ] Workshops [ ] Conservation club [ ]

10. Do you have environmental clubs at your school? Yes [ ] No [ ]

11. From the list below please tick environmental club(s) existing in your school.

Conservation club [ ] ENO club [ ]

Chongololo club [ ]

Others please specify ……

12. Do you belong to any of the clubs listed above? Yes [ ] No [ ]

13. How environmental friendly is your school in terms of the following? Kindly tick the appropriate box to indicate the extent of concern of your school for the environment.

Environmental activity	Very friendly	To a great extent	Moderately	A little	Not at all
Solid waste management and litter					
Tree planting					
Water reticulation					
Parking area					
Greening the environment					
Gardening					
Painting the buildings					
Rubbish pit					

SECTION: C - Integrating environmental sustainability issues of Agenda 21

14. To what extent have the following environmental sustainability issues of Agenda 21 been integrated in the 2013 revised science education curriculum at junior secondary?

Environmental sustainability issues	Extremely	To a great extent	Moderately	A little	Not at all
Combating poverty					
Changing consumption patterns					
Population and sustainability					
Protecting and promoting human health					
Sustainable human settlements					
Making decisions for sustainable development					
Protecting the atmosphere					
Management of land sustainably					
Combating deforestation					
Combating desertification and drought					
Sustainable agriculture and rural development					
Conservation of biological diversity					
Management of biotechnology					
Protecting and managing fresh water					
Managing solid wastes and sewage					

SECTION: D – Environmental sustainability issues - teaching and learning resources.

15. From the following list, kindly tick the teaching materials your teacher uses for teaching and learning of environmental sustainability issues in your school

Books on sustainability concerns [ ] Physical sites [ ]

Books on the environment [ ] Charts [ ]

Circulars on environmental sustainability [ ] Videos about the environment [ ]

Others please specify…….

SECTION: E - Environmental sustainability issues – teaching methods

16. From the following list, kindly tick five education teaching methods you feel can be suitable for teaching environmental sustainability issues.

Field work [ ] Project work [ ] Presentation [ ]

Experimentations [ ] Explorations [ ] Demonstrations [ ]

Observations [ ] Role play [ ] Quizzes and games [ ]

Problem solving [ ] Reflexivity [ ] Investigations [ ]

Field trip [ ] Enquiry [ ] Classification [ ] story telling [ ]

17. Which of these methods are frequently used by your teacher for science teaching in your school?

Field work [ ] Field trip [ ] Project work [ ] Presentation [ ] Experimentations [ ] Explorations [ ] Demonstrations [ ] Observations [ ] Role play [ ] Quizzes and games [ ] Problem solving [ ] Reflexivity [ ] Investigations [ ] Enquiry [ ] Classification [ ] Story telling [ ]

SECTION F I: - Benefits of integration.

18. Below is a series of environmental sustainability issues from Agenda 21. Please read each statement and circle one appropriate number that best indicates your opinion on whether a particular environmental sustainability issue will be beneficial or not once in the curriculum. Use the following five point scale to describe the extent of your opinion.

Extremely not Beneficial Extremely Beneficial

1 2 3 4 5

Environmental sustainability issues	Extremely not Beneficial				Extremely Beneficial
i.Combating poverty	1	2	3	4	5
ii.Changing consumption patterns	1	2	3	4	5
iii.Population and sustainability	1	2	3	4	5
iv.Protecting and promoting human health	1	2	3	4	5
v.Sustainable human settlements	1	2	3	4	5
vi.Making decisions for sustainable development	1	2	3	4	5
vii.Protecting the atmosphere	1	2	3	4	5
vii.Management of land sustainably	1	2	3	4	5
ix.Combating deforestation	1	2	3	4	5
x.Combating desertification and drought	1	2	3	4	5
xi.Sustainable agriculture and rural development	1	2	3	4	5
xii.Conservation of biological diversity	1	2	3	4	5
xiii.Management of biotechnology	1	2	3	4	5
xiv.Protecting and managing fresh water	1	2	3	4	5
xv.Managing solid wastes and sewage	1	2	3	4	5

SECTION F II: - Benefits of integration.

Below is a series of statements regarding the benefits of integrating environmental sustainability issues in the 2013 revised science education curriculum. Please read and rank the statements according to how important you think each is as a benefit of incorporating environmental sustainability issues in the science education curriculum.

Use the following response scale: 1 = not at all, 2 = somewhat important, 3 = important, 4 = very important, 5 = extremely important.

19. How important do you think the following benefits are to you as a result of integrating environmental sustainability issues in the 2013 revised science education curriculum?

Benefits of integrating ESI.					
With sustainability issues in the curriculum;	Not at all				Extremely Important
i. Learners will graduate with political responsibility on how to make sound decisions for sustainable development	1	2	3	4	5
ii.Learners will be literate about the 'environment'	1	2	3	4	5
iii.Learners will graduate with socio- ecological responsibility on the use of sustainable farming practices.	1	2	3	4	5
iv. Learners will graduate with political responsibility on how to plan for sustainable human settlement.	1	2	3	4	5
v.Learners will graduate with social responsibility on how to combat poverty without destroying the 'environment' through timber logging and agricultural clearing.	1	2	3	4	5
vi.Learners will graduate with a social responsibility of protecting and promoting human health through care full use of environmentally unfriendly fuels and chemicals.	1	2	3	4	5
vii.Learners will graduate with social and ecological responsibility and consciousness on the conservation of biological diversity, forests and woodlands.	1	2	3	4	5
viii.Learners will graduate with economic responsibilities on how to control consumption patterns which lead to over use of resources.	1	2	3	4	5
ix.Learners will graduate with social and economic responsibility on how to plan for management of solid waste and sewage.	1	2	3	4	5
x.Learners will act with responsibility when employed in the world of industry and commerce to promote the ideas of community, economic and ecological responsibility.	1	2	3	4	5
xi.Learners will act with responsibility when employed in government institutions to promote ideas of global environmental responsibility.	1	2	3	4	5
xii.It helps the country to catch up with fast changing and challenging social, economic, political, technological and natural environment	1	2	3	4	5
xiii.It helps the country to catch up with new scientific facts discovered at a rapid pace.	1	2	3	4	5

20. How is the school environment beneficial to you?

Appendix 3: Letters of request to conduct research

March 2014
The School Manager
Institution: ……
……..

Dear Sir
RE: PERMISSION TO CONDUCT RESEARCH FOR MASTER OF EDUCATION IN ENVIRONMENTAL EDUCATION

I am registered for the above-mentioned programme at UNZA. In accordance with the requirements for this degree, I am conducting a study to establish the extent to which 20 key environmental sustainability issues as defined by agenda 21 (section I and II) have been integrated in the 2013 revised science education curriculum at junior secondary school level(Grades 8 & 9) in Zambia.

The extent and ways of integration are much appreciated and will make a significant contribution both to my research and to the country in producing environmentally responsible citizens of the future. I therefore request to conduct this research at you institution.

Yours faithfully,

Chilufya Theresa.

STUDENT NUMBER: 512800112.

Dear respondent,

I am a student at the University of Zambia pursuing a Master of Education in Environmental Education. This research is a major requirement for me to complete the programme.

I wish to establish the extent to which 20 key environmental sustainability issues have been integrated in the 2013 science education curriculum at junior secondary level. Therefore, the above information serves to give you understanding of the purpose of this research and procedures that will be followed. The data collected from this research will be treated with confidentiality. Your rights will be protected and respected. You are assured that you will suffer no harm as results of participating in this exercise. You are free to ask for clarification at any point of the exercise and to inform the researcher if you feel uncomfortable about any procedure in the research.

Finally, you are requested to sign this form to indicate that you have volunteered to participate in this exercise

I have read and understood this document. I therefore agree to participant in this exercise.

…….. …….

Signature Name

March 2014
The Director Curriculum Development
Curriculum Development Centre (CDC) Lusaka
P.O Box 5oo92
Lusaka

Dear Sir

RE: PERMISSION TO CONDUCT RESEARCH FOR MASTER OF EDUCATION IN ENVIRONMENTAL EDUCATION

I am registered for the above-mentioned programme at UNZA. In accordance with the requirements for this degree, I am conducting a study to establish the extent to which 20 key environmental sustainability issues as defined by agenda 21 (section I and II) have been integrated in the 2013 revised science education curriculum at junior secondary school level(Grades 8 & 9) in Zambia.

The extent and ways of integration are much appreciated and will make a significant contribution both to my research and to the country in producing environmentally responsible citizens of the future. I therefore request to conduct this research at CDC.

Yours faithfully,

Chilufya Theresa.

STUDENT NUMBER: 512800112.

March 2014
The PEO
Provincial Education Officer Central Province (PEO) Kabwe
P.O Box 80197
Kabwe.

Dear Sir

RE: PERMISSION TO CONDUCT RESEARCH FOR MASTER OF EDUCATION IN ENVIRONMENTAL EDUCATION

I am registered for the above-mentioned programme at UNZA. In accordance with the requirements for this degree, I am conducting a study to establish the extent to which 20 key environmental sustainability issues as defined by agenda 21 (section I and II) have been integrated in the 2012 revised science education curriculum at junior secondary school level(Grades 8 & 9) in Zambia.

The extent and ways of integration are much appreciated and will make a significant contribution both to my research and to the country in producing environmentally responsible citizens of the future. I therefore request to conduct this research in 4 secondary schools of central province.

Yours faithfully,

Chilufya Theresa.

STUDENT NUMBER: 512800112.

INTERVIEW GUIDE

The main questions that were asked during the interviews were as follows:

a) What in your view is sustainability?

b) In your opinion, does the 2013 science curriculum contain issues of national concern such as health, forest conservation, air, water, and land pollution, poverty, population, waste management, agriculture and rural development?

c) What are the related teaching and learning resources provided towards the teaching of environmental sustainability issues in the 2013science education curriculum, which of these are readily available for both learners and teachers?

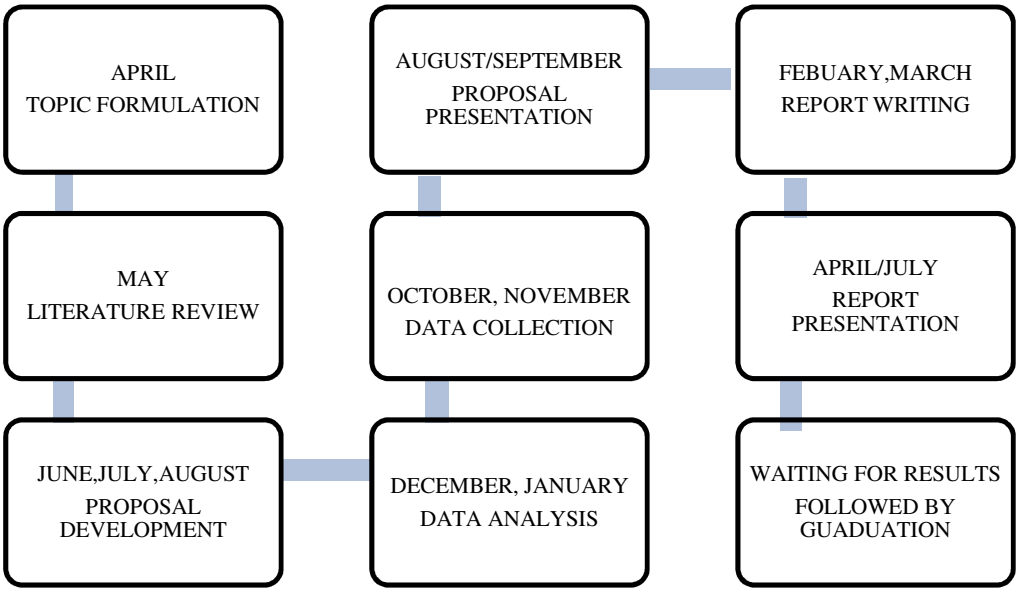
d) What do you think are the suitable methods for teaching environmental sustainability issues?

e) What do you think are the benefits of incorporating environmental sustainability issues in the science education curriculum?

f) What challenges do you encounter in integrating environmental sustainability issues using the existing science teaching methods?

g) In your view, what is the extent/degree of integration of environmental sustainability issues in the 2013 science education curriculum?

Appendix 4: Time Line



Appendix 5:Working Budget

Items	Description	Amount in Kwacha.
Tuition fees	Two semesters	K4,800.00
Examination	Per academic year	K1000.00
Research costs	All inclusive	K10,530.00
	TOTAL	**K16,330.00**

Research Cost break down

Review of Documents	Curriculum, curriculum framework, policy Documents and all relevant Documents.	KR1,000.00
Pre-test of research instruments.	Questionnaires and interview schedules.	KR 100.00
Data collection	From all respondents	KR1,000.00
Data analysis and report writing	A4 paper x 10 reams @ KR 35.00	KR 350.00
Binding(spiral)	05 Copies	KR1,000.00
Binding(hard cover)	05 Copies	KR2,000.00
Additional stationary	A5 note books x 2 @ kR10.00	KR 20.00
"	Pens x 1box @ KR10.00	KR 10.00
"	Photocopying 03 copies	KR 900.00
"	Printing o1 copy	KR 750.00
poster	01	KR 400.00
Transport	To provincial centre, study places within the province and within study areas.	KR2,000.00

Budget Justification

Preliminary Work

1. The researcher travelled to provincial centres, to study sites (schools and CDC) within the provinces and within study areas; and transport costs and lunch have been budgeted for.

Data Collection process

2. The budget allows for the living expenses of the researcher.
3. The researcher used private transport to the provincial centres, to the study sites within the provinces and within study areas.

Data Analysis and Report Writing
The study was conducted and analysed by the researcher.

Stationery
This was used from pre-test to production of final report.

Duration of study
The study was conducted from October 2013 to July 2014.