

**AN ANALYSIS OF THE CHANGES IN THE COVERAGE, TEACHING AND
EXAMINATION OF ENVIRONMENTAL IMPACT TOPICS IN THE SOUTH
AFRICAN FURTHER EDUCATION AND TRAINING BAND**

By

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DECLARATION

Student Number: 44144156

I, **Sikhulile Bonginkosi Msezane**, hereby declare that this thesis, which is submitted to the University of South Africa for the PhD in Education, has not been submitted for a degree at this or any other university and it is my work in design and execution. The title of the study is, *“AN ANALYSIS OF THE CHANGES IN THE COVERAGE, TEACHING AND EXAMINATION OF ENVIRONMENTAL IMPACT TOPICS IN THE SOUTH AFRICAN FURTHER EDUCATION AND TRAINING BAND”*. I further declare that all sources that I have used or quoted have been acknowledged by means of complete references.

A handwritten signature in black ink, appearing to be 'SB Msezane', written over a horizontal line.

Mr SB Msezane

JANUARY 2020

Date

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ABSTRACT

Environmental education and/or education for sustainability are educational responses to negative environmental impacts, both locally and globally. The South African education sector has experienced several shifts in the curriculum since 1994, thus affecting the coverage, teaching and examination of environmental impact topics in the Further Education and Training Phase (FET) phase (Grades 10-12). The effects had profound consequences for curriculum delivery. Few studies have been conducted to determine the alignment of curriculum policy requirements with teaching practice and coverage in the actual examinations of environmental impact topics that are in the curriculum. The aim of the research was to investigate how the coverage of environmental impact topics teaching has been affected by the shifts in the curriculum, and the proportional alignment of content coverage in the examinations in relation to policy projections in FET phase in South Africa. A qualitative case study design was used to frame the research. The overall findings of the study on the impact of curriculum changes were that different structures contributed towards ensuring that the environmental content knowledge gap was closed. Examiners contributed to the teaching of environmental impact topics in terms of determining which topics to focus on and their percentage coverage in the FET examinations. Their interpretation of the policy requirements therefore had direct implications on how these topics were addressed in the education system. Teachers need to collaborate and use appropriate teaching methods that improve learners' knowledge of environmental topics. Teachers also need to participate fully in training programmes that aim at improving skills in environmental content knowledge, teaching practice and assessment such as the Fundisa for Change programme.

The education system in South Africa is examination focused, therefore it is important that documents which assist teachers in the preparation of learners for examinations be aligned to the curriculum policy framework of the Department of Basic Education. Consistency in the proportional coverage of environmental impact topics in the curriculum, and alignment of the curriculum policy with actual content in the examinations would encourage pro-environment teaching practices, thereby enabling positive transformation in the culture of teaching environmental impact topics. The extent of the coverage of these topics in the examination papers will change the ways

in which both teachers and learners focus on environmental topics in their teaching and learning, both inside and outside of the classroom. This will in turn enable learners to respond to environmental issues they may encounter in their lived context. It is important to have relevant environmental teaching and learning documents that can be used by learners and teachers, such as past examination papers aligned to the policy projections of environmental impact topics in order to be able to foster structures, cultures, roles and ideas that encourage environmental sustainability. The results revealed that environmental impact topics were covered in varying degrees in the South African curriculum. The level of coverage of environmental impact topics in the examination question papers fluctuated, sometimes to levels below those stipulated in the CAPS documents. The variable coverage of environmental impact topics in the examinations can affect the way teachers address the topics in the classroom. This is based on the observation that teachers tend to focus on topics that frequently appear in past examination papers in order to prepare learners for the end of year examinations. Therefore, consistent coverage of environmental impact topics in the curriculum and examinations content can encourage the agency of teachers and learners towards greater awareness of environmental issues in their society and the need to act pro-actively towards responding to them. However, on a positive note, the shift in the curriculum focus positively influenced greater coverage, teaching and examination of environmental impact topics in South Africa's FET phase. This resulted in an emergence of structural and cultural morphogenesis in the teaching of environmental content in the FET phase.

Keywords: Environmental impact topics, content coverage, examinations, structure, culture and agency

ISIZULU: I-ABSTRACT

Imfundo yezemvelo kanye / noma imfundo yokuzinza izimpendulo zemfundo kwimithelela emibi yemvelo, ngaphakathi nasekhaya jikelele. Umkhakha wezemfundo ubhekane nezinguquko eziningi kwikharikhulamu ukusuka ngonyaka we-1994, ngaleyo ndlela uthinta ukumboza, ukufundisa kanye nokuhlolwa kwezihloko ezithinta imvelo esigabeni saseNingizimu Afrika iSigaba seFundo nokuQeqesha (i-FET) samaBanga (amaBanga 10-12). Imiphumela inemiphumela emibi ekulethweni kwekharikhulamu. Zimbalwa izifundo esezenziwe ukuthola ukuqondaniswa kokuqashelwa kwenqubomgomo yekharikhulamu nokubhekwa ezivivinyweni zangempela zezihloko ezithinta imvelo ezikhona kwikharikhulamu. Inhloso yalolucwaningo bekuwukuphenya ukuthi ukumbozwa kwezihloko ezithinta imvelo kuthintekane kanjani ekushintsheni kwekharikhulamu, kanye nokuqondanisa kokuhlanganiswa kokuqokethwe ezivivinyweni maqondana nokuqanjwa kwenqubomgomo esigabeni se-FET eNingizimu Afrika. Ukutholwa okuphelele kocwaningo ngomthelela woshintsho lwekharikhulamu kwakuwukuthi izinhlaka ezahlukahlukene zaba negalelo ekuqinisekiseni ukuthi igebe lolwazi lokuqokethwe kwemvelo livaliwe. Abahloli baba negalelo ekufundisweni kwezihloko ezithinta imvelo ngokwezimo zokunquma ukuthi yiziphi izihloko okufanele bagxile kuzo kanye nokubalwa kwabo ngamaphesenti ezivivinyweni ze-FET. Ukuchazwa kwabo kwezidingo zenqubomgomo ngakho-ke kunomthelela oqondile ekutheni lezi zihloko zibhekwana kanjani ohlelweni lwezemfundo. Othisha badinga ukusebenzisana futhi basebenzise izindlela ezifanele zokufundisa ezithuthukisa ulwazi lwabafundi lwezihloko zemvelo. Othisha kudingeka futhi babambe iqhaza ngokugcwele ezinhlelweni zokuqeqesha ezihlose ukuthuthukisa amakhono olwazini lokuqokethwe kwemvelo, ukuzifundisa nokuhlola okufana nohlelo lweFundisa for Change.

Uhlelo lwezemfundo eNingizimu Afrika luyagxila ekuhlolweni ngakho-ke kubalulekile ukuthi amadokhumenti asiza othisha ekulungiseleleni abafundi izivivinyo ahlanganiswe nohlaka lwenqubomgomo lwezifundo loMnyango Wezemfundo Eyisisekelo. Ukutholakala ekuhlanganisweni ngokulinganayo kwezihloko ezithinta imvelo kwikharikhulamu, kanye nokuqondaniswa kwenqubomgomo yekharikhulamu nokuqokethwe okuyikho ezivivinyweni kuzokhuthaza izindlela zokufundisa zendawo ezungezile, ngaleyo ndlela kube noshintsho oluhle kusiko lokufundisa ngezihloko ezithinta imvelo. Ubukhulu bokumbozwa kwalezi zihloko emaphepheni wokuhlola

kuzoshintsha izindlela lapho bothishela kanye nabafundi bagxila kuzo izihloko zemvelo ekufundiseni nasekufundeni kwabo, ngaphakathi nangaphandle kweklasi. Lokhu kuzosiza abafundi ukuba bakwazi ukuxazulula futhi baphendule ezindabeni zemvelo abangahlangabezana nazo esimweni sabo esiphilayo. Kubalulekile ukuba nemibhalo yokufunda ngendalo nokufunda esetshenziswa ngabafundi nothisha, njengamaphepha okuhlola esedlule, aqondaniswe nenqubomgomo yokuqagela izihloko zomthelela wezemvelo ukuze ukwazi ukukhulisa izinhloko, amasiko, izindima kanye nemibono ekhuthaza ukuqhubekela phambili ukusetshenziswa kwemithombo yemvelo ngaphakathi kwezenhlalo. Imiphumela iveze ukuthi izihloko ezithinta imvelo zimbozwe ngamazinga ehlukeni kukharikhulamu yaseNingizimu Afrika. Izinga lokumbozwa kwezihloko ezithinta imvelo emaphepheni emibuzo luyeguquguquka, kwesinye isikhathi libe ngamazinga angezansi kwalawo ashiwo kumadokhumenti weCAPS. Ukuvikelwa okuguqukayo kwezihloko ezithinta imvelo ezivivinyweni kungathinta indlela othisha abazisingatha ngayo izihloko ekilasini. Lokhu kusekelwe ekubukeni kokuthi othisha bavame ukugxila ezihlokwani ezingezona lezo, ezigxile emvelweni ukuze zilungiselele abafundi ukubhala izivivinyo zokuphela konyaka. Ngakho-ke, ukumbozwa okungaguquki kwezihloko zomthelela wezemvelo kwikharikhulamu kanye nokuqokethwe kwezivivinyo kungakhuthaza i-ejensi yothisha kanye nabafundi ekuqondeni okukhulu kwezindaba zezemvelo emphakathini wabo kanye nesidingo sokwenza ngokuqinile ekuphenduleni kubo. Kodwa-ke, ngokubona okuhle ukushintshwa kwekharikhulamu kugxile kakhulu ekufundisweni, ekufundiseni nasekuhlolweni kwezihloko ezithinta imvelo esigabeni se-FET saseNingizimu Afrika. Lokhu kuholele ekuqubukeni kwe-morphoasemis eyakhiwayo kanye namasiko ekufundisweni kokuqokethwe kwemvelo esigabeni se-FET.

Amagama agqamile: Izihloko ezithinta indawo ezungezile, ukumbozwa kokuqokethwe, ukuhlolwa, ukwakheka, isiko ne-ejensi.

SESOTHO: KHOTSO

Lithuto tsa tikoloho le / kapa thuto ea ho tsitsa ke likarabo tsa thuto ho litlamorao tse mpe tsa tikoloho, kahare le lefats'e. Lekala la thuto le bile le liphetho tse ngata kharikhulamong ho tloha ka 1994, ka hona, le ama ts'ireletso, ho ruta le ho hlahloba lihlooho tsa litlamorao tsa tikoloho mohatong oa Phapanyetsano ea Thupelo le Thupelo ea Aforika Borwa (Mephato ea 12). Litlamorao li na le litlamorao tse matla ho tsamaisoa ha kharikhulamo. Ho entsoe lithuto tse fokolang tsa ho fumana tumellano ea liprojeke tsa kharikhulamo le tlhahlobo litlhahlobo tsa lihlooho tsa sephetho sa tikoloho tse fumanehang ho kharikhulamo. Morero oa lipatlisiso e ne e le ho etsa lipatlisiso hore na litaba tse mabapi le tšusumetso ea litaba tsa tikoloho li amiloe joang ke liphetho tse teng kharikhulamong, le tšebeliso ea litaba tsa litlhahlobo lithutong tse amanang le sephetho sa leano mokhahlelong oa lithuto oa Afrika Boroa. Liphetho tse akaretsang tsa boithuto mabapi le tšusumetso ea liphetho tsa kharikhulamo e bile hore likarolo tse fapaneng li kentse letsoho ho netefatsa hore lekhalo la tsebo ea tikoloho le koaloa. Bahlahlobi ba kentse letsoho thutong ea lihlooho tsa phello ea tikoloho ho latela hore na ke lihlooho life tseo ba lokelang ho tsepamisa maikutlo ho tsona le liperesente tsa bona tsa tlhathobo ea FET. Tlhaloso ea bona ea litlhoko tsa pholisi ka hona e na le moelelo o tobileng mabapi le hore na lihlooho tsena li sebetsoa joang tsamaisong ea thuto. Matichere a hloka ho sebelisana le ho sebelisa mekhoha e nepahetseng ea ho ruta e ntlafatsang tsebo ea barutoana ea lihlooho tsa tikoloho. Matichere a boetse a hloka ho nka karolo ka botlalo ho mananeo a koetliso a ikemiselitseng ho ntlafatsa tsebo tsebong ea tikoloho, ho ruta le ho hlahloba joalo ka lenaneo la Fundisa for Change.

Sistimi ya thuto ka hara Aforika Borwa e shebilwe ka ho hlaka kahoo ho bohlokwa hore dingolwa tse thusang barutabana ho lokisoeng ha barutoana bakeng sa litlhahlobo li hokahane le moralo oa leano la kharikhulamo la Lefapha la Thuto ea Motheo. Ho lumellana ha litaba tsa tšusumetso ea tikoloho kharikhulamong, le ho hokahana ha leano la kharikhulamo le litaba tsa tlhahlobo ho tla khothaletsa litloaelo tsa ho ruta tikoloho, ka ho etsa joalo phetoho e ntle moetlong oa ho ruta lihlooho tse amang tikoloho. Tekanyo ea sekoaelo sa lihlooho tsena lipampiring tsa tlhathobo e tla fetola mekhoha eo ka eona matichere le baithuti ba shebaneng le lihlooho tsa tikoloho ho ruteng le ho ithuteng, kahare le ka ntle ho phapusi. Sena se tla nolofalletsa baithuti ho rarolla le ho arabela litabeng tsa tikoloho tseo ba ka kopanang le tsona

maemong a bona a bophelo. Ho bohlokoa ho ba le litokomane tsa ho ruta tikoloho le ho ithuta tse sebelisoang ke barutoana le matichere, joalo ka lipampiri tsa tlhahlobo tse fetileng, tse hokahantsoeng le lipakanyo tsa melaoana ea lihlooho tsa phello ea tikoloho hore o tsebe ho khothaletsa meaho, litso, mesebetsi le mehopolo e khothalletsang e tsitsitseng. ts'ebeliso ea lisebelisoa tsa tlhaho tikolohong ea sechaba. Liphetho li hlahisitse hore lihlooho tsa phello ea tikoloho li koahetsoe ka maemo a fapaneng kharikhulamong ea Afrika Boroa. Boemo ba ho koaheloa ha lihlooho tsa phello ea tikoloho lipampiring tsa lipotso tsa tlhahlobo bo ne bo fokotseha, ka linako tse ling ho fihla tlase ho tse boletsoeng litokomaneng tsa CAPS. Ho koaheloa ha lihlooho tsa litlamorao tsa tikoloho lithutong ho ka ama tsela eo matichere a sebetsanang le lihlooho ka tlelaseng. Sena se ipapisitse le tlhokomeliso ea hore matichere a tloaetse ho shebana le lihlooho tse ling ntle le tseo, tse etselitsoeng tikoloho molemong oa ho itokisetsa liithuti bakeng sa ho ngola litlhahlobo tsa selemo. Ka hona, ho koaheloa khafetsa ha lihlooho tsa tšusumetso ea tikoloho kharikhulamong ea litlhahlobo le litlhahlobo ho ka khothaletsa lefapha la matitjhere le barutoana ho fihlela tlhokomeliso e kholo ea litaba tsa tikoloho sechabeng sa habo bona le tlhoko ea ho nka bohato ba pele ho ba arabela. Le ha ho le joalo, ho netefatso e fetohileng phetoho ea kharikhulamo e ile ea ba le tšusumetso e kholo ho koaetsoeng, ho rutoa le ho hlahlojoa ha lihlooho tsa litlamorao tsa tikoloho sehlopheng sa thuto sa Afrika Boroa. Hona ho felletse ka ho hlaha ha morphogenesis oa sebopeho le moetlo ho ruteng litaba tsa tikoloho sethaleng sa FET.

Mantsoe a bohlokoa: Lihlooho tsa tšusumetso ea tikoloho, litaba tsa tikoloho, litlhahlobo, sebopeho, setso le mokhatlo

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LIST OF ACRONYMS AND ABBREVIATIONS

ABBREVIATION	DESCRIPTION
FET	Further Education and Training
CAPS	Curriculum Assessment Policy Statement
WCED	World Commission on Environmental and Development
RST	Realist Social Theory
EE	Environmental Education
UNEP	United Nations Environmental Programme
UN	United Nations
CO ₂	Carbon Dioxide
USA	United States of America
ESD	Education for Sustainable Development
DoE	Department of Education
DBE	Department of Basic Education
SDG	Sustainable Development Goals
CMOc	Context-Mechanism-Outcome
UNESCO	United Nations Educational Scientific and Cultural Organisation
EEASA	Environmental Education Association of Southern Africa
NGOs	Non- Governmental Organisations
WESSA	Wildlife and Environment Society of South Africa
UVP	Umgeni Valley Project
NEAC	National Environmental Awareness Council
EEPI	Environmental Education Policy Initiative
NEEP-GET	National Environmental Education Project for General Education Training
GNP	Gross National Product
ADHD	Attention-Deficit/Hyperactivity Disorder
SDT	Self-Determination Theory
UMALUSI	Council for Quality Assurance in General and Further Education and Training
RNCS	Revised National Curriculum Statement

DESD	Decade of Education for Sustainable Development
CI's	Curriculum Implementers
SGB	School Governing Body
ICT	Information Computer Technology
SADC	Southern African Development Community

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CHAPTER 1

ORIENTATION OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

The purpose of this study was to analyse the coverage, teaching and examination of environmental impact topics in the Further Education and Training (FET) phase (Grades 10-12) of the South African education system. The study investigated whether there was alignment between policy documents and the Grade 12 past examination question papers' coverage of environmental impact topics, which were written in the years 2005 to 2015 during the United Nations Decade of Education for Sustainable Development (UNDESD). This period was chosen because it covered the time of the shifts in the school curriculum in South Africa up to the new Curriculum Assessment Policy Statement (CAPS) was implemented in Grade 12 in 2012. This was also a period of international focus on sustainable development and this should have had an influence on the school curricula.

The South African education system has undergone several curricula transformations since the dawn of democracy in the country in 1994. In this study, curriculum refers to the means and materials used by teachers and learners for the purpose of acquiring selected educational results (Ebert, Ebert & Bentley, 2017). Furthermore, Mednick (2006) states that a curriculum involves learning activities that are fully controlled and implemented by educational institutions and educators, then done by the intended learners individually or in formed groups, inside or outside of the classroom environment. The purpose of the curriculum is to prepare learners to adapt and strive within the society in terms of educational change and growth (Ebert et al., 2017).

The analysis of the curriculum design orientation is discussed in Chapter 5 of this study. Khan and Law (2015) outline different types of curriculum designs, which are: the official, taught, learned, tested and hidden curriculum. Su (2012) however, believes that curriculum can be seen as a variety of ideas and activities such as a certain set of objectives, the process of selecting content, plans to implement educational activities or documents written on paper, and it is a programme of experiences. Ebert et al. (2017) describe four curriculum designs, which are the explicit, implicit, null and

extra curriculum. In line with the four different propositions of curriculum designs, it can be generalised that curriculum informs teaching, learning and assessment.

In the school system, assessment is one of the most important aspects in a curriculum which determines whether learners have acquired the expertise and skills necessary to practice what they have been taught. In the South African education system, assessment is used to determine whether learners can be advanced to a higher grade. Teachers find themselves compelled to teach what is likely to be examinable in the end of the year examinations, which is part of the curriculum design postulated by Su (2012). It is against this background that summative assessments for the Grade 12 exit level examinations have been analysed to determine the integration of environmental impact topics. The study shows that teachers are affected by the way summative assessment is integrated at the end of the year. This leads to changes in teaching methods in order to ensure that more emphasis is put on content that will more likely be in examinations at the end of the year. For example, if coverage of environmental impact topics in the examinations is less than what the policy stipulates, educators will most likely give less teaching time to those topics, thus environmental literacy and knowledge accumulation about the environment will be compromised. Within the context of this study, I investigated the extent to which environmental impact topics have been covered in the South African school curriculum using documents such as policies, textbooks and past examinations. The study also investigated how teachers were teaching environmental impact topics after attending training programmes.

In this study, the analysis of educational documents regarding environmental impact topics formed the basic unit of analysis. Environmental impacts have become an increasingly growing concern over the decades. However, the problems associated with negative environmental impacts still remain unresolved despite increased media attention, public awareness programmes and pressures from international agreements. Harris (2012) contends that we are living in a volatile global environment that has evolving dynamism in response to impetus. Harris (2012) further states that in the last century it has become apparent that humanity has taken control of the planet's ecosystems and biochemical cycles in such a way that human activities are now causing environmental change. "Globally, nature is viewed as a provider of natural resources, aspects of the natural environment that are critical to satisfying

living and non-living things” (Hill, Alan & Woodland, 2006:93). This view of biophysical and human (social, economic and political) is associated with the definition of sustainable development of the World Commission on Environment and Development (WCED) (now called the Brundtland Commission) that is based on the current and future needs of humanity (WCED, 1987). In support of sustainable development and the alleviation of environmental problems, this research is aimed at exploring the integration of environmental impact topics in the curriculum on aspects such as coverage, teaching, and examination.

More importantly, it was envisaged that due to curriculum changes, there might be possible disparity between content coverage and actual examination in the school exit level (Grade 12). Hence, this study investigated documents and teachers’ involvement with regards to environmental impact topics in the curriculum. This study used a qualitative research approach, where Archer’s Realist Social Theory (RST) was the guiding framework (Archer, 1996). Supporting this approach, documents and interviews were used as sources of data. This study focused on environmental impact content knowledge rather than the actual teaching practice, hence only documents and interviews were used as data. Observation was not used in the study because it was dominantly a document analysis-based study.

Ramberg (2014:49) remarked that:

Some studies have focused on educational policies and curriculum reforms effect on teacher change, where individual teacher characteristics and prior experiences with change initiatives may lead to teachers to take action and persist in the effort required to successfully implementing change initiative.

The key documents analysed in this study were sourced from the Department of Basic Education’s (DBE) website at <https://www.education.gov.za/>. See Figure 1.1 for an example of one of the past examination question papers for Life Sciences which was investigated during this study.

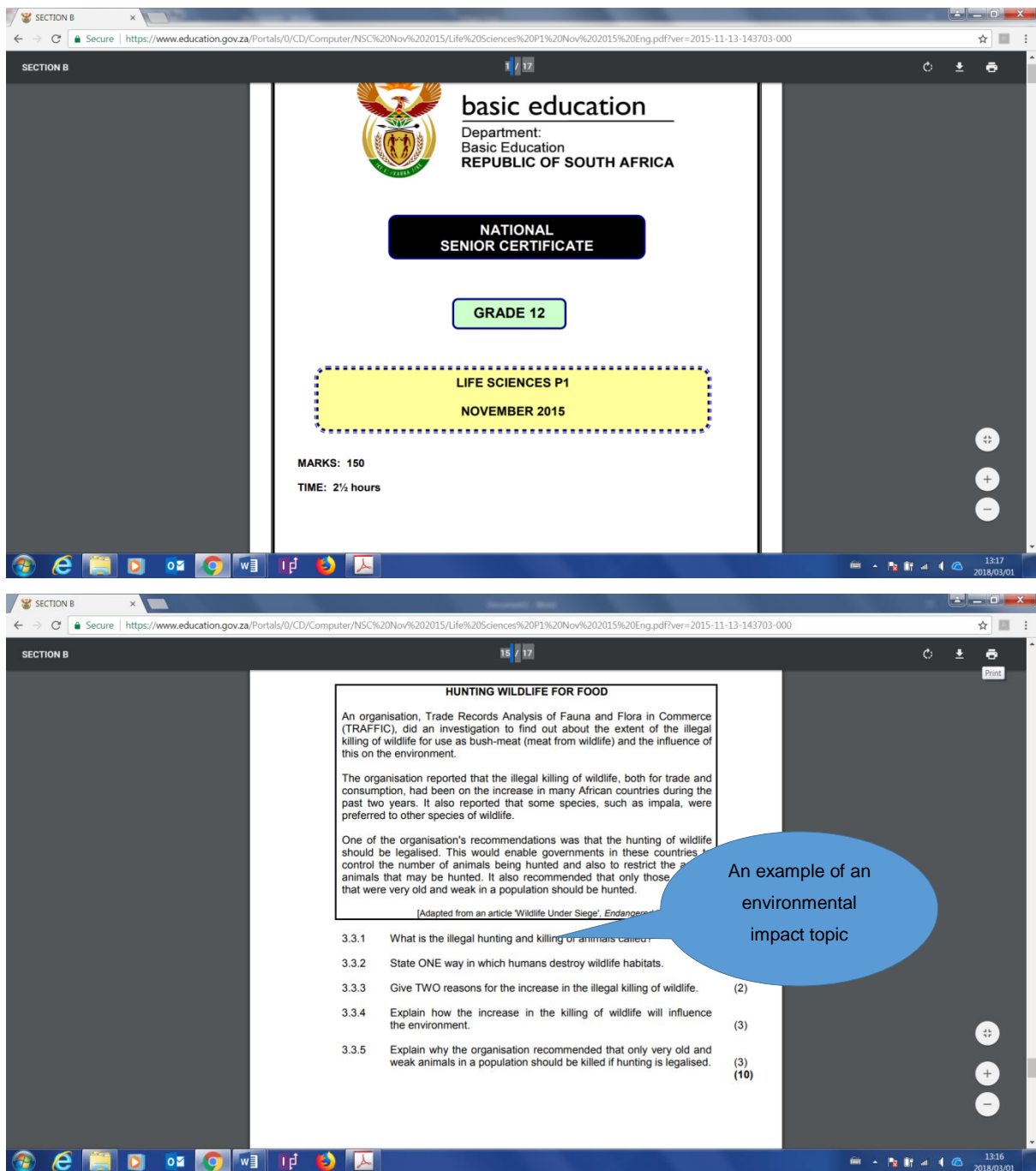


Figure 1.1: Life Sciences (Paper 1) October/November 2015

Source: (DBE, 2017)

The analysis in this study focused on the alignment between CAPS' stipulated proportional coverage of environmental impact topics and actual coverage of environmental impact topics in the examinations. For example, in the CAPS documents for Life Sciences specifies that the stipulated coverage of environmental impact topics should be about 8% of the total in the examinations. I investigated the

marks allocation for environmental impact topics against the total marks of the examination paper to assess whether examination adhered to the curriculum policy. Figure 1.1 above shows an example of how the comparison was conducted where marks allocated against environmental impact topics were proportioned against the total mark of 150 for the examination paper.

Furthermore, the study also intended to find out if there was a relationship between environmental impact topic coverage in teaching and learning resources such as textbooks and the actual content that is examinable at the school exit level. This study attempts to close a research gap as few studies have investigated the extent of coverage of environmental impact topics in the South African curriculum. This is seen where issues such as climate change are well covered in the policy documents, yet not much has been seen in translating this into the actual practice in the form of examination (Togo, Zhou & Khan, 2015). Most studies have focused on the effects of policies in teaching and adaptation of teachers to new policies (Maluleke, 2015). However, the factors that influence teachers' responses to changes in policies that affect their usual teaching patterns have not been well researched (Maluleke, 2015).

1.2 CHANGES OF CURRICULUM IN THE SOUTH AFRICAN EDUCATION SYSTEM

The South African education system has frequently changed since 1994 resulting in the curriculum change that was problematic in its implementation. These challenges were caused by the complexity of the implementation programme and the capacity of teachers to adopt new teaching strategies in the classroom. The curriculum has undergone multiple variations, from Curriculum 2005 (C2005), to the Revised National Curriculum Statement (RNCS), to the National Curriculum Statement (NCS) Grade R–12, and then, in 2011 to the Curriculum and Assessment Policy Statements, commonly known as CAPS. The transformation of the curriculum in South Africa focused on the content, teaching methods and assessment (DBE, 2017).

1.2.1 Curriculum Changes

Changes in the South African education system post 1994 have changed the curriculum landscape (Ramatlapanana & Makonye, 2012), which have led to challenges in the implementation of the curricula in schools. Curriculum changes aim to improve

the quality of teaching and learning, with the aim of enhancing the socio-economic development of citizens. In support of the several curriculum revisions, Du Plessis and Marais (2015) argue that it is the responsibility of the government to provide teachers with quality training to face the challenges that change causes.

Due to ongoing implementation, challenges where teachers were expected to select appropriate learning content and develop a curriculum without having relevant skills, time and resources to develop learning content. In 2012, the CAPS became the curriculum for all school subjects (DBE, 2018a). CAPS is content-based rather than outcomes-based and the transformation concentrated mainly on the content, teaching methods and assessment thereof, and gives a clear outline of what should be covered in each school term as well as the assessments that are needed with regard to the National Protocol for Assessment Grades R-12 (DBE, 2017).

In 1997, the South African Department of Education introduced outcomes-based education to overcome the curricular divisions of the post-apartheid era, namely Curriculum 2005, but the problem with implementation prompted a review in the year 2000. This led to the first curriculum revision, the Revised National Curriculum Statement Grades R-9 and the National Curriculum Statement Grades 10-12 (2002). The implementation challenges resulted in another review in 2009 which revised the Revised National Curriculum Statement (2002) and the National Curriculum Statement Grades 10-12 to produce one document, the National Curriculum Statement Grades R-12 (NCS). The NCS stipulates policy on curriculum and assessment in the schooling sector. The implications of these changes led to EE being recognised in the curriculum in the form of environmental themes across some subjects such as Life Sciences, Geography, Life Orientation and Agricultural Sciences.

To improve implementation, the National Curriculum Statement was again amended, with the amendments coming into effect in January 2012. As a result, a single comprehensive Curriculum and Assessment Policy Statement (CAPS) document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12. In 2012, the two national Curriculum statements, for Grades R-9 and Grades 10-12 respectively, were combined into a single document which is known as the National Curriculum

Statement Grades R-12. The later builds on the previous curriculum but also updates it and aims to provide clearer specifications on what is to be taught and learnt on a term-by-term basis. The National Curriculum Statement Grades R-12 represents the current policy statement for learning and teaching in South African schools and comprises the following (DBE, 2014):

- (a) Curriculum and Assessment Policy Statements (CAPS) for all approved subjects listed in this document;
- (b) National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and
- (c) National Protocol for Assessment Grades R-12.

1.2.2 Description of the Shifts in the South African Curriculum

Iqbal and Arif (2011:104) suggest that a paradigmatic shift in education requires that the objectives of the education policy would be to serve the interests of teachers and learners rather than of those who develop policy or implement programmes. Iqbal and Arif (2011:100) view this as a very fundamental shift as it implies changes in all the important spheres of education such as what educational provision to offer; who benefits from educational provision; what pedagogy and teaching and learning methods to employ; and how the resource costs should be shared among the stakeholders. In light of this, the need for reforms and making recommendations for action in a wide range of areas, which are divided into two categories, is recognised. The first category is system level reforms, which deal with issues such as the vision of the system, sector priorities and governance, and resources for the sector. The second set of reforms address problems that are specific to individual sub-sectors of education, ranging from early childhood education through to adult learning.

According to Dreyer and Loubser (2014:128), the Environmental Education Policy Initiative (EEPI) suggested the following four main policy options for introducing Environmental Education into the formal education system:

1. Environmental Education as local problem-solving curriculum actions;
2. Environmental Education as an integrated approach to Environmental Education (an environmental perspective within separate subjects);

3. Environmental Education as a separate subject; and
4. Environmental Education as a component within a subject.

From the options above, it seems that curriculum developers can develop different models to suit different paradigms in curriculum development as they are guided by the developers' philosophical stance. Two philosophical frameworks have been linked with curriculum development are the rational/classical approach and the interactive/participatory approach (Dreyer & Loubser, 2014:147). The rational approach has been used by researchers and curriculum experts in developing a curriculum and disseminating it to teachers and can thus be seen as a product-oriented approach and objective. However, Dreyer and Loubser (2014) highlight the participatory model of curriculum development as the preferred model. This has been used in South Africa. It shows general trends that were seen to be emerging such as a:

- Focus on process within disciplines;
- Emphasis on the participation of the role players;
- Focus on social change; and
- A curriculum based on outcomes being seen as an alternative to objective based curricula.

According to the DBE (2014), complaints were raised on the following hindrances where stakeholder's realised changes were necessary to revamp the education system in South Africa:

- Implementation problems;
- Educators overworked with administration needs;
- Different interpretations of the curriculum requirements; and
- Learners' underperformance.

The above concerns pointed to the need for improvement of the NCS towards a user-friendly and acceptable curriculum for all stakeholders in the education sector. These hindrances were also experienced with the implementation of EE in the South African education system.

1.2.3 Environmental Education in the Curriculum

Department of Education (DoE) adopted a policy document called the White Paper on Education and Training Notice 196 of 1995 in Cape Town on 15 March 1995.

According to the DBE (2018b), the purpose and scope of the White Paper was to describe the necessary steps in policy development in the Department of Education. One of the principles and values of education and training policy stipulated in Chapter 4, Section 20 discusses the implementation of environmental education (EE) in the South African curriculum. The White Paper states that:

Environmental education, involving an inter-disciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources (DBE, 2018b)

The 1995 White Paper paved the way for EE to be implemented in the education system across all levels of education and is included in the current CAPS. To ensure that EE is fully implemented in the CAPS, one of the principles in the policy statements is to ensure that human rights, inclusivity, environmental and social justice are emphasised in the curriculum in line with the Constitution of the Republic of South Africa.

1.2.4 Importance of environmental impact topics coverage in the curriculum.

Currently the Earth is in the Anthropocene era where human-derived environmental crises have taken center stage due to their global extent to the point that they can no longer be avoided. Our impact on the environment is threatening not only biodiversity but also the very existence of humankind itself. Climate change and global warming are recent phenomena that were not part of the curriculum in the past, yet we are already feeling the effects of climate change locally and globally. Therefore, it is against this background that environmental impact topics need to be sufficiently covered in the curriculum, in teaching and learning processes and in examinations to ensure that values and principles of sustainable development are encouraged. Natural resources are important to every living organism and they should be utilised without being depleted in order to satisfy human livelihood. Unsustainable human exploitation of natural resources, pollution and degradation results in negative environmental impacts that consequently have negative implications on biodiversity, ecosystems, the physical environment and, subsequently, human development and livelihood

sustenance. For this reason, it is important to ensure that environmental impact topics are sufficiently covered in the curriculum (Hill et al., 2006).

Moreover, since the Industrial Revolution, the rapid development of society has resulted in many global environmental problems such as global warming, a rise in sea levels, ozone depletion, air and water pollution, land degradation, destruction of wetlands and deforestation (Dunnette & O'Brien, 1992; Kupchella, 1992; Xu 2015). These environmental problems outlined above can be partially addressed through a school curriculum that includes a consideration of environmental impact topics across all levels from policy to implementation. Therefore, teaching of environmental impact topics through EE and its alignment to curriculum policies is the focus of this study.

The efficient utilisation of the world's natural resources is one of the important themes of AGENDA 21, "A global action plan for environmental impacts into the 21st century" (UN, 1992:263). The precious natural resources of the planet are being depleted and degraded at a rapid rate. Sitarz (1994) notes that the Earth's limited supply of natural resources and its inability to recover from degradation were not taken seriously in the past. The rapid increase in population and the accompanying human activities in the last century have placed extreme stress on environmental resources. As a result, Hill et al. (2006) point out that, in 1993, a National Environmental and Planning Agency was formed in some European countries to promote EE activities through environmental impact programmes. In South Africa, non-governmental organisations (NGOs) play an important role in ensuring that the ruling government upholds EE where, in 1975 for example, the Umgeni Valley Project encouraged the development of EE practice and theory in the country (Irwin & Lotz-Sisitka, 2005).

It is generally accepted that there are limits to both the Earth's resources and its capacity to handle the environmental impacts caused by humans (Sitarz, 1994). Thomas-Hope (1998) reveals, for instance, that the environmental impacts of solid waste which is disposed of at landfills which cannot cope with such disposal contribute greatly to land degradation. This human activity is evident in the global arena where the effects of cumulative negative environmental impacts on the environment are experienced. In addition, Xu (2015) emphasises that human activity is a factor that has important impact on the environment, even in remote areas, since the onset of the

Holocene era. Goudie and Viles (1997) further argue that it normally takes some time for the causes of environmental impacts to become apparent and this makes the causes hard to identify. They also associate environmental changes with human impacts which go hand-in-hand with natural fluctuations to create massive and unpredictable changes in the environment.

Against this background, it is essential that the global resources of land, fresh water, marine, biological and genetic resources and energy are protected (Sitarz, 1994). Human development must be achieved in a way that improves productivity to meet global demand for goods and services while sustaining the Earth's natural resources. Educating future generations is important in order to expose them to environmental issues that are detrimental to the environment, which sustains human existence. Depletion of natural resources through unsustainable resource extraction has often been associated with population growth, which was estimated to have reached seven billion people globally by 2016 (World Watch Institute, 2016). Population growth and development can lead to violence since people affected by shortages of natural resources believe that they are unfairly treated in the distribution of basic needs such as food (DEAT, 1997). The next section describes link between environmental impact topics and EE.

1.2.5 Link between environmental impact topics and environmental education

The Law Dictionary.org (2017) defines environmental impact as “the effects to organisms or their environment, possibly adverse, caused by development, industrial or infrastructural projects or a pollutant”. Environmental impacts are environmental issues that negatively affect resources such as land, water and the atmosphere. The Southern Africa Environment Outlook (2008) defines an environmental impact as the consequences of environmental changes for human beings and ecological systems, and on social and economic development. EE processes enable individuals to explore environmental issues, engage in problem solving, and take action to improve the environment (United States Environmental Protection Agency, 2019). EE allows individuals to develop an awareness of environmental impacts and skills to make informed and responsible decisions. Between 2017 and 2018, South Africa was affected by severe drought in the Eastern, Northern and Western Cape provinces, which resulted in the local government imposing restrictions in the use of water. The

Department of Water and Sanitation (DWS) (2018) notes that South Africa is an arid country and is one of the 30 driest countries in the world. DWS (2018) further mentions that South Africa has not yet recovered from the 2014 drought during which the Western Cape experienced the worst drought in 400 years. The effects of climate change experienced in these provinces highlights the importance for humans to have knowledge and understanding about the cause of these challenges and the need to change their attitudes towards the environment, develop skills to solve the crisis and participate in mitigation strategies. Environmental impact topics in the South African curriculum are taught in all subjects in the FET phase, which is part of EE.

1.3 BRIEF REVIEW OF THE GLOBAL ENVIRONMENTAL IMPACTS

The world is experiencing environmental impacts such as global warming, acid rain, air pollution, waste disposal, water pollution, biodiversity loss among others that affect the natural environment and humankind. This section discusses the effects of global environmental impacts. A broader review of literature on environmental impact is provided in Chapter 2.

1.3.1 Effects of environmental impacts globally

The global environmental challenges have not gone unnoticed by society. According to Kukreja (2017), the world today is faced with 25 key environmental impacts, which are discussed in depth in Chapter 2. These impacts include air pollution, water pollution, soil and land pollution, light and noise pollution, climate change, global warming, ozone layer depletion, deforestation, desertification, increased carbon footprint, genetic modification, public health issues, overpopulation and loss of biodiversity, which have serious consequences for the biophysical environment and the lives of people. Some of these impacts are briefly described below:

Air pollution: Polluted air takes many years to recover. The major contributors to air pollution are industry and vehicle engine fumes, which are toxic to the environment. Kukreja (2017) also mentions that substantial metals, nitrates and plastics contribute to air pollution. The World Health Organisation (2018) states that, annually, about 4.3 million deaths are caused by exposure to smoke from dirty stoves and fuels.

Water pollution: The world today is facing major challenges of clean water availability. Wastes from industrial and agricultural activities pollute much of the water used by plants, humans and animals. According to European Environmental Agency (EEA) (2017), unsafe water, poor sanitation and hygienic conditions cause about a tenth of all the deaths and diseases reported globally and about one quarter of the deaths and diseases reported in children under five years old. African countries are faced with the scourge of polluted water due to agricultural activities and mining. A lack of clean water threatens about 50% of the 1.45 billion people in Africa. Polluted water not only threatens human existence but also affects many animal species and vegetation (All about Water Filters, 2018). In Southern Africa, water pollution is caused by rapid urbanisation that results in the spillage of chemicals from industries and mines and inadequate sewage collection and treatment. Water pollution in the region also results in the spread of diseases such as cholera and bilharzia to humans. According to News 24 (2018), the Umgeni River near Howick Falls in South Africa is polluted with plastic bottles, polystyrene, paint cans and wooden crates that present a danger to biodiversity and human life.

Soil and land pollution: Human activities such as agricultural practices, mining, deforestation, littering, industrial and construction activities possess a serious threat to human health because they degrade the Earth's surface (Kukreja, 2017). For example, the overuse of pesticides in China has led to the disposal of empty pesticide packaging on agricultural fields. The discarded pesticide packages in the form of plastics pollute the water and soil ecosystems (Jin, Bluemling & Mol, 2018). The impact is heightened because plastic deposits of pesticide packaging are not easily degradable (Jin et al., 2018).

Climate change: Climate change has various negative impacts that include, but are not limited to, the melting of polar ice caps, changes in seasons, new epidemics, and changes to the general climate situation. According to McEldowney and McEldowney (2014), the United Nations Environment Programme estimated greenhouse gas emissions to be 50 gigatons of carbon annually, which is likely to increase to 58 gigatons by 2020. This is in line with the Earth temperature predictions of an increase by six degrees Celsius in the year 2050. This is 20% more than in the year 2000 and 14% above the level it should be in 2016, which does not offer much hope for

emissions to meet the 2020 target of less than 44 gigatons per year (UNEP, 2011). The most remarkable change in the recent past is the shift in blame from the developed to the developing worlds in a competition for the status of the most polluting nation. McEldowney and McEldowney (2014) mention that the United States of America (USA) and European countries are no longer the most polluting countries, but developing countries like China and India are the world's largest producers of greenhouse gases, which have been brought about by their rapid economic growth. The United Nations climate change report (UN, 2017) reveals that the Earth's temperature increased by 0.85 degrees Celsius over the period 1818-2012, and the past three decades (1990–2015) were the warmest for the past 1 400 years. Xu (2015) states that climate change is the most typical environmental problem where, globally, carbon dioxide (CO₂) atmospheric concentration is exceptionally high at 400 ppm, compared to the average of 300 ppm over the past millennia. This raises concerns regarding the negative impacts of anthropogenic gradual warming of the earth (Xu, 2015).

Global warming: This is caused by greenhouse gasses that result in environmental change. As mentioned above, the United States of America (USA) and European countries are no longer the most polluting countries. China and India are the world's largest emitters of greenhouse gases, which has been brought about by their rapid economic growth (McEldowney & McEldowney, 2014). China contributes to 25% of global emissions and India, in years 2000 to 2011, accounted for 83% of the increase in carbon emissions (IPCC, 2014). In contrast to developed countries, McEldowney and McEldowney (2014) believe that developing countries face enormous challenges. The disproportionate effect of global warming on developing countries is clear. It is estimated that a 2.5% rise in global temperature would cut agriculture productivity by 6% in the USA and up to 38% in India, although the reactions of the Earth's ecosystems to climate change have not been extensively researched (Xu, 2015). This shows a need for further research on the impact of these changes to the environment.

In the context of Africa, climate change threats could undermine the progress that African countries have made in tackling diseases, malnutrition, premature deaths and agricultural productivity (IPCC, 2014). The IPCC Fifth Assessment Report notes that droughts and heavy rainfall that have been predominant in the last 30-60 years have

resulted in extreme precipitation changes over Africa. This is evident in South Africa where the Western Cape Province has experienced the worst drought in over 400 years between 2017 and 2018. The IPCC (2014) report also projects that, if global society continues to emit greenhouse gases at current rates, the average global temperature could rise by 2.6 to 4.8° Celsius by the year 2100. Climate change will have a greater impact on water availability for society and the natural environment in Africa (IPCC, 2014). According to the Western Cape Government (2018), the drought resulted in restrictions in the usage of water, where each person was restricted to using 50 litres of water per day. Cape Town dam levels were estimated at 24% on 26 February 2018 due to drought (Western Cape Government, 2018). The Western Cape government identified climate change as one of the main reasons for drought in the area. The province experienced poor rainfall during the 2015, 2016 and 2017 winter seasons, coupled with the provinces' rapid growth in population and economy that has increased the demand for water every year, leading to severe water shortages. This is one of the reasons that this study aims to address the coverage of these important topics in the school curriculum.

Deforestation: One of the major environmental concerns is how the global woodlands and biomes such as the Amazonian rainforest are destroyed, thus limiting the creation of new oxygen, and affecting temperature management and precipitation. The major concern is that woodlands are being chopped down by humans who are looking for food, materials and new homes, as well as more pastoral lands for grazing. Loss of biodiversity can be attributed to deforestation (WWF, 2018)

Genetic modification: Genetic modification utilises biotechnology which could be of great benefit in making crops which can survive the environmental changes humans are causing. However, it could also bring about stronger poisons and sicknesses as negative characteristics from a hypersensitive plants could be transferred into the target and non-target related plant breeds. This transfer can be accidental, for example from the use of certain pesticides. Animals can become affected after ingesting the unnatural chemicals (One Green Planet, 2018). According to One Green Planet (2018), genetically modified organisms (GMOs) have been modified to be insect and virus resistant, but the chemicals used can also be toxic to non-target organisms such

as bees and butterflies. The toxic residue released into the soil through the plants means fewer soil bacteria overall (One Green Planet, 2018).

Loss of biodiversity: Human activities can result in habitat destruction. Deforestation, overpopulation, pollution and climate change cause habitat loss. According to the European Environmental Agency (EEA, 2017), biodiversity has continued to decline globally, with the rate of extinction of species estimated to be up to 1 000 times higher than the natural rate. In South Africa, changes in land coverage is the greatest driver of habitat loss across the country (SANBI, 2013), with nearly one fifth of the land surface in South Africa having been lost due to natural vegetation being removed for farming, mining, forestry and urban sprawl. SANBI (2013) also revealed that pollution from mining, agriculture and manufacturing disrupts ecosystems, and that provinces such as KwaZulu Natal, Gauteng and the North West are among the worst affected by the loss of natural habitats. SANBI (2013) concludes that if these provinces continue to develop at the current rate without due consideration of environmental impacts there will be almost no natural vegetation by the year 2050. It is necessary to focus on environmental impacts because of the depletion and degradation of natural resources, which is detrimental to human survival. The negative actions of some people have not been in favour of protecting the environment, hence, it is important to focus on environmental impacts topics and responding to them. The section below discusses some of the global extent of environmental concerns.

As Dunnette and O'Brien (1992:5) state, these negative environmental impacts have also resulted in food scarcity. Therefore, it is important to make people aware of the human impacts in the environment and what could be done to alleviate the scourge of environmental degradation. Investigating the extent to which environmental impact topics have been included in the school curriculum can help to reduce the extent of degradation locally by ensuring that future generations (learners) are aware of potential threats to the environment. This study is supported by Xu's (2015) assertion that differences in ecosystem-type and complexity of climate systems render future predictions uncertain.

This study focuses on the coverage of environmental impact topics in the FET curriculum. Therefore, the researcher used teacher interviews and document reviews

to analyse the extent to which environmental impact topics, such as those discussed above, are integrated in the curriculum.

1.4 CONTEXT OF THE STUDY

This study was conducted in the Mpumalanga Province. The province was chosen because it was convenient for the researcher to conduct the study since a national environmental teacher training programme called Fundisa for Change had trained teachers on a module entitled Teaching Biodiversity: Life Sciences Grade 10-12 that covered environmental impact topics. I was therefore able to access information-rich participants in the limited period available for doing the research. Figure 1.2 shows the different districts from where the participants were interviewed. The aim of Fundisa for Change programme was to support teachers in terms of their knowledge, pedagogy and assessment of environmental and sustainability issues in the curriculum so that they can contribute towards building a healthy society and promoting environmental sustainability as envisaged in the South African Constitution (Fundisa for Change, 2013). The programme focused on enhancing three essential elements of teaching, namely: environmental content knowledge, teaching practice and assessment practice (Fundisa for Change, 2013). It was also convenient and financially viable for me as the researcher to source additional information when the need arose as I resided in the province. The participants were part of a cluster of teachers who were teaching related subjects such as Agricultural Sciences, Life Sciences and Geography in their schools.

Mpumalanga Province where the study was conducted lies in eastern South Africa, north of Kwazulu Natal Province and is bordered by Swaziland and Mozambique. According to the Mpumalanga Government (2015), the province constitutes 6.5 % of South Africa's land area and has a total population of about 4 million people. The Drakensburg escarpment divides Mpumalanga into a western half, consisting mainly of high-altitude grassland known as Highveld and an eastern half, situated in low altitude known as the Lowveld, and is mainly a Savannah biome (Mpumalanga Government, 2015). Mpumalanga's climate is generally warm and frost-free (Mpumalanga Government, 2015). The study was conducted in the towns of Emalahleni in the Nkangala District, Nkomazi in the Ehlanzeni District, and Msukaligwa, Elukwatini and Govan Mbeki in the Gert Sibande District, where 12

educators trained by the Fundisa for Change Programme were located (see Figure 1.2 below). These educators made up the sample used in the study. Mpumalanga is known for its extensive agricultural activities, which utilise 68% of the land, in addition to mining and tourism (Mpumalanga Government, 2015).



Figure 1.2: Map of Mpumalanga province showing Ehlanzeni, Nkangala and Gert Sibande where the study was conducted.

Source: <https://www.google.co.za/search?q=map+of+mpumalanga+province&tbm>

1.5 STATEMENT OF THE PROBLEM

The underpinning assumption in this research is that teachers' views on the content and nature of environmental impact issues are complex and founded upon implicit theories and personal practical knowledge. Environmental impacts have negative implications of global proportions. Negative human impacts on the environment threaten not only natural resources such as water, air and land but also the very existence of humanity itself. The education sector plays an important role in ensuring that younger generations develop appropriate skills, knowledge and principles for sustainable living. Furthermore, the changes in the curriculum can be linked to shifts in content coverage in the examinations, thus the study investigates the extent of such changes for environmental impact topics. It is also assumed that it is teachers' internal perceptions rather than external constraints that inform their pedagogical practice

(Hart & Nolan, 1999). Hart and Nolan (1999) note that studies on teachers' thinking are important, as they remain one of the under-researched areas within EE processes. Further to this, it is also against the assumption that teachers tend to teach and put more emphasis to topics that are frequently examined at the end of the year examinations, leaving behind topics that are not consistently being examined, thus creating a knowledge gap in the learners.

Le Grange (2013) argues that the new language of education involves risk and that the risk is compounded when the environment is added into the equation. According to Le Grange (2013), environmental problems are complex and today's solutions could become tomorrow's problems. Human civilisation has brought about the current modern era and the associated imbalance between natural resource utilisation and sustainability of the Earth. Le Grange (2013) further believes that the complex and contingent nature of environmental problems and their associated risk cannot be captured in a few learning outcomes set out in the curriculum in South Africa. Le Grange (2013) states that the previous South African curricula such as the NCS (Grade 10-12) did not include the environment as a key component, but created space for EE processes to be included. In CAPS, assessment is one of the major aspects used to determine whether learners have reached a level of competence to progress to a higher grade and teachers put more emphasis on the content that is likely to be examined at the end of the year. This has led to my investigation of the integration of environmental impact aspects in Grade 12 examinations, policies and textbooks.

1.6 RESEARCH QUESTIONS, AIM AND OBJECTIVES

1.6.1 The Research Questions

This research was based on the following questions:

Main question:

How has the shift in the curriculum affected coverage, teaching and examination of environmental impact topics in South Africa's Further Education and Training (FET) phase?

Sub-questions:

- i) What changes have been made to the new curriculum (CAPS) in the coverage of environmental impact topics?
- ii) To what extent are environmental impact topics being examined in the Grade 12 (Matric) exit examinations?
- iii) A
- iv) What is the impact of teacher support for teaching environmental impacts topics provided through the Fundisa for Change programme?

1.6.2 Rationale for the study

Environmental degradation significantly affects our lives. According to Stearns (1992), children and students are exposed to environmental vocabulary, such as ozone and acid rain, but do not have the scientific background to understand them. She further argues that the curriculum exposing students to these terms must prepare them to be environmentally aware citizens in terms of relevant topics and appropriate teaching context. Therefore, the study of environmental impact topics in the South African curriculum should not only illuminate their coverage but also critically evaluate the ways in which the field of EE is addressed in examinations in South Africa. Firstly, not enough studies have been done where the two aspects of teaching of environmental impact topics in the curriculum and examination coverage are intertwined. Secondly, this study will contribute towards the discourses on the teaching of EE in the CAPS curriculum. Stevenson, Brody, Dillon and Wals (2013) state that EE as a field of inquiry is conceptualised from theoretical, ethical, policy, curriculum, learning and assessment discourses that are all examined from an environmental perspective. They further posit that research in this field raises key issues concerning the framing, doing, and assessment of EE research.

This study will contribute to knowledge on the effect that curriculum transformation has on coverage, teaching and examination of environmental impact topics in the South African FET phase. In addition, there is a need for environmental impacts issues to find expression in the classroom and to be related to the practical reality in the learners' surroundings (Pedretti & Nazir, 2014). As Pedretti and Nazir (2014) note, there are few reports on empirical studies tracking teachers' views on EE. Le Grange (2013) argues that, in order for EE to be effective, it needs teachers to mediate, be

responsible, and be knowledgeable about environmental impact topics. The critical interaction of teachers and learners should result in outcomes that lead to better understanding and teaching of environmental issues in the classroom. The study will further help the education sector and supporting organisations involved in environmental work to ascertain the extent of environmental impact topics coverage in the education system. Broadly, this study covers three perspectives, which are the analysis of the coverage, teaching and assessment of environmental impact topics in the FET phase.

1.6.3 Aim of the Study

The aim of the study is to investigate the extent to which environmental impact topics have been integrated into the curriculum and to determine the proportional alignment of environmental content coverage in the examinations against policy projections in the South African FET phase.

1.6.4 Objectives of the Study

- To determine if changes in the South African FET curriculum had an effect on the teaching of environmental impact topics in schools.
- To investigate how teachers carry out their duties and responsibilities in the classroom when teaching environmental impact topics in the new CAPS curriculum.
- To establish if shifts in curriculum had an effect on the examination of environmental impact content.
- To investigate whether the Fundisa for Change programme had an impact on the teaching of environmental impact topics in the FET CAPS.

1.7 RESEARCH DESIGN

This study employed a qualitative research approach using a case study of teachers in Mpumalanga. An interpretive case study makes significant contribution to both theory and practice in providing results on the inclusion of environmental impact topics in the curriculum. I used this approach because it allows for multiple realities, such as understanding of social situation from participants' perspectives (McMillan & Schumacher, 2010). The data collection methods used in the study were (i) semi-

structured interviews, because this method allowed the researcher to gain understanding from the teachers' perspective of the key issues, and (ii) document analysis which enabled the researcher to obtain insights into the environmental impact content and assessment approaches and could be accessed at a time convenient to the researcher (Creswell, 2007).

1.7.1 Research Design

According to Hartas (2010), a research approach involves devising a specific way of answering a research question or set of questions. A qualitative research approach was used in this study. The study adopted an evaluative research design (McMillan & Schumacher, 2010) where the focus was on the FET phase. A diagrammatic overview of the research design used in this study is presented in Figure 1.3.

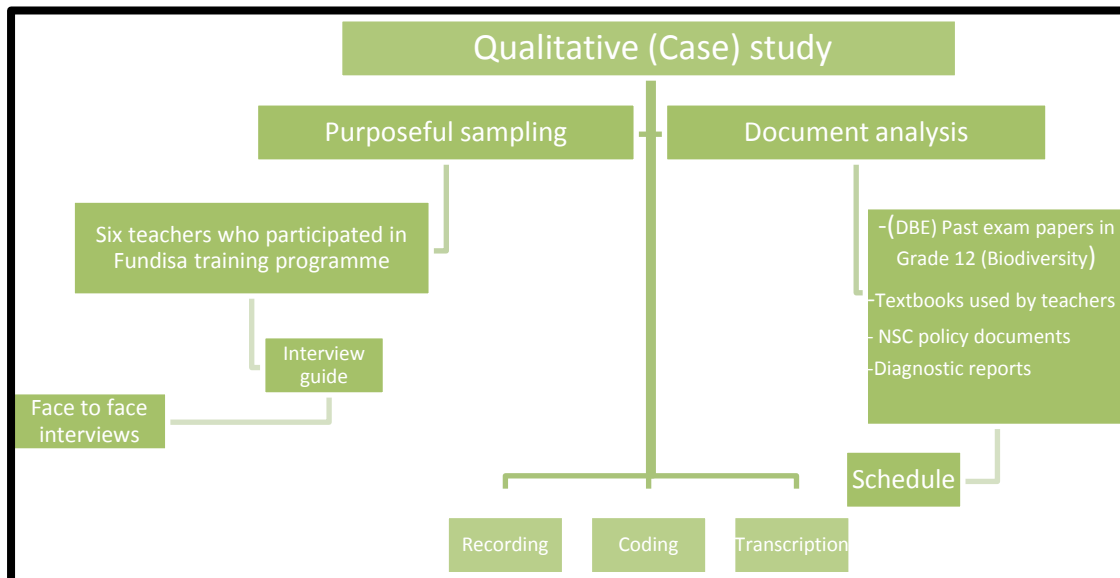


Figure 1.3: Schematic presentation of research design of the study

Table 1.1 below provides a schematic presentation on how research questions have been addressed in this study. The table shows the main question which has been classified into three aspects, which are: coverage, teaching and examination of environmental impact topics in the curriculum. Table 1.1 further illustrates how sub-questions were addressed in the entire study with aspects such as data collection techniques, sampling and population, theoretical framework context, research setting, data analysis methods and chapter demarcation of the research questions.

Table 1.1: Schematic presentation on how the research questions has been addressed by this study

RESEARCH QUESTIONS	SAMPLE OR DATA SOURCE	DATA COLLECTION INSTRUMENT	THEORETICAL ORIENTATION	FINDINGS AND ANALYSIS CHAPTERS
How has the shift in the curriculum affected coverage, teaching and examination of environmental impact topics in South Africa's Further Education and Training (FET) phase? (Main question)	6 Teachers Documents: -CAPS documents -Past exams -Diagnostic reports	Coverage (Document analysis) Teaching (Face-to-face interviews) Examination (Document analysis)	Realist Social Theory (Structure, culture, agency and relations)	Chapter 5 and 6
What changes have been brought by the new curriculum (CAPS) in the coverage of environmental impact topics? (Sub-question)	6 teachers Documents: -CAPS documents -Past exams -Diagnostic reports	Face-to-face interviews Document analysis		Chapter 5 and 6 Chapter 5
How many environmental impact topics in the FET curriculum are being examined in the Grade 12 (Matric) exit examinations? (Sub-question)	Documents -CAPS documents -Past exams -Diagnostic reports	Document analysis		Chapter 5
How do teachers find the teaching of environmental impacts topics in the curriculum under CAPS (FET phase) compared with the old curriculum? (Sub-question)	6 teachers Fundisa for Change resource materials (Teaching Biodiversity: Life Sciences Grade 10-12 and Teaching Climate Change: Geography Grade 10-12 module)	Face-to-face interviews Document analysis		Chapter 7
What is the impact of teacher support for the teaching environmental impacts topics provided through the Fundisa for Change programme? (Sub-question)				

1.7.2 Theoretical Framework of the Research

Realist Social Theory (RST) is the framework that underpinned this case study research (Figure 1.4). In this study RST is premised on both theoretical and methodological framework approaches. As Young (2008) and Creswell (2009) explain, knowledge is socially produced and it warrants exploration of social interests and the related dynamics of power as individuals seek understanding of the world in which they live and work. The global environmental crisis is a real social problem as evident in its impacts such as depletion of the ozone layer, rising levels of carbon dioxide in the atmosphere, global warming, deforestation, climate change, pollution and improper toxic waste disposal. Hartas (2010) suggests that individuals create their own realist meanings of their experiences through interactions with each other and with their surrounding environment. In this study, the interactions studied occurred within school environment and were supported by different structures and agents such as documents, teachers, learners and external support such as training programmes. The theoretical framework of this study comprised the interactions and roles played by structure, culture, agency in the integration of environmental impact topics in the curriculum (Figure 1.4). The theoretical framework is discussed in detail in Chapter 2 Section 2.10 of this study. The study is premised on the critical realism paradigm where most scholars agree with the ontological claim that social reality is stratified and emergent (Parra, Said-Hung & Montoya-Vargas, 2020; Howell, 2015). Further discussion on the paradigm is presented in Chapter 4 Section 4.2 where realist notion of emergence in this study highlights that entities operating in each of those layers possess properties that are non-reducible to those of its constituent parts. For example one cannot study the coverage, teaching and examination of environmental impact topics without analysing all the important documents such as policy statements, examination papers and textbooks.

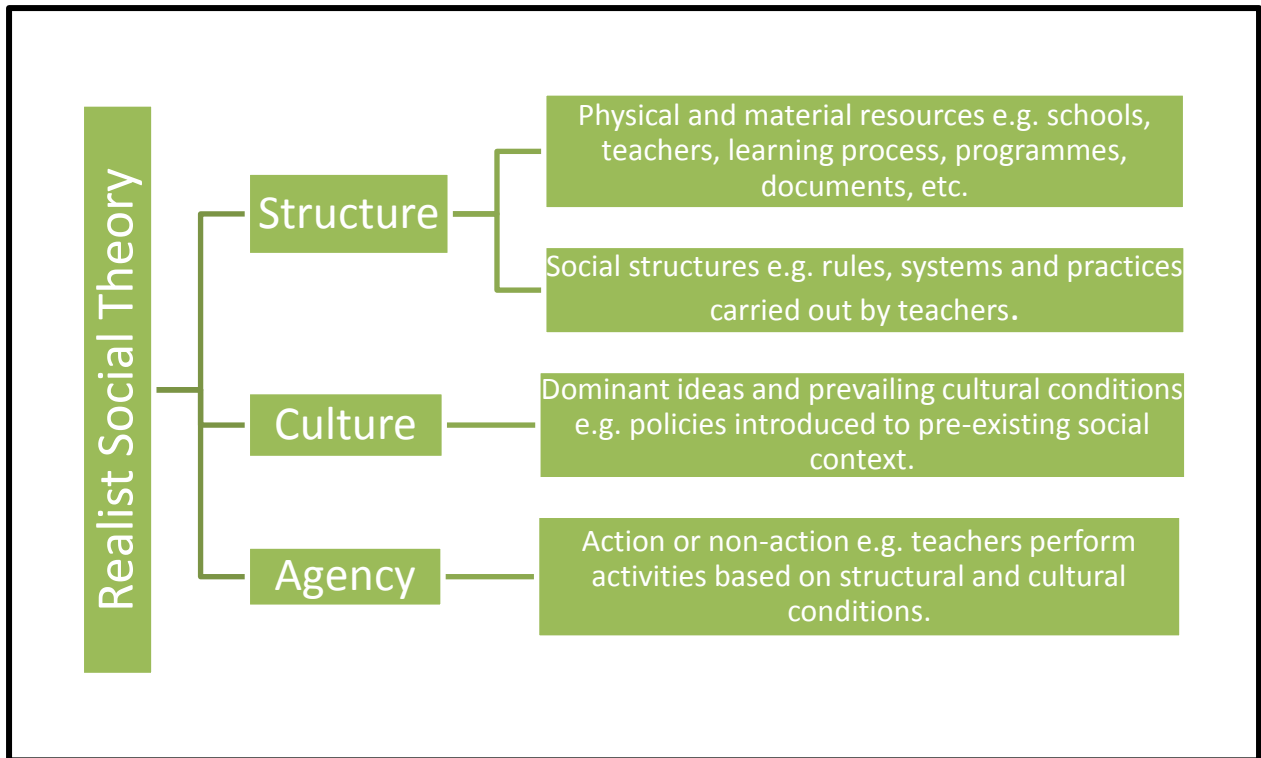


Figure 1.4: Realist social theoretical framework used in this study

1.7.3 Ontological and Epistemological Assumptions

I adopted a realist orientation towards the research whereby my interaction with educational structures and teachers as the participants during the study evoked a new niche and spaces that are deemed necessary in providing ideal solutions to the enquiry being conducted. According to RST, reality is not an independent construct but is socially constructed and has varied meanings. The RST ontology followed by this study is that there is reality of the world (environmental impacts), however the interpretation of reality is in the human mind and is conditional upon individual experiences and interpretations (Lotz-Sisitka, Fien & Ketlhoilwe, 2013). The research also adopted an epistemological approach where knowledge is considered subjective and constructed by people. In this research, knowledge was accumulated from the FET curriculum (CAPS), teacher and learner support materials, teachers, subject specialists, teaching and learning processes and the examinations.

1.7.4 Research Strategy

The case study for this research involved educators trained on the Teaching Biodiversity Life Sciences Grade 10-12 (Shava & Schudel, 2013) module developed

by Fundisa for Change programme and the Teaching Climate Change: Geography Grade 10-12 module (Vogel, Misser & Vallabh, 2013) as participants.

A case study approach was chosen because it was convenient for me as the researcher due to my residing in the province and the availability of a specific group of participants that had attended the Fundisa for Change environmental teacher training programme workshops. Creswell (2011) states that a case study may involve a single individual, several individuals, a programme or an activity. Therefore, a case study approach was chosen because it focuses on a smaller unit rather than a bigger one that would need more time and resources to investigate. Furthermore, a case study approach was chosen so that I could explore features, create interpretations and test the findings for trustworthiness. A case study approach also provided me with the opportunity to interact with the participants and gain insights into the teaching of environmental impact topics in the FET curriculum. Yin (2011) states that a case study investigates a phenomenon in its real-world context.

1.7.5 Research Methods

Creswell (2011) and McMillan and Schumacher (2010) state that research methods comprise types of data collection, analysis and interpretations for a study.

1.7.5.1 Sampling strategies and population

Purposeful sampling was used in this study, where information-rich participants were conveniently sampled (McMillan & Schumacher, 2010). The population for this research were 12 teachers who were trained under the Fundisa for Change programme in Mpumalanga Province.

1.7.5.2 Sample size

A total of 12 educators were contacted by the researcher. These were educators who had undergone training on the Teaching Biodiversity Life Sciences Grade 10-12 and Teaching Climate Change: Geography Grade 10-12 module developed by Fundisa for Change programme as participants in Mpumalanga between July and November 2013. All of these educators were invited to take part in the research. However, only six out of the 12 educators agreed to be interviewed. The other six were either unavailable or voluntarily withdrew from participation in the study.

1.7.6 Data Collection Techniques

According to Yin (2011), interviews, which he terms “interviewing and conversing”, and document analysis, which he terms “collecting and examining”, are the two techniques used in collecting qualitative data and thus are the methods used in this study. He further mentions that data collection is controlled by the engagement of the researcher together with his or her participants based on the participants’ behaviour, perceptions and beliefs. The researcher chose these two techniques in order to gain greater insight into the integration and alignment of environmental impacts topics in the curriculum. These techniques are described in detail in Chapter 4.

1.7.7 Data Analysis

Yin (2011) identifies five phases in the full cycle of analysing qualitative data. These phases are compiling, disassembling, reassembling, interpreting and concluding. This study used focused and indexical transcription in the compilation of data (Hartas, 2010) and applied interpretive coding described by Olsen (2012) as setting up a code to summarise the meaning of a sentence or phrase. This research followed three basic steps in coding qualitative data as outlined by Richards (2005), namely:

- Selection of material of interest and classifying what it is about.
- Creation and finding the appropriate category.
- Coding of relevant information and development of themes.

1.7.8 Trustworthiness, Transferability and Dependability

I used a multi-method strategy in collecting data to ensure that the study was rigorous. These methods were namely the use of interviews and document analysis. According to McMillan and Schumacher (2010), multi-method strategies allow for the triangulation of data and may yield different insights into a topic of interest, thus increasing the credibility of findings. Interview questions were pre-tested in a pilot interview before they were used in the study to verify whether they were appropriate.

1.8 ETHICAL CONSIDERATIONS

In any research, one must uphold ethical considerations, which are guided by beliefs of what is right or wrong from a moral perspective (Yin, 2011; McMillan & Schumacher, 2010). Yin (2011) further articulates that qualitative research gives the researcher an

opportunity to study the real world and it is important that a researcher behaves properly in ensuring research integrity. Yin (2011:40) illustrates the following items of the code of ethics:

- Responsibility to people being studied
- Responsibility to scholarship and science
- Responsibility to the public
- Competency and systematic enquiry

To uphold the above codes of ethics in this research, access was requested from the relevant authorities such as the schools with the sampled teachers that will take part in the research and the Department of Education where curriculum documents will be used as a source of data (see Appendix G for the letter of approval from the Mpumalanga Province). Some information was sourced online and in libraries. The study provides an analysis of the examinable content coverage in the curriculum and that helped to assess whether the shifts in curriculum has affected the delivery of the environmental impact content by teachers at school level. Ethical clearance was also obtained from the UNISA College of Education's Research Ethics Committee before the start of data collection (see attached ethical clearance certificate in Appendix D). The following ethical considerations were made:

- Informed consent, privacy, anonymity and confidentiality;
- Safe data storage and unbiased, fair, honest and accurate reporting;
- Inclusion of all data, without interference from any outside body; and
- Careful data handling and analysis.

1.9 LIMITATIONS AND DELIMITATIONS OF THE STUDY

One of the limitations of this was study was that this qualitative research processes were time-consuming. It took me several months to complete the analyses of documents data. Another limitation that this study experienced was that it was a labour intensive approach where analysis required processes such as recording, transcribing, categorizing, themes, etcetera. The study was conducted only in Mpumalanga Province, which was the home province for all of the participants.

Mpumalanga was also convenient for me as the researcher to carry out the study, as I was a teacher in the province and knew most of the places that I had to travel to when collecting data. Educators who did not participate in the Fundisa for Change training workshops were excluded. Only questions that were approved by the supervisor and the College of Education Research Ethics Committee were used in the study. The study focused on content knowledge and assessment of environmental impact topics; hence, observations were not carried out which may have enhanced the validity of the findings.

1.10 KEY CONCEPTS INFLUENCING THE STUDY

The main concepts that influenced this study were environmental education, environmental impact topics, sustainable model, structure, culture and agency. These concepts are discussed below.

Environmental education: According to IUCN (1971:n.p.), EE is defined as “the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among people, their culture and their biophysical surroundings”. From the above definition, this study clarifies the concept of environmental impact topics within the context of environmental education in terms of its effects on the global, regional and local perspective (as seen in Chapter 2 of this study). The study also evaluates the impact of the Fundisa for Change programme on teachers’ acquisition of knowledge, skills, values and experiences (see Chapter 7 of this study). From the definition of IUCN, it can be emphasised that the concept of EE in this study helped in evaluating the learning process that increase knowledge, awareness on challenges affecting the biophysical, social, economic and political aspects of the environment.

Environmental impact topics: Section 1.2.4, Law Dictionary.org (2017) defines environmental impacts as the “effects to organisms or their environment, possibly adverse, caused by development, industrial or infrastructural projects or a pollutant”. According to the Southern Africa Environment Outlook (2008), an environmental impact is defined as “the consequences of the environmental change on human and ecological systems, and on social and economic development”. This study embodied both definitions to support the concept of environmental impacts in the study. Analysis

of the coverage of environmental impact topics in the FET curriculum is discussed in Chapter 5 and 6 of this study.

Sustainability model: The study uses the sustainability model as one of the concepts in the analysis of the coverage, teaching and examination of environmental impact topics in the FET curriculum. The concept of sustainability, which is fully discussed in Chapter 3, presents three key features, which are: biophysical (biological and physical environment), social and economic spheres (2nd South African Environmental Outlook, 2016). The concept of sustainability in this study has reference to the 1987 Brundtland Commission definition that says, “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (2nd South African Environmental Outlook, 2016). According to the outlook report, the social sphere exists within the economic sphere while both are dependent on the biophysical dimension. The biophysical dimension in this study includes climate, water, air and natural resources that are used by people or which they depend upon. However, without a functioning and healthy environment, progress in the social and economic dimensions is affected. The Second South African Environmental Outlook (Department of Environmental Affairs [DEA], 2016) further mentions that aspects such as individual health, cultural values and recreation need to be considered in the wider holistic concept of the environment.

Structure: In this study, structure represents sets of internally related objects (physical or material resources) and practices that are carried out by people (Archer; 1996; De Souza, 2013). In the context of this research, social structure is used to represent schools, teaching and learning processes, programmes and documents that are analysed in Chapter 5.

Culture: In this study, the concept of culture is refers to the ideas that inform the actions of individuals and what actions and outcomes are possible (De Souza, 2013). Culture represents the realm within which people live and deals with relations between ideas and the ideational influences operating between them (Archer, 1996a).

Agency: In this study the concept of agency represents individuals (teachers) in a society engaging in action or non-action under the influences of structural and cultural conditions (De Souza, 2013). Schematic presentation of the concepts such as

structure, culture and agency is outlined in Chapter 4 in the Realist Social Theory that is used as this study's theoretical framework.

1.11 CHAPTER OUTLINE

The study is demarcated into eight chapters. The division of the chapters is as follows:

Chapter 1: This chapter provides the introduction and background to the research. The problem statement and sub-problems are addressed. The chapter further describes the objectives, methodology, the value of the research and an explanation of key concepts.

Chapter 2: The review of literature on environmental impacts is addressed by the study in the second chapter. Vital information on environmental impact issues from the global scale, to the African context, and to the local South African context from different sources are unveiled in this chapter. Apart from a literature review, this chapter also provides a discussion of the theoretical background and a critique of different theories when evaluating the challenges facing the entire world in efforts to reduce environmental degradation.

Chapter 3: Environmental Education is outlined in this chapter as a response to environmental impacts. Chapter 3 further discusses different aspects of EE, including definitions of EE, the development of EE globally through to the African region and locally in South Africa. This chapter also discusses the importance of EE, different views, aims and objectives of EE, the role of teachers in the dissemination of environmental impact topics and the challenges in the implementation of EE. Chapter 3 further provides three principles of teaching and learning EE, global countries' and selected Southern African countries' approach to the implementation of EE in the curriculum.

Chapter 4: This chapter outlines the research methodology for this study. The research design and methods used in the study are explained in detail. This chapter describes the research methods (data collection and data analysis), ethical considerations, measures to ensure trustworthiness that were used in the research. A qualitative approach which was used in this study is succinctly discussed. In this chapter, the plan of action for the research is described in detail.

Chapter 5: The environmental impacts content coverage in South African FET phase curriculum is discussed in this chapter. Selected subject curriculum policy statements with respect to EE impact topics were analysed. In this chapter CAPS documents, past examinations questions and examination diagnostic reports were interpreted to answer some of the research questions in section 1.6 of this chapter.

Chapter 6: The findings and analysis in this chapter were based on data collected through face-to-face interviews with teachers.

Chapter 7: This chapter highlights the effects of the Fundisa for Change programme in the teaching of EE in schools. This chapter explores the influence of Fundisa for Change programme in the teaching of environmental impact topics.

Chapter 8: This is the concluding chapter. The findings of this study are synthesised in this chapter in line with the research objectives discussed in section 1.6.4 of Chapter 1. A summary of results as well as conclusions with reference to the postulated problems is provided. This chapter summarises whether the objectives of the study have been achieved, discusses the limitations of the study and provides recommendations for EE practitioners and policy makers as well as for future research.

1.12 CHAPTER SUMMARY

This chapter introduced the study and provided the background for it. The chapter further outlined the rationale for the study, statement of the problem, research questions, aims and objectives, preliminary literature review, research methodology, limitations and delimitations, definition of key terms and the chapter outline. The following chapter provides a substantial literature review on environmental impact topics from global, regional and local perspectives.

CHAPTER 2

OVERVIEW ENVIRONMENTAL IMPACTS

2.1 INTRODUCTION

This chapter explores ways in which environmental impacts have transformed the face of the earth. As the human population expands in number and spreads more rapidly worldwide, the environment is being modified into a deplorable situation largely due to the effects of human capitalistic development such as industrialisation, commercial agriculture, mining, oil drilling, urban settlements development and expansion, accumulation of solid waste, pollution, biodiversity loss and environmental degradation (Goudie & Viles, 2003). This chapter draws on environmental impacts literature from local (South African), regional (Southern African), continental (African) and Global perspectives. The literature review in this chapter also evaluates the challenges facing the entire world in its efforts to reduce environmental degradation. As seen in Chapter 1, the current negative environmental situation has been brought about by natural and human-induced activities (SADC, 2008). The Southern Africa Environment Outlook (2008) defines environmental impacts as the consequences of environmental changes on social and economic development and human and ecological systems. Based on the above-mentioned definition, this chapter discusses natural and human-induced environmental impacts and their effects on environmental sustainability. A tabulated summary showing key global, regional and local environmental impact issues is given in Table 2.4. It should be mentioned that all environmental impact topics that are discussed in this chapter formed part of content that is being taught in the school curriculum. Therefore, it is significant to review the status of these environmental impact topics in this study.

2.2 HUMAN DERIVED ENVIRONMENTAL IMPACTS

Kemp et al. (2003) further ascertain that primitive people were operating at low energy levels with basic tools, which contributed little to the destruction of natural resources. In contrast, most of the environmental impacts facing the world today are human derived. This section discusses some of the human-induced activities that have led to environmental crises (Goudie & Viles, 2003). Beliefs in the value of the environment, our attitudes to the future and our ability to solve problems from local perspectives to

global perspectives must also be questioned and adapted to deal with the crisis we are causing upon ourselves (Harris, 2012). According to Goudie and Viles (2003), as the world is becoming increasingly urbanised, urban ecology has played a significant role in environmental impact. They mention that in 1980 there were 35 cities with populations of over four million and projected that by 2025 there will be about 135 cities of that magnitude, and that these cities would contain around half of the world's population of more than seven billion. According to UNEP (2016), urban areas including cities contribute more towards global pollution. With this development, the impact of urban areas on the environment and ecology can be devastating, occasioning a burgeoning environmental catastrophe (Goudie & Viles, 2003).

The environmental issues dealt with in schools should therefore incorporate environmental impact topics. Harris (2012) emphasises that human environmental impact of the human population on the environment is seen inland use change, urbanisation, and the pollution of water, seas and landscapes (Harris, 2012). According to Goudie and Viles (2003), cities produce a major demand for natural resources in the surrounding areas and obliterate the natural hydrological system on the site of the city. Furthermore, cities reduce biomass and produce waste products, which can alter the species composition on the site of the city. Goudie and Viles (2003:48) also establish that, urban areas produce waste products which can alter the environment in and around the city and create new land through reclamation and landfill.

Goudie and Viles (2003) reveal that the impacts mentioned above are the ecological footprint of a city, which is affected by pollution, resource extraction and development. They articulate that urbanisation leads to drastic changes in geomorphology, climate, hydrology and ecology. Although cities have a devastating impact on the environment, the authors mention that there are mitigation strategies employed to alleviate the scourge of degradation in the cities such as the planting of trees in streets, developing urban farms and urban nature reserves and so forth. Increasing urban pollution problems show, however, that success in dealing with problems caused by urban development has been limited. Di Chiro (2014:9) contends that, "one thing on which there is widespread consensus is that the earth and its inhabitants are in social peril". However, there is equally widespread disagreement about the nature and causes of

the environmental crisis because most countries prefer economic gain instead of sustainable development gains.

In support of Thoeun's statement, Lofdahl (2002) highlights the scope of environmental degradation that can take place on many levels. Some environmental problems are so large that they range across national and continental borders while others manifest themselves in the local community. Lofdahl further identifies that human activity is disproportionately large with respect to the natural environment, so the continued growth of international trade now threatens the viability of the natural environment.

They noted other mechanisms that have potential to cause climate change such as aerosol generation and albedo change (albedo refers to the "whiteness" of a surface and has the potential to change temperatures in the environment). This shows that a number of pollutants have transformed the quality of air as the world strives for economic liberation at the expense of the declining environmental situation in the world.

In support of the statement above, Di Chiro (2014) mentions that all of our major problems as a species, such as nuclear war, overpopulation, pollution, hunger, the desolation of the planet, and the inequality among people are a crisis, not of information, but of policy. As things stand now, the people especially of the Third World are going to perish due to "our selfish drive of economic liberation at the expense of limited natural resources" (Di Chiro, 2014:15). The call therefore is that the world needs to become "environmentally literate" (McBride, Brewer, Berkowitz & Borrie, 2013:3).

The above authors believe that urgent measures need to be taken to combat negative human impacts on the environment and environmental researchers need to gain more insight into systems such as biogeochemical cycles and the linkage of human behaviour with these cycles.

Goudie and Viles (2003) conclude that environmental quality has clearly deteriorated because of human activity, which is the cause of excessive and inconsiderate extraction of natural resources, extensive waste emissions, and failure to observe ecological and aesthetic laws. Other causes are inefficient economies that consume

large amounts of raw materials and energy, as well as technology companies who manufacture goods with little respect for the ecological consequences of environmental degradation. Human-induced impacts on the environment come in different forms that are described in detail in this section.

2.2.1 Human Impact on Vegetation

Deforestation is one of the ways in which humans have altered the environment in the search for wood, fuel, and food production and has resulted in destruction of natural resources. Human impact on vegetation has been estimated to have increased by 45 percent in the last 2000 years due to harvesting, deforestation and conversion of grass and wetlands (Goudie, 2013). Goudie (2013:27) classifies the extent of human influence on vegetation as follows:

Table 2.1: Extent of human influence on vegetation

1. Natural	A landscape or an ecosystem not influenced by human activity.
2. Sub natural	A landscape or ecosystem partly influenced by human
3. Semi-natural	A landscape or ecosystem in which flora and fauna are largely spontaneous, but the vegetation structure is altered so that it belongs to another formation type.
4. Cultural	A landscape or ecosystem in which flora and fauna have been essentially affected by agency in such a way that the dominant species may have been replaced by other species.

Some useful reasons for using fire are clearing forests, improving pastures, killing and driving away predatory animals, repelling and attacking human enemies, providing light and heat for cooking and transmitting messages by smoke signs (Goudie & Viles, 2003). Although fire has made some important contributions to human living, it also has some consequences that are detrimental to the environment. Uncontrolled fires can lead to huge losses of vegetation cover and animal habitats (Goudie, 2013). The extent of fire damage to vegetation, according to Goudie (2013), depends also on the size, duration and intensity of the fire. Furthermore, the burning of forests by humans may cause the pH value of the soil to rise by three units or more, creating alkaline conditions, loss of soil nutrients, and increases in soil temperature where vegetation was burnt and animal species were destroyed (Goudie & Viles, 2003).

Another human-induced impact on vegetation is overgrazing, where plants are destroyed because of trampling which leads to shrub dominance (Goudie, 2013). Furthermore, Goudie (2013) states that another human activity that affects vegetation growth is deforestation where there is a deliberate and permanent removal of forest for purposes such as agriculture. According to Goudie (2013), deforestation can be done by either cutting or burning of the forest, which can bring about climate change, cause air pollution, desertification and loss of biodiversity, increase the rate of erosion and accelerate the mass movement of animals. These features are also present in South Africa in all nine provinces. As Goudie (2013) illustrates, the major negative human-induced impact on the environment is caused by deforestation. Table 2.2 below illustrates some consequences of deforestation.

Table 2.2: Some major consequences of deforestation

Type of change	Examples
Reduced biological diversity	<ul style="list-style-type: none"> ➤ Species extinctions ➤ Reduced capacity to breed improved crop varieties ➤ Inability to make some plants economic crops ➤ Threat to production of minor forest products
Changes in local and regional environments	<ul style="list-style-type: none"> ➤ More soil degradation ➤ Changes in water flows from catchments ➤ Changes in buffering of water flows by wetland forests ➤ Increased sedimentation of rivers, reservoirs, etc. ➤ Possible changes in rainfall characteristics
Changes in global environments	<ul style="list-style-type: none"> ➤ Reduction in carbon stored in the terrestrial biota ➤ Increase in carbon dioxide content of atmosphere ➤ Changes in global temperature and rainfall patterns through greenhouse effects

Source: Adapted from Grainger (1992)

Goudie and Viles (2003) give further examples of human-induced impacts, which have direct and indirect effects on vegetation. Agriculture, aquaculture and other forms of food production have a wide range of environmental impacts, including soil erosion, nutrient depletion, changes in species diversity and genetic changes to crops. Forestry and quarrying are extractive industries, which are creating completely new landscapes and releasing large amounts of sediment in some parts of the world (Goudie & Viles, 2003:12).

Humans are great exporters of other organisms, whether deliberate or accidental. For example, plants from foreign biomes can be easily transported by human activities, become dominant, and retard the growth of another species (Goudie & Viles, 2003). The authors go on to comment that introduced plants are capable of invading areas to which they were introduced to the extent of causing ecological explosions. The reason they cause ecological explosions is that they prove to be so successful in their new habitat that they expand in range and numbers to the detriment of the native species. For example, in South Africa there five main alien invasive species are the pompom weed, famine weed, water hyacinth, bug weed and the *Lantana camara*. *Lantana camara* has displaced valuable forager species and medicinal plants and prevents the regeneration of native plant species (Lifeisagarden, 2019). The syringa tree (*Melea azedarach*) and the jacaranda (*Jacaranda mimmosilfolia*) among others are other good examples of aline inavise species which deprive ecosystems of much needed water.

2.2.2 Human Influence on Animal Species

The World Wide Fund for Nature (WWF) posits that the habitats of large numbers of the Earth's animal species are under threat due to the human induced environmental impacts. Goudie (2013) points out those human beings have the greatest biomass of any species and the impact that they have had on animals is grouped into five categories: domestication, dispersal, extinction, expansion and contraction. Goudie believes that domestication is one of the most profound ways in which humans have affected animals. Moreover, habitat loss can also be attributed to the loss of wetlands, plains, lakes, and human activities such as pollution, trading in wildlife, and engagement in wars, urbanisation, industrialisation and tourism (WWF, 2017).

Goudie (2013) highlights that most attention on research tends to focus on the negative impact of human agency on animals although there are some circumstances where alterations to the environment has favoured the proliferation of some species. This positive aspect, however, is not part of the scope of this study. Goudie further mentions that human economic activities may lead to the rise of particular species of animals and that can lead to the expansion and distribution of those species because of the removal and modification of their preferred habitats. Goudie (2013:80) posits that the "extreme effect of human interference with animals is extinction, but before

that point is reached humans may cause major contractions in both animal numbers and animal distribution”. These contractions include the biological impacts of fishing and game activities, which are becoming large scale and affect the survival of natural species. These contractions mentioned by the author are caused by pollution, habitat change or loss and competition from invaders. Furthermore, the decline in dissolved oxygen concentration can also promote the formation of reduced compounds, such as hydrogen sulphide, resulting in aquatic animals being exposed to higher toxic effects (Camargo & Alonso, 2006:831).

Goudie (2013) further provides examples of pollution such as oil pollution that has a negative impact on marine and coastal fauna and flora. Industrial air pollution has an adverse effect on wild animals and arsenic emissions from silver foundries have killed deer and rabbits in Germany. Similarly, Sulphur emissions from a pulp mill in Canada have killed many songbirds; asbestos has been found in baboons and rodents near asbestos mines in South Africa and oxidants from air pollution are recognised as causing blindness in sheep in the United States of America. Goudie (2013) also notes that agricultural activities have resulted in the extinction of some species, for example when a plant is eradicated and a butterfly vanishes because it is not adapted to feeding on plants grown in an area of improved pasture. Goudie (2013:89) mentions that, “numbers of animals have declined by half over the last quarter of a century”. He mentioned the following reasons for the decline: pesticide usage, loss of hedgerows, fragmented habitats, presence of less rough field edges, human population growth and technology.

2.2.3 Human Impact on the Soil

In arid and semi-arid areas, the main cause of land degradation is soil salinisation, which is caused by both natural processes and anthropogenic activities (Zhang, Wang & Han, 2017). Goudie (2013:103) remarks that humans modify soils in many ways. Among the most important changes are those involving accelerated salinisation, lateritisation, podsolisation, and acidification. The coastal aquifer of Rome is characterised by salinisation, where early warning was detected through changes in groundwater, which became unsuitable for watering plants during dry seasons (Mastrorillo, Mazza, Manca & Tuccimei, 2016).

Payen et al. (2016), identify four biophysical and human management factors associated with anthropogenic salinization. These are salinisation associated with land use change, salinisation caused by fertilisers and irrigation, salinisation associated with brine disposal and salinisation associated with overuse of water bodies near coastal areas. Apart from the negative impacts of salinisation of the soil, acidification of the soil has resulted in the decline of forests in some parts of the world. Acidification of the soil is caused by increased emissions of sulphur dioxide, oxidized nitrogen and other acidifying substances due to anthropogenic activities (Li Dai, Wang, Li Webb, Wang, Li Kou, Shi & Zhang, 2016; Tang, Weligama & Sale, 2013). Soil acidification has affected agricultural production (Xiao, Xu, Tang, Zhang & Brookes, 2013) and approximately 50% of the world's potential arable land consists of acidic soils (Kochian, Piñeros, Liu & Magalhaes, 2015).

Human impacts on the soil can be beneficial or detrimental. This study focuses on the latter where negative environmental impact topics have culminated in the inception of EE and ESD as a response to the emerging environmental crises. Goudie (2013) has seen the same phenomenon of positive and negative effects of soil-forming factors. As the study focuses on the negative human influence on soil-forming factors, it is imperative to discuss those factors such as parent material, topography, climate, organisms and time. These environmental impact topics are predominantly found in Geography, which is one of the subjects that has been analysed in this research (see Chapter 5).

Goudie (2013) specifies that agricultural activities and deforestation have a major effect on soil degradation because they cause soil erosion. Human activities may have had an important effect on soil erosion and consequently generate dust storms in the world's drylands (Goudie, 2013). Goudie further comments that soil erosion can also be accelerated by set fires as the soil is left bare after extensive burning of vegetation which acts as soil cover. He further states that the highest rate of erosion is produced in the construction of infrastructure when there are large amounts of exposed ground and much disturbance produced by vehicle movements and excavation. Sterling, Ducharme and Polcher (2012) reveal that humans have altered the incidence and severity of events by changing the terrestrial water cycle. These changes lead largely to impacts on runoff, which alters land cover.

Furthermore, Goudie and Viles (2003) mention that humans have increasingly added aerosols into the air such as industrial waste, which could influence the absorption of solar radiation that will lead to climate change. Industrialisation is not the only source of particles in the atmosphere; dust storms generated by deflation from land surfaces with limited vegetation cover also contribute to air pollution.

Goudie (2013) names three of the environmental impacts of mineral extraction:

- excavation and iron ore removal, which results in the destruction of plant and animal habitats; human settlements and other features (surface mining); land subsidence (underground mining); increased erosion such as silting of lakes and streams; waste generation; acid drainage (if ore or overburden contains sulphuric compounds); and metal contamination of lakes, streams and groundwater;
- iron ore concentration which is exacerbated by waste generation, organic chemical contamination, acid drainage and metal contamination of lakes, streams and groundwater; and
- smelting or refining, which causes air pollution (substances emitted can include sulphur dioxide, arsenic, lead, cadmium and other toxic substances), waste generation (slag) and energy production (most of the energy used in extracting minerals goes into smelting and refining).

One of the effects of human-induced interaction with the environment is desertification. Goudie and Viles (2003:26) state that “desertification is the main environmental problem of arid lands, which occupy about 40% of the total global land area and at present, desertification threatens about 3.6 billion hectares which consist of 70% of potentially productive drylands or a quarter of the total land area of the world”. The devastating effects of desertification include the reduction of crop yields, reduction of biomass produced by rangelands, reduction of available wood biomass, overgrazing, salinisation, reduction of available water and social disruptions as support systems will be needed for relief aid in affected areas. Goudie and Viles (2003) note that fires and desertification are some of the worst negative influences that humans have on the environment.

2.2.4 Human Impact on the Earth's Waters

Surface water pollution remains a major problem around the world due to both natural processes and anthropogenic activities (Vadde, Wang, Cao, Yuan, McCarthy & Sekar, 2018). Chenoweth, Hadjikakou and Zoumides (2014) reveal that modern human societies use large amounts of water compared to the scarce water resources available, thus heavily influencing present and future generation's welfare and natural environment. In China, water pollution is largely from domestic wastewater and solid wastes due to coordinated development of the rural society (Peng, 2017). This is a result of the low treatment rate of urban domestic sewage which contaminates the water environment in rural areas, thus affecting agricultural production and the quality of health of the people (Peng, 2017; Zaharia & Jufa, 2017). Low treatment efficiency of pollutants from township enterprises and pollutant migration from urban areas to rural areas not only threatens the health of rural residents but also influences health of the population through water pollution and food contamination (Peng, 2017). Goudie (2013) points out that the result of human modification of river regions is that lake water levels have suffered some drastic changes. He goes on to comment that the cause of the declining level in lakes was due to deforestation and abstraction of water for irrigation. The reduced water level of lakes has a detrimental effect on the survival of animals and aquatic plants. Humans obtain water supplies by pumping ground water and about 38% of the world's irrigated areas are groundwater-based, where abstraction exceeds recharge and thus causes water depletion. The two main effects of abstraction exceeding recharging in an area are a reduction in the levels of the water table and the replacement in coastal areas of fresh water by saltwater. Water pollution is one of the undesirable negative impacts on the environment as it causes disease transmission through infection, poisons humans and animals and creates objectionable odours and unsightliness. For example, Tiaoxi River in China is heavily contaminated with pollutants from various sources that are related to anthropogenic activities (Vadde et al., 2018).

Forms of water pollution created by humans that pose a threat to the environment are sewage wastes, infectious agents, organic chemicals, mineral substances, sediments, radioactive substances and thermal pollution. Moreover, "many human activities can contribute to changes in water quality, including agriculture, fire, urbanisation, industry, mining, irrigation and others" (Goudie, 2013:155). These activities have local effects

such as acid rain that have implications for the continental and global environment (Goudie, 2013, Kemp et al., 2003; Vadde et al., 2018). In China, the southeast Jiangsu province is one of the more industrialised regions where pollution of water bodies causes an environmental threat to animals and humans (Vadde et al., 2018). Similarly, in Romania, the direct discharge of effluents from industries and municipal wastewater treatment plants into streams represents a growing environmental concern due to its impact on water ecology and potential effects on human health (Zaharia & Jufa, 2017). In contrast, Vadde et al. (2018), remarks that severe rainfall can accelerate pollutant loadings due to the entry of storm water runoff from urban areas as well as from agricultural areas into water bodies due to practices such as manure used as fertilisers and livestock grazing near water bodies. Chemical pollutants such as nitrates, phosphates, metals, synthetic and industrial organic pollutants play a negative role in the environment (Goudie, 2013). Goudie further mentions that human use of metals has increased and the amount of water pollution is of greatest concern as lead, mercury, arsenic and cadmium have adverse health effects.

In addition, chemical pollution by agriculture such as chemical wastes has a detrimental effect on environment. Nitrogen with phosphorous tends to disrupt the natural growth of aquatic plants and leads to the eutrophication of inland waters. Eutrophication is the enrichment of water by nutrients and it occurs naturally during the slow aging of lakes. This excess nitrogen can also be a health hazard to humans and animals (Goudie, 2013). Goudie (2013), in support of the above, sees that storm water run-off from urban areas may contain large numbers of contaminants derived from litter, garbage, car-washings, horticultural treatments, oil leaks from vehicles, industry, construction, animal droppings and the chemicals used for snow and ice clearance.

Another ecosystem type that is threatened by human activities is the wetlands, which They also recharge groundwater aquifers, prevent floods, store carbon from the greenhouse effect, provide building materials, provide fuel, cleanse polluted water and provide unique habitats for a wide variety of flora and fauna (Goudie & Viles, 2003). Goudie and Viles state that wetlands are under threat from draining, ditching, dredging, filling, pollution and channelisation.

2.2.5 Human Agency in Geomorphology

It is useful to recognise that direct anthropogenic processes, which are deliberately and knowingly created, produce some features of landforms. For example, erosion of soils leads to a decrease in the thickness of its horizon, water permeability and moisture capacity of soils, the content of waterproof aggregates, humus, mobile phosphorus and exchangeable potassium (Munteanu & Cojocaru, 2017). These negative effects of erosion on soil properties lead to a shortage of crops harvested and a decrease in the efficiency of agricultural production (Munteanu & Cojocaru, 2017 and Van Loo, Dugar, Verstraeten, Renssen, Notebaert, Haen and Bakker, 2017). Global warming, sea level rise and severe typhoons have an effect on the stability of human settlements along coastlines (Duc, Yasuhara, Hieu & Lan, 2017). One of the most severe cases of coastal erosion is in Hai Hau, Vietnam, which was caused by degradation of the Ha Lan river mouth, which reached up to 100m per year in some segments during the period 1905-1930 (Duc et al., 2017). Likewise, changes in land-use have caused increased sediment erosion and eutrophication of near-shore waters, which has led to degradation and loss of marine ecosystems such as seagrass meadows (Sanders et al., 2017). In addition, over the past 40 years the South Baltic coastal zone has been exposed to dune erosion and the greatest destruction of the coastal dunes in Poland has been observed on sandbar sections of the Lake Kopan Sandbar and Dziwnow Sandbar (Tylkowski, 2017). The coastal erosion on the Polish coast of the Baltic Sea is caused by sea level rises during extreme storm surges, when loss of dune sediments along the entire coast is about 400 000 m³ (Tylkowski, 2017).

Singh et al. (2017) declare that prescribed fires have several benefits for managing forest ecosystems including the reduction of fuel loading and invasive species and enhanced regeneration of desired tree species. However, these benefits have negatives which accompany them like nutrient and sediment loss.

Goudie (2013) further points out that environmental devastation produced by strip mining is exceptional where the amount of excavation will often be higher than the amount of subsequent dumping of waste.

Goudie (2013) and Van Loo et al. (2017) remark that there are several human activities that trigger changes in the natural landform and have an adverse effect on the environment. These changes are landforms produced by construction and dumping,

sediments transported by rivers, accelerated sedimentation, ground subsidence, accelerated weathering, accelerated mass movement such as landslides, deliberate modification of channels, overgrazing and inadvertently triggered volcanoes.

Developing countries like China and South Africa face some challenges in trying to preserve biodiversity. These challenges, according to Goudie and Viles (2003:62), include the uneven distribution and administration of nature reserves, many of which are too small to be ecologically effective; environmental literacy among people living near nature reserves is low; planners do not consider the economic concerns of these people sufficiently; and tourism has placed an additional stress on many nature reserves. Van Loo et al. (2017) concludes that human activities have affected their environment throughout their history due to the introduction of widespread agriculture and the associated forest logging activity.

2.2.6 Human Impact on Climate and the Atmosphere

Goudie and Viles (2003) highlight that climate change can be accelerated by the impact of human-induced activities such as aerosols. Goudie and Viles (2003) and Kemp (2003) describe aerosols as a mixture of liquid and solid state dispersed uniformly within a gas. Examples of aerosols are smoke, dust, condensation nuclei, freezing nuclei, fog, spores, salt crystals, bacteria, sulphur dioxide, nitrogen oxide and other microscopic particles (Goudie & Viles, 2003; Kemp et al., 2003). Aerosols cause air pollution that is harmful to humans, although the cause of the pollution is accelerated by human involvement. These aerosols affect the atmosphere through pollution.

On the same note, China is the largest and most rapidly urbanising country in the world and projections reveal that there will be an additional 200 million city dwellers by the end of 2030 (Cao, Yu, Georgescu, Wu & Wang, 2018). Cao et al. (2018) posit that rapid urbanisation leads to vast expansion of built-up areas, possible climate change and associated human health impacts. On another note, Goudie (2013) and Cook et al. (2017) explain that the concentration of several greenhouse gases such as CO₂ has contributed to the depletion of the natural resources and thus results in environmental degradation. Gases such as carbon dioxide, methane, nitrous oxide and chlorofluorocarbons are principal gases that affect the earth due to negative human impacts. According to Goudie (2013), these human-derived sources are fossil-

fuel combustion, cement production, biomass burning, landfills, animal waste, nitrogenous fertiliser, industrial sources, coal combustion and enteric fermentation.

Another major possible human-induced cause of climate change is alteration in the reflective properties (albedo) of the ground surface and the proportion of solar radiation, which the surface reflects (Goudie & Viles, 2003). Albedo is defined by Goudie and Viles as a measure of the reflectivity of a body or surface or the total radiation reflected by the body divided by the total radiation falling on it. Values are expected to have a scale from 0-100 percent (Goudie & Viles, 2003). In addition, land use changes create differences in albedo that have important effect on the energy balance of an area. Tall rain forests may have an albedo as low as 9%, while the albedo of deserts may be as high as 37%. This can be caused by human activities such as overgrazing and deforestation (Goudie & Viles, 2003). According to Brownlee,

On the same note, Dunnette and O'Brien (1992) reveal that two major activities, in addition to food production, have been found to be threats to the global environment through the influence of human activities. They cite the combustion of fossil fuels to provide energy to transport people, to power the industrial complexes, and to provide heat and light and other forms of energy as one of these activities. Dunnette and O'Brien (1992) further outline that these forms of energy create many forms of pollution from refining or processing activities and water, land and air pollution from energy-producing activities.

2.3 ENVIRONMENTAL IMPACT ASPECTS IN THE CURRICULUM

As mentioned earlier in this Chapter, local, regional and the global environments are being gradually degraded by mostly human-induced as well as non-human induced activities. Therefore, it is important to perform research about the coverage of environmental impacts in the curriculum due to continued lack of realisation of the unsustainability of human actions on the environment and their implications on human livelihood. Hence, it is important to respond to these environmental impacts through education, which should incorporate EE/ESD themes in the curriculum and across all subjects. Coverage of environmental impact topics in the South African school curriculum should be accessible to the younger generations who will have informed knowledge on how they could preserve resources for future usage by acquainting themselves with environmental knowledge embedded in the documents. Therefore,

documents such as Grade 12 textbooks, examination papers and CAPS have to be aligned to important practices that aim at EE/ESD. This study aims to provide an assessment of what is being projected by policy on environmental education and what is actually being practiced in the FET phase of Basic Education in the Mpumalanga province.

Carvello (2009) in her study of an assessment of the role of eco-schools in achieving whole school development through sustainability education, highlighted some evidence of environmental education and sustainable education in the NCS in subjects such as Business studies, Consumer studies, Life Orientation, Agricultural Sciences, Tourism, Mechanical Technology and Economics. Carvello's (2009) study was done before the CAPS curriculum was implemented and does not analyse alignment between policy and practice. On the other hand, Zwelibanzi (2016) in her study of an investigation into issues and challenges in implementing environmental education in special schools in South Africa, states that the constant changing of the curriculum in a very short period confuses teachers. Her findings point to a situation where teachers are unable to cope with the changes that have been effected in the curriculum. Similarly, Maluleke (2015) points out that South African teachers are frustrated by curriculum policy changes, where teachers indicated that since 1994 there have been many curriculum changes where some policies have been repealed before they could be implemented.

In addition, Zwelibanzi's (2016) study further reveals that teacher's views about the environment are very superficial and they confuse EE with nature studies or nature conservation, which influences the way they teach. Furthermore, Maluleke (2015) reveals that teachers indicated that they find it difficult to integrate EE into the curriculum because they were not fully trained on how they could use EE concepts in the classroom. Zwelibanzi (2016) is of the opinion that an exploratory study could be conducted on how to enhance teacher's pedagogical and content knowledge regarding EE through in-service and pre-service training. She further recommends that survey studies should be conducted on teacher's knowledge and perceptions about constructivism that underpins CAPS. Some studies provided important findings about the integration of EE/ESD in the school curriculum, teachers discourse and practices, political, economic and social dimensions of EE, different EE approaches, environmental behavioural changes, pre-service teacher training and assessing

environmental competency (Blyth & Meiring, 2018; Cosenza & Martins, 2018; Okur-Berberoglu, 2017; Paredes-Chi & Viga-de Alva, 2018; Walker, Clary & Wissehr, 2017). This study evaluated the extent of support provided by teacher training programmes, specifically the Fundisa for Change environmental teacher training programme.

When reviewing literature on EE/ESD in South Africa, most of the studies conducted research on integration, teacher practices, pedagogical and content knowledge, different EE approaches, behavioural changes and assessing environmental literacy (Carvello, 2009; Maluleke, 2015; Zwelibanzi, 2016). However, none of the studies was about the alignment and extent of EE/ESD coverage in curriculum policy and in the examinations. It is against this background that this study analysed the coverage, teaching and examinations of environmental impact topics in the FET curriculum. In addition, this study analysed how the shift of the curriculum has affected coverage of environmental impact topics.

This policy framework requires that teachers attain the requisite knowledge for integration of environmental and sustainability concerns (UNESCO, 2017). The approaches used in South Africa to include ESD in the curriculum are an issues-based approach and a fragmented approach (UNESCO, 2017). The extent and depth of coverage of ESD content in the curriculum is dependent on the subject. Some subjects have greater coverage of environmental content than others do (UNESCO, 2017). However, the Curriculum Assessment Policy Statement (CAPS) requires teachers to integrate aspects of environment and sustainable development into almost all subjects as seen in Table 2.3 for example.

Table 2.3: Mapping some of the key EE/ESD knowledge areas/themes in the South African school curriculum

Phase and Subject	Biodiversity and ecosystems	Sustainable development	Water system and security
FET Agricultural Sciences	Plant studies;– Components of ecosystem; The biomes of Southern Africa; Ecology and agro-ecology; Interactions in ecosystems and ecological farming	Sustainable utilisation of natural resources; Farming systems that use agro-ecological principles	Water quality and management; Sustainable use of water in agriculture; Water use/irrigation

Phase and Subject	Biodiversity and ecosystems	Sustainable development	Water system and security
FET Geography		The concept of development; Effect of development on the environment; Using resources; Effects of using more non-conventional energy sources on the South African economy and the environment; Energy management	Water in the world; The world's oceans; Water management in South Africa; Floods; Drainage systems in South Africa; Fluvial processes; Catchment and river management
FET Life Sciences	Biosphere to ecosystems; Biodiversity ; The role of invertebrates in agriculture and ecosystems; Population ecology ; Human impact on the environment;; Current crises for human survival; Loss of biodiversity		Water (availability and quality)

Source: (UNESCO, 2017)

According to the UNESCO Global Action Programme on Education for Sustainable Development, ten SADC countries experienced challenges in integrating and implementing EE/ESD in teacher education. These challenges were:

- ESD is not very obvious in curricula and assessment;
- The school syllabus is too long and hence educators rush over ESD issues;
- Lack of clear policy on ESD integration;
- Lack of teaching and learning support materials;
- Lack of a whole system approach during the implementation; and
- Inadequate support from management and financial support.

It is important to indicate that the UNESCO Global Action Programme of Education for Sustainable Development workshop held in Swaziland in 2017 provided documents

that specifically highlighted some of the environmental content found in the curriculum. In the case of South Africa as seen in Table 2.3 above, there were few subjects selected for analysis in the FET phase. The analyses were based on the extent of EE/ESD topics that are covered in the subject policy documents. The shortfall of these (UNESCO, 2017) analyses were that it did not further review the extent of these topics' coverage in the textbooks and in assessment such as in examinations. As mentioned, this is one of the challenges of EE/ESD that it is not obvious in curricula and assessment. The section below delineates the major threats of globalisation's effect on sustainable development.

2.4 GLOBALISATION'S EFFECT ON SUSTAINABLE DEVELOPMENT

According to Lofdahl (2002:6), "globalisation does not just happen, people make it happen". Thus, there is a significant amount of pro-globalisation literature that not only describes globalisation micro-level paths and processes but also illustrates the micro-level strategies required to survive and strive within its grip. In view of this assertion, the world is fighting against environmental crises caused by global changes. These changes are also experienced in the South African environment and therefore the economic impacts of globalisation are a major threat to sustainable development. However, other theorists argue that globalisation brings positive impacts in our lives and needs to be encouraged (Lofdahl, 2002). According to Lofdahl (2002), these theorists portray globalisation as a progressive and transformative project. Most literature revealed in this chapter outlines the environmental crises experienced such as pollution, solid waste disposal, land degradation, nutrient depletion, or soil erosion without divulging much on the theories behind what leads to degradation.

In support of the above, Lofdahl (2002) further highlights that, for the world to determine the best course of action to reduce environmental degradation, thoughts, concepts and policies that have led to today's state of international affairs must be interrogated.

Lofdahl (2002) mentions that it is important, while undertaking or addressing individual ecosystems, to consider the inherent interconnectedness of the international environmental system and global environmental degradation. In his view, putting studies on environmental degradation of global and local extent together in what he

termed a “coherent whole” would yield a much more positive result. He further mentions that such studies could present evidence that would contradict or support some previously held views of the world. Lofdahl (2002:30) termed “the view of the world as a theory that will speculate and guide the analysis of global environmental degradation”. He further suggests that theory formulation will be made possible by the formulation of questions or puzzles that provide fundamental insights into the many different types of environmental degradation that are present across the globe.

2.5 TEACHING ENVIRONMENTAL IMPACT TOPICS IN SCHOOLS

According to Yang (2015), curricula and teaching methods adopted by elementary and junior high schools in Taiwan affected the outcomes of EE. Yang gives the following example: at elementary schools, social science and nature and life technology textbooks typically contain and mention nature and environmental issues, but fail to teach much beyond natural aesthetic appreciation. Lessons typically focus on students’ semantic analysis and rhetoric skills, and the teachers are more concerned with the appreciation of poetry. Yang (2015) remarks that the Chinese use nature to understand the beauty of literature, and do not pay attention to nature itself. In Taiwan, social studies, nature and life technology involve a large coverage of geographic and natural environmental content, yet this content is based on knowledge without any real appreciation of environmental issues and rather focuses on the aesthetics of nature. Yang (2015) argues that although elementary school learners do not experience substantial academic pressure, environmental awareness cannot be achieved solely by studying the written content of teaching materials.

Table 2.4: Global, African, Southern African and South African environmental impact issues

ENVIRONMENTAL IMPACTS							
GLOBAL					AFRICAN	SOUTHERN AFRICAN	SOUTH AFRICAN
Asia and the Pacific	Europe	Latin America and the Caribbean	North America	West Asia			
Air pollution	Biodiversity loss, ecosystem degradation and chemical pollution.	Overpopulation, deforestation and water erosion.	Climate change effects	Water quality	Water pollution	Land degradation	Land issues
Climate change	Climate change	Poor air quality	Chemical contaminants and water scarcity	Biodiversity loss	Land degradation	Climate change	Biodiversity and ecosystem health issues
Land degradation	Poor air quality		Coastal and marine resources depletion and solid waste	Desertification	Biodiversity loss	Water and air pollution	Inland water issues
Biota and ecosystem loss	Unacceptable waste disposal		Air pollution		Climate change	Deforestation	Ocean and coasts issues
	Land degradation		Air quality issues				
	Depletion of coastal marine, ocean and fresh-water ecosystems.		Climate change				
			Waste management issues				
							Human settlement issues

2.6 GLOBAL ENVIRONMENTAL IMPACTS

Globally, humans derive their livelihoods from using natural resources that are at their disposal, hence our living is solemnly dependent on natural resources (Harris, 2012). The environment provides us with coal, oil and gas for energy, wildlife and natural landscapes for tourism, animal products, food, medicine, firewood and timber. Despite the importance of the environment for our livelihoods, we still contribute immensely to environmental crisis on the biophysical, social, economic and political domains in all countries around the globe. One of the major environmental crises facing human survival is the challenge of food security and providing environmentally sustainable and healthy diets (Godfray et al, 2010).

Apart from the increasing demand for food, Birdsall (2013:452) contends that science and technology involve environmental issues facing contemporary society. Birdsall (2013) further articulates that the world is failing to make rational decisions about intricate socio-scientific issues such as finding out the kind of personal actions that need to be taken to reduce the effects of climate change. On the same note, IPCC (2014) summarises five reasons for concern over climate change effects, namely:

- 1) Impacts on unique and threatened systems,
- 2) Extreme weather events,
- 3) Global distribution of climate change impacts,
- 4) Global aggregate climate change impacts and
- 5) Large-scale singular climate change-induced events.

The IPCC (2014) declares that the combined land and sea temperature has over the period from 1880 to 2012 increased by 0.85° Celsius due to global warming. As a result, the impacts of climate change can be seen in the changing precipitation or melting of ice and increased sea levels. In addition, the prevalent emission of greenhouse gases will increase the likelihood of severe, irreversible impacts on people and ecosystems, causing further warming (IPCC, 2014; Nunn, 2012).

More importantly, the IPCC (2014) reveals that, beyond 2100 sea levels will rise by 1.9 m and global temperatures will rise by 4°C if global warming continues at the current pace (IPCC, 2014). According to IPCC (2014), increased ocean temperatures are responsible for more than 90% of the energy accumulated between 1971 and

2010, ecosystem services and economic development is being negatively affected by the continued high emissions, thus amplifying risks for livelihood sustenance, food and human security (IPCC, 2014). Moreover, heavy industries, power generation plants and high technology industries have many different environmental impacts and causing land, water, and air pollution on the local and regional stage (Goudie & Viles, 2003). Goudie and Viles (2003) also reveal that transport and urbanisation have some dramatic impacts on the environment through pollution and waste generation. The balancing of human development through source exploitation and a concern for the Earth's environmental future can be attained through the idea of sustainable development.

UNEP (2016) provides a synopsis of the Sixth Global Environmental Outlook Regional Assessments. Section 2.1 below discusses environmental impacts affecting global regions such as the Caribbean, North America, Latin America, Europe, and West Asia, Asia and the Pacific.

2.6.1 Asia and the Pacific

UNEP (2016) indicates that rapid urbanization, changes in lifestyle and increased services associated with economic growth and demand for resources are exerting increasing pressures on ecosystems resources in this region. This region has also experienced an increase in resource utilisation, with less improvement in the efficient use thereof, which poses the risk of economic losses, increased poverty and threatens water and food security. Asia and the Pacific regions are affected by air pollution, coast and ocean contamination, climate change, loss of biodiversity, land degradation, ecosystem degradation and unacceptable disposal of solid waste

Air pollution: According to the UNEP (2016) report, poor air quality is one of the environmental impacts that affect the region. This is due to the ambient concentration of ozone and fine particles such as black carbon. Bougiatioti et al. (2014) and Grandey, Cheng and Wang (2016) state that the Asia and the Pacific region has a long history of aerosols that affect remote areas. Grandey et al. (2016) indicate that an important driver of anthropogenic greenhouse gas emissions is fuel usage, where an increase in coal burning is a result of economic growth. For example, in India, CO₂ emissions have increased by 70% over a 14-year period, driven by increasing energy consumption (Grandey et al., 2016). One of the most affected areas is the Tibetan

Plateau, which has rings of high elevated mountains that are considered blocks to the transportation of air pollutants (Zheng et al, 2017). Zheng et al. (2017) and Grandey et al. (2016) explain that anthropogenic emissions into the pristine region of the Tibetan Plateau has influenced climate change due to increased sulfate and black carbon concentrations. The UNEP report also indicates that burning poor quality fuels or biomass results in indoor air pollution, which is contributing to adverse health effects in children and women.

Climate change and land degradation: This region is also affected by severe climate change impacts on infrastructure and cities that are notably extreme in Pacific island and coastal zones countries. There is an observation that wide distribution of glacial lake melt water over a period of 23 years (1990-2013) as well as precipitation increase and evaporation decrease due to climate change has affected the Tarim Basin in Central Asia resulting in its expansion by about 0,67% per year in the Tian Shan, Altun and Shan mountains (Wang, Liu, Liu, Wei & Jiang, 2016). Wang et al. (2016) state that the increase of glacial lakes, in the between 2000 and 2013, which is caused glacial shrinkage and snow cover thickening since 2000, was about four times faster than that of the period 1990-2000. Li and Sheng (2012) reveal that in the high mountains of Central Asia, water levels of glacier-fed lakes remained stable despite increasing temperature, thus showing severe melt water feed from snow and glaciers. Apart from the expansion of glacier-fed lakes in Asia-Pacific, carbon and pollutant emissions in the region have constrained the continuous development in the region (Wei, Wang & Liao, 2016).

Biota and Ecosystems loss: The prevalence of Asian elephants has caused biodiversity loss in China (Chen, Marino, Chen, Tao, Sullivan, Shi & Macdonald, 2016). The region also experiences loss of biodiversity and ecosystem integrity due to extensive agriculture, aquaculture and illegal wildlife trade, palm oil and rubber plantations. UNEP (2016) and UNESCO (2018) state that natural forest areas in Southern Asia and the Pacific declined in the period between 1990 and 2015.

UNEP (2016) also confirms that land degradation has been rife in the region with consequences such as loss of biodiversity, displacement of indigenous people and deforestation. In the region, land degradation has negative impacts on soil water content and ground water recharge. According to Choy (2015), many of the original

uncontrolled exploitation of natural resources, irreversible habitat destruction and the threats of biological extinction remain unresolved.

Coasts, Ocean contamination and waste. According to Wickramasooriya et al. (2015), harmful radionuclides from nuclear power plant accidents create a great risk to the environment. The regions' coastal zones are attractive for human settlement and continued urbanisation (UNEP, 2016). It is estimated that by the year 2025 about 325 millions are may live in the coastal zones and that that will cause severe pollution due to plastic debris. In addition, the region is faced with uncontrolled dumping which leads to spontaneous combustion, methane emission, leachate run-off and other environmental problems. For instance, about 150 million tons of garbage is generated per annum in China and it is estimated that by the year 2020, it will generate 400 million tons of solid waste per year. This aligns with the large economic growth currently experienced by China in this new era (Leon-Guerrero, 2011). More importantly, Shim and Thomposon (2015) state that marine pollution due to plastic litter in Asia and the Pacific has become a major global environmental issue in recent decades. Because it is not easy to remove plastic from the environment manually, this has resulted in plastic litter breaking down into harmful microscopic plastic particles in the ocean.

2.6.2 Europe

UNEP (2016) highlights that Europe is also not spared from negative environmental impacts, which are complex and intertwined with socio-economic factors. The region is faced with environmental impacts such as an increased biodiversity loss, climate change, effects on the nitrogen cycle, poor air quality, unacceptable waste disposal, freshwater pollution, land degradation and depletion of coastal, marine and ocean resources (Nature.com, 2015; UNEP, 2016)

Climate change: Climate change in Europe has contributed to rising air temperatures and the continent will likely experience increased temperature gradients, with extremely high temperatures in the summer coupled with extremely low temperatures in the winter (Nature.com, 2015). European Union greenhouse emissions appear to have stabilised, however in the Southeastern sub-region, they are increasing. The already hot temperatures in southern Europe are expected to become warmer and drier, thus affecting agriculture, waterways and other factors which indirectly influence

social systems (Achino, 2015). According to Doherty, Heal and O' Connor (2017), Europe experience poor air quality due to climate change effects. For instance, short-term exposure to ozone could lead to cardiovascular and respiratory hospitalisation and mortality. They indicate that the European Environmental Agency has about 467 000 people in Europe who died due to the exposure to ambient Particulate Matter (PM_{2.5}) in 2013.

Biodiversity loss, ecosystem degradation and chemical pollution: Europe is greatly crippled by ecosystem changes and biodiversity loss due to increased land use, agricultural intensification, urbanisation and habitat loss caused by transport systems. The current greenhouse gas emissions in Europe have an effect to both animal and plant species. For example, substantial loss to current biodiversity is a result of increasing conservation priorities for reptiles and amphibians in Europe (Reside, Van der Wal, Moilanen & Graham, 2017). UNEP (2016) report confirms that hazardous chemicals adversely affect humans and the ecosystem in the region. The UNEP study also mentions that mercury pollution still poses a threat to some consumer products. Land use change in Europe has contributed to the emergence of new ecosystems or anthropogenic landscapes, which may be favourable to the conservation of certain species but cause a decline in overall biodiversity (Amici, Landi, Frascaroli, Rocchini, Santi & Chiarucci, 2015). For example, in Mediterranean Europe, ecological changes and traditional human activities have been key to shaping biodiversity patterns and cultural landscapes for centuries (Amici et al., 2015).

Poor air quality: The economic and social aspects in the form of increased population growth and mobility in transport such as shipping, road and air traffic has contributed to poor air quality emanating from the transport sector. According to Aksoyoglu, Prevot and Baltensperger (2015), these emissions have affected air quality and resulted in climate change. In Europe, ambient air pollution contributes to the prevalence of cardiovascular and respiratory diseases (Eze, Hemkens, Bucher, Hoffmann, Schindler, Kunzli, Schikowski & Probst-Hensch, 2015). Furthermore, one of the least regulated emissions in Europe comes from the marine transport sector, which is contributing to high sulfur content from marine vessel emissions (Aksoyoglu et al., 2015). Concentrations of particulate sulfate increased in the last two decades due to ship emissions that account for about 60% in the Mediterranean and about 30-35% in the English Channel and North Sea (Aksoyoglu et al., 2015). Moreover, the quality of

the air is a major health risk to the pan-European population, where children, elderly and the poor are particularly susceptible.

UNEP (2016) findings reveal that poor ambient air quality has contributed to about 500 000 premature deaths in the region and poor indoor air quality caused 100 000 deaths in 2012. The UNEP report also states that over 95% of urban people suffer from pollution that is above the (WHO) recommended threshold. Most of the poor air quality patterns have been negatively influenced by agricultural deposits of nitrogen, unsustainable lifestyles, and consumption and transport patterns in the region. Emissions of nitrogen oxides from the international maritime transport sector in European waters could be equal to land-based sources by 2020 (Aksoyoglu et al., 2015). Air in Bucharest, the capital of Romania, is one of the most polluted in Europe (Manoiu, Gheorghe & Craciun, 2016)

Unacceptable waste disposal: Waste volumes in Europe increase, where disposal of waste in landfills poses environmental challenges. Plastic waste management is lacking due to unavailable sustainable substitutes and marine litter is increasing. Holliday (1992) states that from 1949 the dumping of radioactive waste in the north-east Atlantic was started by the UK and later other European nations such as, Italy, Belgium, the Netherlands, West Germany, Sweden, France, and Switzerland. This indicates that European countries have been dumping radioactive waste for more than forty years.

Land degradation: According to the UNEP report climate change, floods, salinisation, erosion, contamination and landslides affect soil quality and threaten food security (UNEP, 2016). Land degradation in Europe is caused mostly by urbanisation which results in the loss of arable land, biodiversity and natural habitats. Land degradation in the region is also associated with the loss of green areas, which accelerates climate change effects and causes mental health and physical and cognitive development issues in children (UNEP 2016). Europe is also affected by gully erosion due to the manifestation of catchment instability, which threatens multiple soil and land functions (Ionita, Fullen, Zglobicki & Poesen, 2015). However, anthropogenic processes and population pressure such as improper land use, deforestation and agricultural practices have increased land degradation, particularly gully erosion (Ionita et al., 2015)

Depletion of coastal, marine, ocean and freshwater resources: Accelerated urbanisation, chemical products, agriculture, transport, fisheries, industrial development, effluents and energy production cause overexploitation of these natural resources in this region. Agricultural deposits such as chemicals, fertilisers and waste cause freshwater unavailability (UNEP, 2016). Further, there was a stronger increase in temperatures in the Arctic than in other places in the region in the last decades due to global warming (Pozzoli et al., 2017).

2.6.3 Latin America and the Caribbean

The LAC economies continue to rely heavily on natural resources, which comprise about 50% of goods exports. According to Andrade-Flores et al. (2016), the LAC region has about 80% of the high-density population hotspots of urbanisation are the result of growth in the population that lives in urban areas. Some of the environmental impacts that affect the LAC region are overpopulation, deforestation, water erosion and poor air quality.

Overpopulation, deforestation and water erosion: UNEP (2016) recognises that urban areas continued to increase by more than 35 million people between 2010 and 2015, and there is a projection of more than 567 million people by 2025. The proliferation of urbanisation results in overpopulation that can then further be associated with more deforestation. Urbanisation in South America was highest with an estimate of about 346 million people, which is 83% of people living in urban areas in 2015. This report associates urbanisation with environmental impacts such as climate change effects, air pollution, increased unacceptable waste disposal, decreases in health status, loss of biodiversity and depletion of ecosystems. For example, forest depletion is at a rate of 9.4% across the region since 1990. The report also mentions that in the Caribbean, average coral cover is estimated to have declined from 34.8% to 16.3% between 1970 and 2011. The report also shows that human-induced water erosion has affected LAC land over an area of about 2.23 million square kilometers.

In addition, Pendrill and Persson (2017) indicate that in LAC deforestation greatly affects biodiversity, ecosystems and carbon emissions. Deforestation in the LAC region is caused by the growing global demand for agricultural goods, which include beef, maize and soybeans. Tropical and dry forests in regions such as South America

are lost due to the expansion of cattle ranching and soybean cultivation (Baumann, Israel, Rodriguez, Gavier-Pizarro, Volante & Kuemmerle, 2017; Pendrill & Persson, 2017).

Poor air quality: UNEP (2016) reports that air quality in cities has declined, caused by concentrations of particulate matter and ozone, which more than World Health Organisation's recommended guidelines. The report mentions that this increases the vulnerability of urban dwellers to respiratory diseases and that air pollution affects more than 100 million people in the region.

2.6.4 North America

According to UNEP (2016), environmental impacts in North America include climate change effects, chemical contaminations, water scarcity, and coastal and marine resource depletion. These environmental impacts are addressed below.

Climate change effects: The UNEP report points out that climate change affects health of human beings as well as diverse aspects of the environment and in some cases human security (UNEP, 2016). The Arctic is an area of special concern because climate change impacts are of most prevalence in the low temperature regions and the risk of further changes in future is growing (UNEP, 2016).

Chemical contaminants and water scarcity: The region is faced with new sources of pollution and chemical contaminants are increasing as water and air quality challenges to environment and people (UNEP, 2016). Water scarcity is a serious challenge in the region characterised by water demands that results in vulnerability of urban and rural areas to drought (UNEP, 2016). This region is characterised by severe droughts that have resulted in water scarcity problems (UNEP, 2016).

Coastal and marine resource depletion and solid waste: The UNEP (2016) report mentions that North America is under threat due ocean acidification, depletion of nutrient loads sea level rise, rising ocean temperatures and different forms of marine debris. Acidification remains the single most significant influence on the ecological health of upland surface water resulting in changes of biological communities, reduction in species richness and loss of acid-sensitive taxa (Allott, 2009). On marine resource depletion, Harris (2012) states that about 40% of the world's oceans are affected by human derived activities such as overfishing. With regards to solid waste,

Raven et al. (1993:513) state that “the world generates a great deal of solid waste, which has become an area of concern for the generation”. In the United States of America, for instance, every man, woman and child produces an average of 1.6 kg of solid waste per day. This results in a total of 160 million metric tons of solid waste per year.

Air pollution: Dunnette and O’Brien (1992) highlight that incorporation of airborne pollutants of manufactured origin has resulted in precipitation over eastern North America and over much of Europe becoming acidic and the acidity values are up to ten times greater than normal. Acidification is having an adverse effect on soil, air, plants, animals and human health. Wang, Xing, Mathur, Pleim, Wang, Hogrefe, Gan, Wong and Hao (2017) note that aerosols with a diameter of 2.5 μm ($\text{PM}_{2.5}$) in the atmosphere have affects human respiratory systems, cerebrovascular and cardiovascular systems. These health conditions have negative impacts on the socio-economic development of North American nations. Even though dramatic changes in the northern hemisphere changes of air quality have been seen over twenty years, conditions have improved in developed countries in North America (Wang et al., 2017).

2.6.5 West Asia

The UNEP (2016) report mentioned water pollution, unsustainable consumption patterns, biodiversity loss, desertification and ecosystem degradation, air pollution and political instability as environmental challenges that affect the region environmental challenges affecting the West Asia region. Due to a lack of regional co-operation, shared water resources continue to be a source of major regional concern. Political instability continues to affect the environment through wars, security and increasing conflict levels.

2.7 AFRICA ENVIRONMENTAL IMPACTS

Africa is the second largest continent after Asia and covers about 20% of Earth’s total land area (UNEP, 2008). Furthermore, Africa is the second most populous continent after Asia with over 965 million people, which accounts for about one-seventh of the world’s human population (UNEP, 2008). However, Africa is not spared from environmental degradation of its rich natural resources. According to United Nations Environment Programme (UNEP), Africa faces challenges in of economic growth as

its population is estimated to increase to 2.5 billion by 2050 (UNEP, 2016). Therefore, there is need to safeguard the life-support system provided by its rich natural capital.

2.7.1 Key environmental impacts in Africa

The key negative environmental impacts in Africa include pollution, biodiversity loss, habitat degradation, deforestation, desertification and global warming. Although southern Africa and South Africa are part of Africa, the negative environmental impacts affecting this sub region and the local study context will be discussed separately.

Air Pollution: About half of the world's households use coal fuels or biomass for heating, lighting and cooking (Amegah & Jaakkola, 2016; Kaplan, 2010). Komolafe, Adegboyega, Anifowose, Akinluyi and Awoniran (2014) indicate that air pollution is mostly anthropogenic in nature, due to chemical pollutant emissions. Pollutant molecules such as Particulate Matter, Nitrogen Oxides, Sulphur Oxides, Lead, Ozone, Benzene and Carbon Oxides have negative effects on human health (Komolafe et al., 2014). In Sub-Saharan African countries that uses unprocessed solid cooking fuels, many people are exposed to dangerous indoor emissions and associated health risks (Armah, Odoi & Luginaah, 2015). According to Armah et al. (2015), indoor air exposure from the combustion of traditional biomass fuels such as wood, charcoal, animal dung and crop waste posits a health hazard to the people. This is because about 60-90% of households in developing countries uses biomass (Armah et al., 2015; Kaplan, 2010). In support of Armah et al. (2015), a UNEP (2016) report highlights that one of the key environmental impacts affecting the continent is indoor air pollution which causes about 600 000 deaths per annum. The UNEP report mentions that, due to the reliance of the use of biomass sources of energy about 90% of the continent's population is exposed to harm (UNEP, 2016). Kaplan (2010) states that most people who are affected by indoor air pollution in Africa are found in developing rural areas and are among the poor families who tend to uses cheap biomass. In Sub-Saharan Africa where biomass and coal are used, women and children are customarily responsible for cooking and they are exposed to the resulting air pollution from carbon monoxide and particulate matter (Amegah & Jaakkola, 2016).

Outdoor air pollution also causes major fatalities due to the growth in urbanisation, industrialisation, motorisation and the emissions of mineral dust from deserts (UNEP, 2016). The extent of biomass usage in African countries such as Ghana is extreme,

as shown by the fact that the country is the largest per capita consumer of charcoal in West Africa. In some countries in Africa, particularly Nigeria in the city of Lagos, sources of gas emissions are solid waste dumpsites, open incinerators, vehicular emissions, buses, chemical waste, fossil fuel burning from industries and power generators (Komolafe et al., 2014). Vehicular emission in Nigeria is regarded as the major contributor of air pollution due to poor transport systems where fuel-driven vehicles are used to transport manufactured goods, thus releasing carbon into the environment (Komolafe et al., 2014).

Water pollution: The UNEP (2016) report mentions that about 40% of Africa's people lack potable water and about 70% still lack adequate sanitation facilities. This inadequate sanitation results in proliferation of water-borne diarrheal infections, which causes about 8% of annual deaths on the continent. UNEP (2008) acknowledges that freshwater in Africa is sparsely distributed due to different rainfall patterns in the climatic zones. Drought in Africa affects water resources and continued changes in the utilisation of land as well as the growing population increases the demand for the already limited water supply (UNEP, 2008). Certainly, in South Africa, particularly the Eastern Cape, Western Cape and Northern Cape provinces have experienced severe drought conditions between 2017 and 2018. Currently it is unknown whether the severe drought conditions that have led to limited drinking water in the provinces will continue in the year's post 2018. The current situation in the Western Cape is similar to Algeria where water shortages and unavailability of water is mainly caused by drought (UNEP, 2008)

Land degradation: UNEP (2016) mentions that land is a critical resource for ensuring socio-economic development in Africa. However, it is degraded by new problems from changing land-use practices, which include urbanisation, mining, deforestation, agricultural expansion and infrastructure development. In Africa, arid and semi-arid lands have been degraded due to human impact and climate change since the 1970s. Elhag and Sulieman (2017) also point out that in the Gadarif region in Sudan, land degradation is one of the main environmental problems the region faces and is characterised by soil erosion, compaction and surface sealing, acidification, declining soil organic matter and soil fertility depletion. UNEP (2016) highlights that about 450 million people will migrate from rural to urban areas by 2050, thereby placing a strain on urban institutions, infrastructure and other natural resources. Land productivity in

the continent remains low due to poor mineral content in the soil and land degradation caused by unsustainable farm practices, mining activities, deforestation and desertification (UNEP, 2008, 2016). Moreover, about 65% of agricultural land has been degraded by erosion, chemical and physical damage, which has resulted in farmers being forced to grow crops in marginal and unproductive soil, which in itself further degrades the land (UNEP, 2008).

Above, four million hectares of forest every year is lost in Africa, which is twice the world's average rate of deforestation. Apart from high deforestation rates, Herrmann and Hutchinson (2005) allege that droughts during the late 1960s in Africa, mainly in the Sahara, have added to the expansion of desertification that was exacerbated by unrest and political instability. Desertification in Africa, more specifically problems of climate change and human activities contributions are still not fully known (Herrmann & Hutchinson, 2005; Institute for Security Studies [ISS], 2010; Smith & Koala, 1999). Kemp, Reynolds, Virginia and Whitford (2003) acknowledge environmental changes that include drought, reduced vegetation cover and soil erosion, and anthropogenic processes that include rapid agricultural activities, energy demands and rapid urbanisation can initiate desertification. However, the negative environmental impacts brought by desertification have significantly affected natural resources as well as people in both developing and developed countries (Smith and Koala; 1999).

Biodiversity loss: A plant or animal species is considered as extinct following its lack of appearance for over 50 years, and currently the rate of extinction is believed to be ten times faster than in previous estimations (Jeong, 2006). Africa's biodiversity is being lost due to habitat destruction, poaching and increasing human populations (UNEP, 2008 & UNESCO, 2018). UNEP reports that eight of the 34 international biodiversity hotspots are in Africa and that they remain threatened due to human encroachment and civil unrest, as well as the prevalence of alien species. In Nigeria, besides decreased forest cover, environmental pollution such as that arising from gas flaring in oil fields has caused loss of biodiversity in the Niger Delta (Ito & Ugbome, 2017). Furthermore, biodiversity loss through vegetation destruction and contamination of soil and air pollution associated with gas flaring have not only deteriorated the environment, but also resulted in negative social and economic impacts to the inhabitants of the Niger Delta.

Climate change: Africa's growth and development is impeded by the impacts of climate change. This is because many vulnerable parts of Africa lie in climate sensitive sectors where economically many of the Africans relies on the land for livelihood such as agriculture and fisheries. Climate change has been identified as the major human and environmental crisis of the 21st century (ISS, 2010; UNEP, 2016). Furthermore, Jeong (2006) mentions that about two-thirds of the planets' excess carbon comes from factory smoke and car exhaust emissions in the atmosphere. More importantly, the reduction of high levels of greenhouse gases in the atmosphere has become more difficult due to a decrease in the number of trees, which can absorb carbon dioxide. Even though Africa emits 4% of total global carbon dioxide emissions, its people are suffering from consequences of global climate change as much as any other nation (Komolafe et al., 2014; UNEP, 2008).

The continents' response to global climate change is relatively low, inhibited mainly by economic constraints, which render the continent vulnerable to environmental impacts. The climate change impacts are evident in Africa as the continent is experiencing higher temperatures, drying of soils, increased pests and diseases and shifts in suitable areas from growing crops and livestock. Furthermore, other observable effects of climate change are the increased desertification in the Sahara region, floods, deforestation, and erosion. The IPCC (2014) mentions that Africa is very likely to experience loss of yields due to climate change. Estimated yield losses at the mid-century point ranges from 18% for southern Africa to a 22% aggregate across sub-Saharan Africa, with yield losses for South Africa and Zimbabwe in excess of 30%. The United Nations Environmental Programme (UNEP, 2008) highlights that, in many African areas, a small change in precipitation levels and water availability could have a serious effect on agriculture, such that if climate change intensifies and its impact deepens, adaptation will become increasingly difficult.

Overview of environmental impacts in Africa: All of the 54 African countries are affected by one or more environmental impacts. Figure 2.1 below reveals that African countries are affected mostly by deforestation followed by land degradation, threats to biodiversity, water scarcity, overfishing, desertification, pollution and poaching. The effects of mining on the environment affects about five countries, which shows the least number of countries in Africa affected by this environmental issue. Africa is still

developing and the population is growing, which has resulted in most countries felling trees for agricultural needs, human settlement and the development of industries.

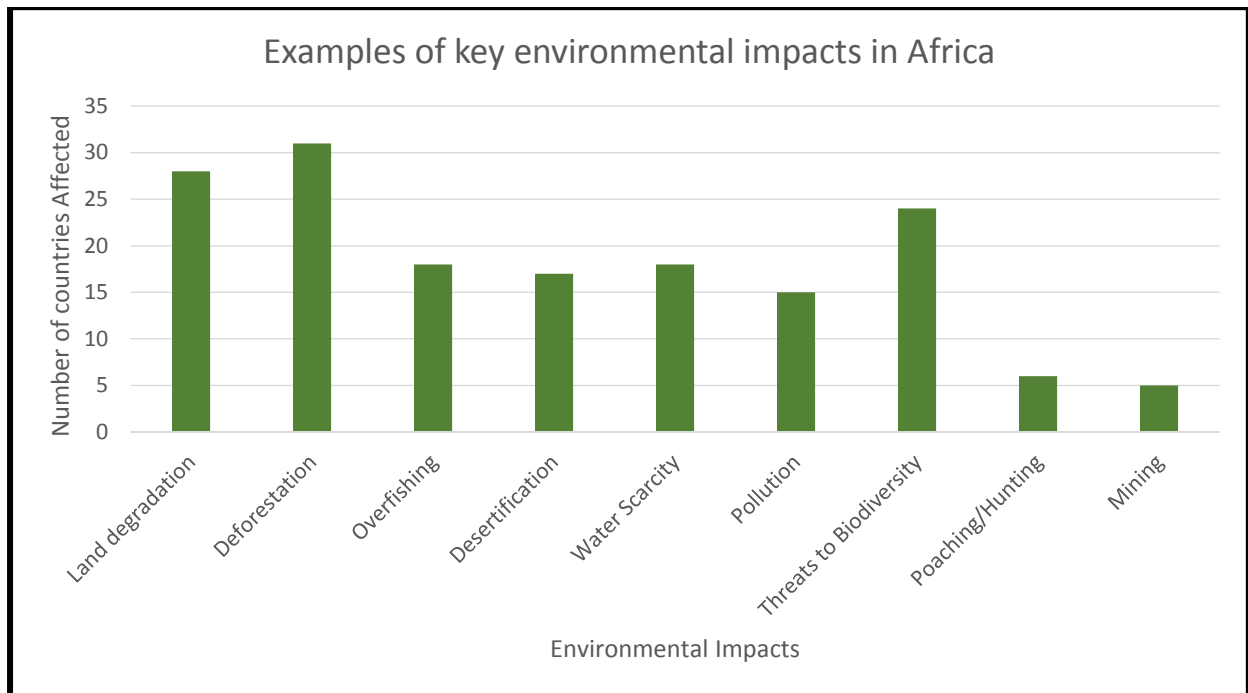


Figure 2.1: Selected environmental impacts in African and number of countries affected

(Source: UNEP (2008))

2.8 SOUTHERN AFRICAN ENVIRONMENTAL IMPACTS

The SADC Environmental Outlook report released in 2008 mentions that the regional community recognises natural resources as critical to the development of a nation and poverty eradication. Environmental sustainability therefore plays a key role in ensuring that the regions' natural resources are secured for future generations. This section mentions biophysical features and socio-economic status of the region concerning environmental issues. This section also presents some of the environmental impacts that affect the SADC region.

2.7.1 Key Southern African environmental impacts

Land degradation: The SADC (2008) report reveals that soil erosion being most prevalent form of soil degradation in southern Africa and accounts for major declines in agricultural production. The SADC report mentions that about 15% of the regions'

land is degraded through erosion. Increased food production and population growth result in pressure being applied to the land where virgin land is being allocated to farming. The SADC report also mentions that soil erosion in the region is caused by over-cultivation, overgrazing, poor irrigation practices and deforestation. For example in Lesotho, the agricultural sector is prone to severe risks from land degradation (Wikle, 2015). Likewise, in Swaziland observations of land degradation is caused by changes in land productivity, with chemical degradation occurring on arable land and physical degradation and erosion mainly on rangeland areas (Orchard, Stringer & Manyatsi, 2017). Orchard et al. (2017:46) maintain that both biophysical (climate, hydrology, topography and soil characteristics) and human (land use, policies, governance, urban migration, poverty and natural resource depletion) factors cause land degradation in Swaziland.

Climate Change. Climate change has led to changes in freshwater, marine and terrestrial ecosystems in Southern Africa (IPCC, 2014). The SADC (2008) mentions that climate variation in the region has an impact on the availability of water resources and food security due to declining rainfall amounts and increasing evaporation rates. The prevalence of drought, floods and tropical cyclones has been one of the indicators of negative impacts of climate change. Droughts in the region have negative impacts on a wide range of environmental and socio-economic activities, particularly in countries such as Botswana, Malawi and Mozambique. Tropical cyclones and floods on the other hand, cause some areas of the region to experience extensive wet seasons. Two major cyclones in Mozambique that occurred between January and March of 2012 resulted in landfalls that affected Madagascar and southern Africa (Chikoore & Vermeulen, 2015). The southwest Indian Ocean islands and coastal southeastern Africa are vulnerable to tropical cyclone impacts. Chikoore and Vermeulen (2015) point out that Tropical Cyclone Giovanna occurred in February 2012 and resulted in the deaths of 35 people in Madagascar, while Tropical Cyclone Irina's looping track killed 65 people in Madagascar. Recent climate change events saw one of the worst tropical cyclones on record to affect Southern Africa called Tropical Cyclone Idai. Tropical cyclone Idai caused catastrophic damage in Mozambique, Zimbabwe and Malawi, killing about 1300 people and many more missing (Yuhua, 2019). These cyclones are negative impacts of climate change that has affected the southern African region. These cyclones not only affect Madagascar, but also affected

neighbouring countries such as Swaziland and the eastern lowlands of South Africa (Chikoore & Vermeulen, 2015).

SADC (2008) revealed that regional temperatures have risen by more than 0.5 degrees Celsius over the past 100 years. Mulenga et al. (2016) further mention that in Zambia and more broadly in the southern Africa region, the effects of rising temperatures and uncertain rainfall have negative impacts on smallholder maize production. Human activities have been attributed as one of the causes of the rise in temperatures (SADC, 2008).

In Swaziland, poor productivity has been caused by erratic rainfall patterns and heat waves affecting crop development, proliferation of invasive weed species and wild fires (Orchard et al., 2017).

The region has also been characterised by an increase in the atmospheric concentration of methane, which is released during decomposition of organic matter (SADC, 2008). The main source of methane is livestock, particularly cattle ranching in the region.

Changes in the climate have also contributed to rises in sea levels due to the melting of snow and ice, drops in crop yields, and the spread of malaria to some parts of South Africa and Namibia.

Water and air pollution: According to the SADC (2008) report, the major sources of water pollution in the SADC include the following:

- Point source pollution: Comprised of sewage effluent, industrial processes, power generation and mineral activities.
- Non-point source pollution: Comprised of natural pollution, storm water run-off, agricultural activities, leachate from landfills, soil erosion and gold panning.

The report also mentions that the main impacts of water pollution include health effects, eutrophication, waterweeds, and ecological effects. Mbewe et al. (2016) and Nyirenda, Cheelo, Ngulube and Mvula (2016) explore the fact that the Kafue River is extensively used for agriculture, fishing, and provides drinking water for both humans and wildlife but it has not been spared from anthropogenic pollution activities, especially mining and manufacturing.

According to Caporn and Emmett (2009), these pollutants include Sulphur and various metals such as lead, zinc and iron. All biomes of the world including those in southern Africa are experiencing continuing nitrogen related eutrophication, ozone and rising concentrations of atmospheric carbon dioxide due to human activity (Caporn & Emmett, 2009).

Caporn and Emmett (2009) indicate in Figure 2.2 that air pollution can be characterised by background drivers such as population growth, food production, energy production, transport and manufacturing industries. These drivers lead to negative impacts that have an effect on soil erosion, human health, ecosystem health, biodiversity phenology, growing season, species migration and soil nutrients. Figure 2.2 below shows drivers, responses and effects of air pollution in ecosystems.

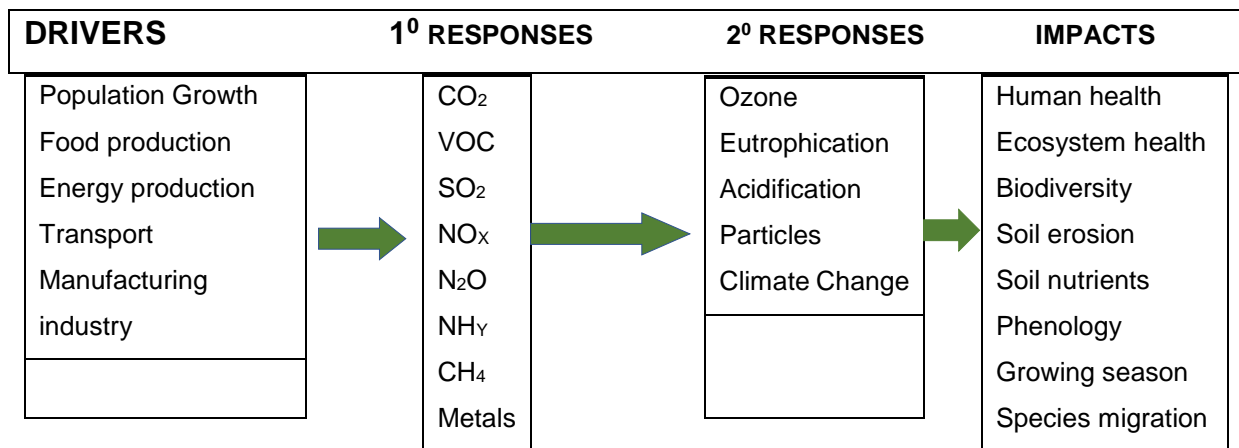


Figure 2.2: Drivers, responses and effects of air pollution in ecosystems

Source: Caporn and Emmett (2009)

In Zimbabwe, the main sources of energy are fossil fuel-based, and most small and medium enterprises (SMEs) use coal and oil, which generate emissions that result in air pollution due to the use of hazardous chemicals such as cyanide and mercury (Muzamwese, 2016). According to Muzamwese (2016), metal fabrication has been responsible for the worsening emissions of metal sulphides and dust and the emerging SMEs have limited capacity to implement dust control measures.

Deforestation: Deforestation, which is the clearing of forested land, contributes to the pollution of rivers and creeks and the loss of wild species (Jeong, 2006). Southern Africa is one of the fastest growing populations in the world (SADC, 2008). The SADC

report (2008) mentions that between 1990 and 2000, forest cover in the region fell from 3.8 million square kilometers to 3.75 million square kilometers, which shows an average loss of 0.6% per annum. Most importantly, Malawi has experienced high levels of poverty and food insecurity, which resulted in environmental degradation in the form of deforestation and forest degradation. Causes of deforestation in the region can be attributed mostly to forest fires.

2.8.2 Other environmental impacts affecting the region

The SADC (2008) reports that the Southern African region is rich in wildlife, which acts as a source of income for communities. Habitat loss is occurring due to agricultural land expansion, settlements and infrastructure development such as roads, dams, construction and electricity power lines. In a country such as Lesotho, the diversity of native fauna has diminished considerably because of human activities.

Invasion of alien species threatens about 10% of mammals, 15% of plants and 30% of birds in the region (SADC, 2008). In a country such as Lesotho, overgrazing has resulted in the spread of invasive plant species that are unpalatable to grazing animals (Wikle, 2015).

In addition to the spread of invasive species in the region, animals such as elephants and rhinos are affected by illegal poaching in the region. The SADC report (2008) also highlighted that coastal erosion is one of the environmental impacts affecting the southern Africa region. The SADC report (2008) noted that failure by the region to respond to environmental crises leads to a decline in development and environmental conditions deteriorating as pollution, climate change, and ecosystems interact. Another environmental impact affecting southern African countries is waste management.

A summary of an important environmental impact in Southern Africa is shown in Table 2.5 below.

Table 2.5: 15 Southern African countries' environmental impacts

Country	Associated Environmental Impacts
Angola	Biodiversity loss, Lack of access to potable water, overfishing and coastal degradation.

Country	Associated Environmental Impacts
Botswana	Overgrazing, desertification, rapid urbanisation and loss of wildlife of the Okavango Delta.
Democratic Republic of Congo	Wildlife Poaching, deforestation, mining, and ecosystem degradation.
Lesotho	Degradation of rangelands, loss of biodiversity in the Lesotho highlands and pollution.
Madagascar	Soil erosion, loss of biodiversity and deforestation.
Malawi	Soil erosion, deforestation for fuel wood, water pollution and aquatic biodiversity.
Mauritius	Coastal water pollution and loss of biodiversity.
Mozambique	Natural disasters, deforestation and lack of access to clean drinking water.
Namibia	Land degradation, deforestation, loss of biodiversity and oil pollution.
Seychelles	Coastal erosion, loss of Mangrove Forests and protection of coral reefs.
South Africa	Lack of water availability and quality, land degradation and threats to biodiversity.
Swaziland	Population encroachment, land degradation, threats to biodiversity and invasive alien species.
Tanzania	Deforestation, biodiversity loss and soil erosion.
Zambia	Acidification from mines, water and air pollution, deforestation, wildlife depletion and rapid urbanisation.
Zimbabwe	Land degradation, deforestation, droughts, and wildlife poaching and water access.

Source: (UNEP, 2008)

2.9 SOUTH AFRICAN ENVIRONMENTAL IMPACTS

The 2nd South Africa Environmental Outlook (SAEO) states that the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in Brazil in 1992 highlighted the importance attached to environmental impacts at local (national), regional and global spheres (SAEO, 2016). According to the report, each country has to produce a state of environmental data and information that would be available to the general public and decision makers. South Africa responded to this call and adopted the concept of sustainable development that had its reference point as the 1987 Brundtland Commission definition, which defines sustainable development as “development that meets the needs of the present without

compromising the ability of future generations to meet their own needs” (WCED; 1987). This section provides some of the key environmental impacts in South Africa that are enshrined in three dimensions that underpin the concept of sustainability which are social, economic and environmental dimensions (IUCN, 2006). The social dimension is at the centre and exists within the economic sphere, while both are dependent on the function of the ecosystems or the environment (SAEO, 2016). Figure 2.3 below shows the dimensions of sustainability with reference to the interrelationship between society, economy and the environment.

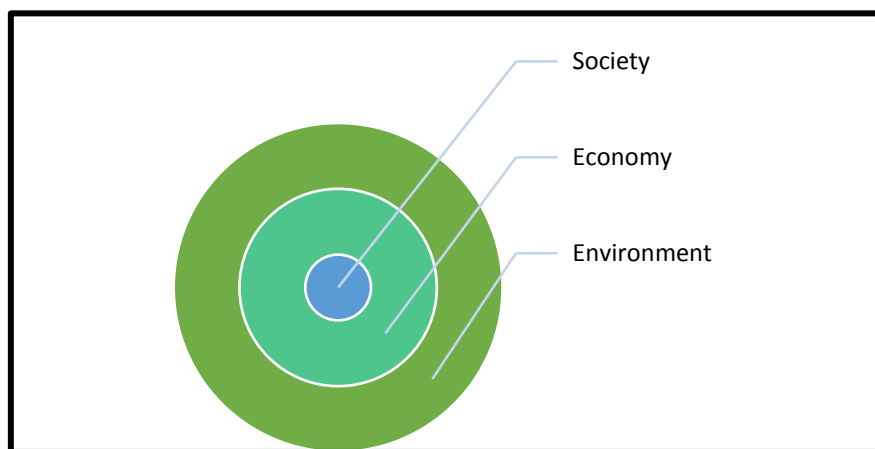


Figure 2.3: Dimensions that underpin the concept of sustainability

Source: Adapted from IUCN (2006)

According to the report, the environmental sphere shown in Figure 2.3 provides services such as water, air and natural resources, which provides livelihood for people. The South African government is obliged to ensure that sustainability operates within the government system with support of relevant policies such as the National Environmental Act of 1998 (Act 107 of 1998), Biodiversity Act (Act 10 of 2004), Air Quality Act, 2004 (Act 39 of 2004) and Integrated Coastal Management Act, 2008 (Act 24 of 2008) (DEA, 2018). Even though the country has developed policies that aim to stem natural resource depletion, the biophysical environment is in a state of decline (SAEO, 2016).

2.9.1 South Africa's Environmental Impacts

The following environmental issues affecting the country are associated with anthropogenic activities as well as natural environment change (Bonn, Allott, Hubacek & Steward, 2009).

Land degradation: In South Africa, land degradation is greatest in the communal areas along the eastern and northern escarpment and in some commercial districts along the Orange River (Hoffman & Todd, 2000). Land degradation in South Africa is influenced by biophysical and socio-economic factors in both communal and commercial areas (Hoffman & Todd, 2000). SAEO (2016) states that land degradation is one of the environmental impacts affecting the country. Land degradation in South Africa is multidisciplinary in nature, where economists and agriculturists have emphasised that overgrazing and poor cultivation practices is a concern, while socio-economists or anthropologists have indicated poverty and population pressure as possible influences on degradation (Hoffman & Todd, 2000, SEO).

Biodiversity loss due to land surface change is one of the signs of degradation. Biodiversity loss is mostly because of loss of habitat due to clearance of the land for the cultivation of crops such as maize, wheat and sugarcane, mining, forestry plantations and urban encroachment (Driver, Sink, Nel, Holness, Van Niekerk, Daniels, Jonas, Majiedt, Harris & Maze, 2012). South Africa consists of nine provinces (as mentioned in Chapter 1) and the worst degraded provinces are the North West, Limpopo, KwaZulu-Natal and the Eastern Cape (Hoffman & Todd, 2000; Parwada & Van Tol, 2016; SAEO, 2016). South Africa has lost about a fifth of its land surface through agriculture, mining, industry and urban sprawl as discussed above.

The DEA (2011) revealed that soil erosion is expanding to the point where 70% of South Africa's land surface is affected. Alien invasive plants cover about 10% of the country's land, and this grows at a rate of five% per annum (DEA, 2011). About 20 million hectares of land are invaded and this has increased since the mid-1990. This alien plant invasion is a threat to water availability and the availability of arable land as seen in Figure 2.4 below.

Other environmental impacts resulting in land degradation in the country are land contamination by toxic chemicals from the mines and deforestation. The disposal of

mining deposits has led to unsightly spoils being left to disfigure the landscape that leaves surface water streams and ground water being polluted as seen in Figure 2.4 below. Mining can cause a direct hazard as seen in Figure 2.4, where old, partially sealed shafts have opened beneath people who have fallen to their deaths, where tailings dams have burst and killed people or where spoil heaps have fallen on top of people causing harm and potential death. Water pollution and land degradation can continue for long periods after the mine which caused the problem has ceased operations (Bell & Donnelly, 2006). On the other hand, deforestation has contributed to the loss of indigenous forests in rural areas as people use forest resources for energy, shelter and for medicinal purposes (SAEO, 2016).

Wetlands are one of the features of the countries' surface area. Wetlands in South Africa cover 2.4% of the surface area and their main function is to support agriculture, filter pollution from water, and function as a source of water during dry seasons, slow flooding, combat desertification and works as shock absorbers from drought pressures. Despite all these benefits of wetlands, in South Africa both human activities and natural environmental processes threaten them. Wetlands are the most threatened ecosystems, of which 12% are endangered, 5% vulnerable, 35% least threatened and 48% critically endangered (Driver et al., 2012).

As discussed in this section, South Africa over the last two decades has been experiencing pressures on land resources due to economic growth and social improvement. This growth and improvement has come at the expense of natural resources and a loss of ecosystems as seen in Figure 2.4 below.

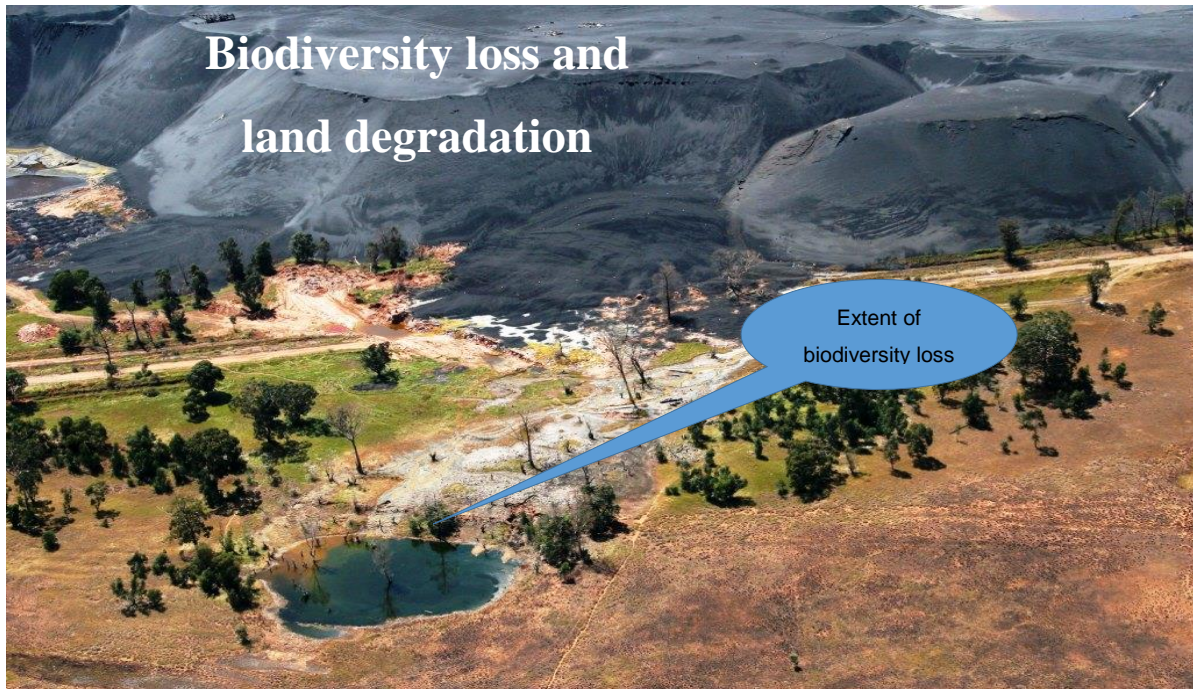


Figure 2.4 Biodiversity loss and land degradation caused by mining in Mpumalanga

Source: Mpumalanga Tourism and Parks Agency (2018)

Loss of biodiversity and ecosystem health: Biodiversity is often threatened by human activities such as growth in human populations that develop and modify the environment (Harris, 2012; UNESCO, 2018). Humans exploit wild living resources through activities such as harvesting and consumption wild produce, or changes in the landscape caused by the expansion of agriculture, forestry and aquaculture (Harris, 2012). South Africa is faced with a loss of natural habitat, which is mostly due to socio-economic aspects of the spread of urban areas, encroachment from mining (see Figure 2.4), and intensive agriculture (SAEO, 2016). Illegal and legal poaching and collector trades are other environmental indicators of overexploitation of species. The report also mentions that terrestrial ecosystems are deteriorating, which accounts for about 30% of natural areas of grasslands being completely lost. In total about 40 percent of terrestrial ecosystem are threatened due to cultivation, mining, plantation, and urban expansion.

(Sowman & Sunde, 2018). They remark that negative social impacts involve the weakening of local governance rights and processes due to a lack of local community participation in decision-making. The lack of tenure rights and access to resources

amongst already marginalised communities has contributed to food insecurity and low household income. Sowman and Sunde (2018) draw attention to the exacerbated poverty, community identity fragmentation and increased conflicts between communities and government authorities as factors undermining the proliferation of MPAs.

Inland water: Water availability and quality in the South Africa is deteriorating, resulting in most water catchments being over-extracted and likely to enter into a negative water balance (Ogundeji & Jordaan, 2017; SAEO, 2016). Ogundeji and Jordaan (2017) draw attention to the impact of climate change to water availability that has affected both crops and livestock, especially in South Africa. South Africa is found in the semi-arid zone and for this reason we do not have enough fresh water. Driven et al. (2012) believe that the earth's water is not spread out evenly because fresh water is a scarce natural resource. South Africa experienced extreme drought in 2016, which has left many urbanised parts of the country with no water, thus affecting food production (Fisher-Jeffes, Carden, Armitage & Winter, 2017). Driven et al. (2012) and Fisher-Jeffes et al. (2017) assert that South Africa, in the City of Cape Town in the Western Cape Province in 2017 did not experience the normal winter rainfall. This has led to fast declining dam levels and the area was affected by severe drought that had not been seen in the past 100 years. The City of Cape Town on 1 February 2018 imposed water restrictions to all citizens (Cape Town Government, 2018). People were restricted to a daily limit of 50 litres or less of water per day. Usage for irrigation purposes was limited to a maximum of one hour only on Tuesdays and Saturdays before 09:00 and after 18:00. The City of Cape Town also forbade the washing of vehicles, trailers and caravans with drinking water. The restriction took into consideration that about 70% of all water used in the city is consumed in homes (Cape Town Government, 2018). Residents who were found to have used excessive amounts of water were fined an amount of R5000-10000 South African Rands (ZAR).

Increased salinity and pollution from agriculture, mining, and urban run-off all result in poor water quality. Poor water quality in the country is predominant in urban areas such as the Gauteng metropolitan areas and the City of Cape Town. The SAEO report states that about 12 dams in South Africa are eutrophic, with very high nutrient concentrations and poor water quality. South Africa has experienced an increase in

phosphate composition of freshwater due to the discharge of wastewater treatment effluents, urban run-off, mining, sewage phosphorous and agricultural activities.

The SAEO (2016) report also states that the increase in freshwater aquaculture, which is mostly for trout and ornamental fish species affects water. Some parts of the country are faced with problems with ground water quality, such as Witwatersrand where acid mine drainage in the old mining areas is a concern for water pollution. Mining activities pollute fresh water during mineral extraction, construction and in many cases are abandoned, and such post operational mines are major sources of pollution. According to the Bureau for food and Agricultural Policy (BFAP), in Mpumalanga particularly, coalmine drainage adversely affects the aesthetic appearance of streams and rivers, and makes streams unfit for domestic, industrial and agricultural use (BFAP, 2012).

Oceans and coasts: Coastal habitats are in danger of destruction from pollution, resource exploitation and other hazardous human activities (Jeong, 2006). Coastal development has been one of the main factors behind the destruction of critical habitats for fish species and this situation is experienced in South Africa (Jeong, 2006). SAEO (2016) states that some of the environmental impacts on oceans and coasts are oil spillage incidents, wastewater discharges, illegal harvesting, coastal and marine mining and sea level rise. The report states that about 50 000 litres per second of treated and partially treated wastewater are discharged daily into the marine environment. This result in oceans and coasts being degraded as well as biodiversity and ecosystems being negatively affected.

The South African seaports have experienced rises in sea levels as a result of climate change, where the West Coast sea level has been recorded to be rising by 1.87 millimetres per year while the South Coast is rising by 2.74 millimetres per year due to changing ocean dynamics. The challenge of sea level rise is one of the characteristics of climate change and is also affecting the whole, world where unprecedented signs were seen between the 1970s and 80s, as the spectre of future sea level rise casts doubts over human futures (Nunn, 2012:92). Predictions of sea level rise reveal that the earth is facing an increase of about 1.9 meters by 2100 and probably more thereafter (Nunn, 2012). Therefore, South African coastal areas cannot be spared from this challenge of rising sea levels caused by greenhouse gas emissions. Nunn (2012) indicates that it is more helpful to concentrate on the negative

environmental impacts of rising sea levels rather than concentrating on its magnitude. Table 2.6 shows primary and secondary impacts of sea level rise.

Table 2.6: Primary and secondary impacts of sea levels

Primary impacts	Secondary impacts
Increased erosion	On livelihoods and human health
Inundation of coastal wetlands and lowlands	On infrastructure and economic activity
Increased risk of flooding and storm damage	Displacement of vulnerable populations
Salinisation of surface and ground waters	Diversion of resources to adaptation responses
	Political and institutional instability, social unrest
	Threats to particular cultures and ways of life

Source: Adapted from Nunn (2012:101)

Air quality: Air pollution is mostly experienced in the major cities of developing countries, where low incomes and industrial activity contribute to pollution (Jury, 2017). Strydom and Savage (2016) and Jury (2017) state that air pollution reduces productivity directly through respiratory diseases and indirectly through reduced municipal property value and resource yields. Jury (2017:3) indicates that the South African Highveld dry winter climate also causes air pollution to accumulate to unhealthy levels. South Africa experiences different types of air pollution due to vehicle emissions, domestic fuel burning, biomass burning, nitrogen dioxide and ozone depletion (SAEO, 2016). According to the SAEO report, the increasing number of vehicles on the road causes increased vehicle emissions in the country and increased dependency on private vehicles has increased fuel consumption and higher overall pollution levels despite improved vehicle emission standards. SAEO (2016) also indicates that domestic fuel burning has resulted in most poor households experiencing very poor indoor air quality due to the burning of wood, coal and paraffin for energy as seen in Figure 2.5 below. Air pollution has increased in the urban environments in many parts of South Africa, mainly in townships where coal, paraffin

and wood are burnt as important energy sources (Goudie & Viles, 2003). Nitrogen dioxide and ozone depletion have also been attributed to poor air quality.

Goudie and Viles (2003) state that South Africa produces the cheapest electricity in the world that is available to 30 percent of the population. Around 83 percent of South African electricity is mostly generated by coal fire, which produces air pollution through the emission of Sulphur Dioxide (SO₂) content (Goudie & Viles, 2003). Sulphur dioxide has the greatest wide-scale impact on the natural environment because of its toxicity and the scale of emissions (Caporn & Emmett, 2009). Evidence of air pollution is seen in Figure 2.5 below, where electricity-producing power stations are situated in the precincts of households. Figure 2.5 also shows that people are inhaling polluted air, which has severe repercussions to their health.



Figure 2.5: Air pollution in Mpumalanga caused by burning coal for energy.

Source: <http://www.greenpeace.org>

Climate change: The global community has generated substantial data about observed risks, impacts and vulnerability of climate change, yet in South Africa and the region of Southern Africa as a whole, information about global warming's long-term trends remains a major gap (DEA, 2016).

Despite limited data about climate change's long-term trends, the South African Weather Service and the National Disaster Management Centre are increasingly providing synthesis and communication of observed climatic condition risks such as droughts, hail storms, water quality and high temperatures (DEA, 2016). The major

convincing evidence of long-term climate change impacts in South Africa is the increased coral reef bleaching in the tropical coastal waters of Sodwana Bay in KwaZulu-Natal (Celliers & Schleyer, 2008). The available indicators of climate change prevalent in South Africa is shown by greenhouse emissions, temperature and rainfall (SAEO, 2016). Greenhouse emissions in the country are increasing in line with the global projections of 20 percent between 2000 and 2010. About 50 percent of all emissions in South Africa are from the energy supply sector, indicating the coal dependent nature of the country's electricity supply. Amongst the remaining emissions, about 16 percent comes from industry and construction, 16 percent comes from emissions of fuel, 9 percent from transport and the remainder from agriculture and forestry, waste and other minor sources. According to the report, temperature has undergone a general warming over the last 40 years, and it has increased since the mid-1960. The increase in temperatures has been stronger in the western, north-eastern and extreme eastern parts of the country. In Addition, IPCC (2014) and Nunn (2012) contend that high temperatures result in ill health, disrupted livelihoods from storm surges, sea level rise and coastal flooding. South Africa has also experienced drastic changes in rainfall patterns that are related to global warming. The rainfall has been characterised by more extreme wet and dry seasons (SAEO, 2016).

Climate change effects have had an effect on the global sphere as well as in South Africa. Cherian (2012) mentions five major characteristics, which not only affects climate change in South Africa as seen in this section but have an effect globally. These include:

- Increases in average global temperature (Global warming)
- Changes in cloud cover and precipitation
- Reduction or melting of ice and glaciers
- Rises in ocean temperatures and acidity
- Increases in the frequency and intensity of extreme weather events.

South Africa has been experiencing severe droughts, particularly in the Western Cape Province, which coincided with the El Nino Southern Oscillation conditions (DEA, 2017). Kemp et al. (2003) defines drought as an environmental situation that indicates a long, dry spell, usually associated with lack of precipitation, when crops shrivel and

reservoirs shrink. This definition is what was experienced in the Western Cape Province between 2017 and 2018. The socio-economic and ecological impacts of drought events are becoming more challenging as they converge with increasing urban water demand and issues of social vulnerability as seen in the Western Cape Province. IPCC (2014) and UNESCO (2018) report that high temperatures also result in shortages of food and water, loss of ecosystems and biodiversity which is currently experienced in drought-stricken areas in Western Cape. According to the DEA (2017), the year 2015 recorded above average temperatures, making it the warmest year on record since 1951. The country recorded maximum temperatures more than 5% higher than the average maximum temperatures in places such as Pretoria, Johannesburg, Limpopo, Mpumalanga and the North West. Short term impacts of climate change trends in South Africa can be seen by shifts from extremely high levels rainfall and storms to drought events from 2010 to 2015 (DEA, 2016). Impacts of high temperatures are often indicated by wildfire events (DEA, 2016).

Waste management: South Africa faces increases in the generation of waste, which are derived from favourable periods of economic growth (SAEO, 2016). The report notes that waste production and unacceptable disposal thereof has increased by an average of 4.8 percent and levels are very high in the Free State and Mpumalanga. This is evident in Figure 2.6, where the community of Mkhondo in Gert Sibande district are disposing of litter in open places, which are in the vicinity of their homes and not demarcated zones. In addition to the unacceptable waste disposal, land is degraded and the litter that is improperly disposed of by residents affects human health.



Figure 2.6: Unacceptable waste disposal in Mkhondo location in Gert Sibande district

Source: Researcher's own

The SAEO report has however noted that there is improvement in the percentage of households with access to waste removal services provided by the municipality. Despite this, the country is also faced with increased incidences of illegal dumping of tyres, where about 28 million tyres have been burnt illegally, causing serious air pollution that contributes to health problems related to emissions (SAEO, 2016).

SAEO reports that mining waste has a negative environmental impact, where about 88% of waste generated is mining waste that is contained within waste dumps, decanted in water and causes air pollution (Figure 2.7). Figure 2.7 shows Mpumalanga Drakensburg area, which is an important supplier of fresh water to the Olifants Catchment. The area is impacted by acid mine drainage from abandoned coal and gold mines. Bell and Donnelly (2006) emphasise that one of the most notable negative effects of coalmine closure is acid mine drainage.



Figure 2.7: Polluted water in Mpumalanga Drakensberg area

Source: Researcher's own

Human settlement: In South Africa, the population is increasing due to better health and living conditions. SAEO (2016) states that the number of households is increasing in the country, which results in an increase in resource consumption patterns. The country has also experienced severe rural to urban migration that is linked to urbanisation. Most people in the country migrate to Gauteng and the Western Cape, with the Eastern Cape and Limpopo losing people. The rural areas are then left isolated, with young children and elderly people having to utilise the scarce resources whereas in the urban areas pollution increases due to the large influx of people. SAEO (2016) reveals that, although housing is improving, high-density townhouse developments are creating hard surfaces with limited open space. Another environmental impact that is brought by urban housing development is that golf estates are often situated in environmentally sensitive areas, thus causing ecological damage. SAEO (2016) also reveals that informal housing is increasing in Gauteng and the Western Cape, where about 50 percent of informal dwellings are vulnerable to environmental factors. The following section discusses South Africa's "tipping points".

2.9.2 South Africa's "tipping points"

South Africa's environmental report shows that in the sustainable model certain "tipping points" need to be addressed to ensure sustainability of the environment. The

SAEO (2016) mentions that, “tipping points” shows critical areas that represent the difference between embarking on a more sustainable path and compromising future environments. The “tipping points” require some uncomfortable trade-offs if South Africa is to avoid crossing environmental thresholds (SAEO, 2016). These “tipping points” are:

- The food-water nexus;
- Renewable energy and changing the energy mix;
- The green economy; and
- Ecological infrastructure

The outlook report mentions that the connections between water, agriculture, energy and the environment need to be managed properly so that the country does not cross ecological thresholds and the Earth’s carrying capacity. According to the SAEO (2016), this also requires addressing wastage, overconsumption, and the dependency on coal and other non-renewable energy sources. The country needs to adopt a green economy that reduces economic activities that have unsustainable environmental costs and ecosystem services need to provide economic growth, social development and a better quality of life. This study will also be important to occupy the space where coverage, teaching and examination of environmental impact topics are investigated in the curriculum to solicit if there is alignment between policy, teaching and examination of the environmental topics highlighted in the section above. The education sector also plays an important role in ensuring that these “tipping points” mentioned above are protected to ensure a more sustainable development path even at school levels. The section below discusses some of the human derived environmental impacts.

2.10 THEORETICAL FRAMEWORK

The study utilises the Realist Social Theory (RST) as its theoretical framework. This theory emerged primarily from Roy Bhasker’s Critical Realist Theory (Archer, Bhaskar, Collier, Lawson & Norrie, 1998) which was further elaborated upon by Margaret Archer (Archer; 1995). RST assists in structuring the general idea of understanding and interpretation by defining and organising the key concepts within this study. Archer’s

RST views reality as complex and recognises the role played by structure, culture and agency to foster relations through mechanisms that influences human behaviour.

Archer (1995) explains that RST is an explanatory framework, which focuses on the operation of programmes to evaluate their effectiveness and challenges. The parameters evaluated are structure, culture, agency and their relationships. RST is a social theory about individuals being in society, how individuals and society are related, and possible interactions between them that may result in or affect change in the social context of interest. These contexts relate to emergent properties, which are called mechanisms. Mechanisms lead to outcomes, which are perspectives of individuals. Using Archer’s (1995) RST concepts of **structure, culture, agency** and **relations**, Pawson and Tilley (1997) proposed the following Context-Mechanism-Outcome configuration (CMOc) (Table 2.7) that forms the conceptual framework of this study: The causal powers (mechanisms) operate in distinctive ways when accompanied by other entities that may trigger, mediate, or contradict these powers to produce distinctive effects (outcomes) (Pawson and Tilley, 1997). Using this conceptual framework, I relate the context to the inclusion of EE in the FET curriculum, the mechanisms to how EE is taught and the outcomes that result in the evaluation of a programme, educational policies, textbooks and past examination question papers, with a focus on environmental impact issues, as seen in Chapters 5, 6, 7 and 8.

Table 2.7: Presentation of realist social theory framework

CONTEXT	MECHANISMS	OUTCOMES
(Comprises aspects of)	(related to the following emergent properties in an action context)	
Structure (Autonomous)	<ul style="list-style-type: none"> • mechanism related to roles and positions • mechanisms related to practices • mechanisms related to resources • mechanisms related to processes 	Transformation, invariance or reproduction of those aspects of structure related to roles, positions, practices, resources and processes
Culture	<ul style="list-style-type: none"> • mechanism related to ideas or propositional formulations about structure 	Transformation, invariance or reproduction of those aspects of culture related to propositional

CONTEXT	MECHANISMS	OUTCOMES
	<ul style="list-style-type: none"> • mechanism related to ideas or propositional formulations about culture • mechanism related to ideas or propositional formulations about agency • mechanism related to ideas or propositional formulations about relations • mechanism related to values and rules 	formulations about structure, culture, agency and relations.
Agency	<ul style="list-style-type: none"> • mechanisms related to beliefs and reasons for action or non-action 	Transformation, invariance or reproduction of those aspects of agency related to beliefs and reasons
Relations	<ul style="list-style-type: none"> • mechanisms related to duties/responsibility • mechanisms related to rights • mechanisms related to power 	Transformation, invariance or reproduction of those aspects of relations related to duties, responsibilities, rights and power

Source: Adapted from De Souza (2013)

According to Archer (1995), the RST framework outlined in Table 2.7 offers a perspective on how social change and social cohesion take place in society. Social change in a society is determined by researchers assuming that institutions such as schools and other social domains are micro-scaled versions of society and institutional changes result from introduction of social programmes (De Souza, 2013).

Archer (1995) and De Souza (2013) further believe that structure enables researchers to suggest that individuals acting under the influence of prevailing institutional structural conditions produce a particular outcome. This research focuses on how participating teachers are subjected to structures that affect their teaching either in a positive or negative way. Archer (1995) believes that culture, on the other hand, allows researchers to analyse how dominant ideas or prevailing cultural conditions affect individuals' perceptions of what can or cannot be done in a social context. In this research, the culture of the school, opinions of participants and content of documents are analysed and interpreted to determine the coverage, teaching and examinations of environmental impact topics in the curriculum, which is analysed in Chapters 5 and

6. This study also provides an analysis of the effectiveness of the Fundisa for Change environmental teacher training programme in Chapter 7 in enabling the teaching of environmental impact topics.

De Souza (2013) states that the aspect of **structure** in a context comprises emergent and internally related properties, without which public institutions and organisations could not exist. Structure has various components, namely roles, positions, practices, resources and processes. In a school context as explored in this study, these can be educational training programmes that aim to transform existing school structures by redefining roles, providing in-service training to adopt new practices, supplying new resources and aligning assessment to suit new generations of students (De Souza, 2013). This was applied in this study where documents were analysed to elicit the coverage of environmental impact topics and to find the roles played by different existing school structures in ensuring that the teaching of environmental impact topics was aligned to CAPS for each FET subject area. This study also analysed the Fundisa for Change environmental teacher training programme to explore whether it was effective in equipping teachers to adopting new, effective practices for teaching environmental impact topics.

De Souza (2013) describes the second aspect of the social context of action as **culture**. Culture refers to ideas, theories, beliefs, values, arguments and relations that affect agents' transaction and operate within an institution as shown in Table 2.7. The operations can be communicated to institutions by using discourse strategies, documents, artefacts, symbols and representations. These operations can be initiated by sources, which can be either internal or external to the context. Therefore, the components of culture involve ideas about roles, positions, practices, resources and processes within a structure. Changes then lead to shifts not only in the structural, material, and physical aspects of the action but also in ideas (De Souza, 2013). This study analysed whether teachers were able to use the information gathered from different components within a culture to shape their ideas about environmental impact topics.

The third aspect is **agency**, which is subjective. In RST, agent reasoning is seen as a defining component. According to De Souza (2013), when evaluators seek to understand these reasonings, they are interested in agent-related mechanisms

associated with the beliefs of people and their justification for either taking an action or not.

The fourth aspect in the RST framework is **relations**. Relations involve duties, responsibilities, powers and rights (Archer, 2003). Relations therefore exist within structure, culture and agency. Success of a school programme may depend on how teachers feel in carrying out their duties in terms of the curriculum, which acts as a guide for their teaching. Success may also depend on how confident students feel in their corresponding duties of learning, studying and meeting the outcomes. This was applied in this study where the curriculum was evaluated for the consistency of coverage of environmental impact topics because it acted as a guide for teachers in the classroom. Past examination question papers were also evaluated in the study because they provided the basis for learners meeting their outcomes at the end of the academic year. This depended on how confident teachers were in their corresponding duties of providing learners with the necessary resources.

RST also has mechanisms that are used to initiate or evaluate actions. De Souza (2013) mentions that these mechanisms have the power to control actions but are not necessarily rigid or unchangeable. This is termed “emergence”, which involves a reconstruction of the processes (Archer, 2003). Archer further points out that emergence can be seen when situations arise through the process of social interaction and people choose to engage, modify or disregard mechanisms with the associated benefits or costs which would result from their decisions.

The theoretical framework is concluded by outcomes, which are the end product of the interactions between structure, culture, agency, relations and mechanisms. The dynamics of the outcomes result in social reality. Social reality illustrates Archer’s (2013) morphogenetic approach to social change, which essentially means that social reality changes (morphs) through the actions of people (genesis). In the morphogenetic approach, social processes tend to change the form, state or structure of systems. If a system resists change, Archer (2003) refers to the outcome as morphostasis. Therefore, social change can be transformative (change) or reproductive (no change). This was applied in this study to explore the manner that the curriculum changed and whether teachers changed their approach to teaching environmental impact topics to enable social change through actions in the classroom

that brought about transformation of learners in their communities towards environmental 'sustainability. Such transformation would also enhance learners' ability to perform well in the examination of environmental impact topics.

In this study, the analysis of the coverage, teaching and examination of EE impact topics was guided by RST as postulated by Archer (1996b), where she outlined that social reality is unlike any other theory because of its human constitution. Archer further reveals that social reality is different from natural reality (the defining feature of which is self-subsistence). For example, environmental impacts on nature are largely human-derived. Human impacts directly affect nature and natural systems, which we depend on for livelihood sustenance, and can be changed by human ability or intervention in the world of nature. In support of the above statement, Bhaskar (2008) highlights that transcendental realism shows conditions which are artificially produced and controlled; skilled people can come to have access to those enduring and active structures, normally presented to people only in a distorted form, that generate the actual phenomena of our world. Empirical realism, according to Bhaskar (2008), depends upon a reduction of the real to the actual and of the actual to the empirical. It thus presupposes the spontaneity of conjunctions and of facts. The facts in this research are shown in the analysis of the environmental impact topic coverage and examination in the curriculum.

According to Archer (1996:1), society is inseparable from its human components because the very existence of society depends in some way upon our activities, such as environmental impacts in the case of this research. She further contends that society is characteristically transformable and it does not have an immutable form or even a preferred state in nature as this depends upon human actions and their consequences. The consequence in this study is regarded as environmental degradation, which is associated with biophysical, social and economic features. Furthermore, she suggests that humans are also not immutable as social agents, for what we are and what we do as social beings is also affected by the society in which we live and by our very efforts to transform it.

Archer (1995) further argues that there are two primary approaches that theorists have taken. They represent what she calls upward and downward conflation. In the first case, which is upward conflation, society vanishes and is replaced by some desire

from individual action. In downward conflation, according to Archer, agents disappear and individuals do no more than act out the imperatives of social norms and structures. She explains this concept as follows: the 'morpho' element is an acknowledgement that society does not have a preferred state. This is evident in the current state of the environment, where it takes its shape from, and is formed by agency originating (genesis) from human activities which have both intended and unintended consequences. This is what Archer refers to as RST.

In support of her statement above, Archer (1995) writes that autonomy is also temporal in the sense that such structural properties are neither the creation of contemporary actors nor are they ontologically reducible to raw resources, but are dependent upon current human interactions with the environment. She contends that realism is achieved when properties identified at different levels or strata are real and causally powerful. Bhaskar (2008) supports Archer's notion that reality is constituted on a range of levels or strata, incorporating structures and mechanisms that bring about the events that influence our experiences. Archer further posits that the realist theory reflects an analysis of properties between micro and macro levels. In this study, the focus is on the micro level, where the agents of change are teachers and learners and the structure is the curriculum that is analysed. In the realist theory, society is small (micro) or big (macro), and the focus in this study is based on a smaller unit of analysis, namely the school context.

Archer's main idea of morphogenesis is that processes of change occur for agents and social structures in interlocking and temporally complex ways. According to Archer (1995), agents are formed within a set of existing social structures, for example, norms, language communities and power relationships. Therefore, agency occurs within the context of these already existing structures. Furthermore, Archer argues that on a longer time scale, the structures themselves change because of the activities and choices of the historically situated individuals (agents) who make them up. In this study, it is anticipated that changes in the curriculum structure had an effect on the coverage, teaching and examination of the environmental impact topics in the FET phase. In the RST, Archer (1996b) states that ontology exists as a set of cycles with different time frames, namely: structural conditioning>social interaction> structural elaboration/reproduction. Furthermore, Bhaskar (2008) states that if the basic knowledge is expressed as certain, is independent of any human activity and reflects

the world, then its constituents must be atomistic (i.e. composed of basic indivisible components). According to Bhaskar (2008), if these constituents were not atomistic, they would be themselves susceptible to analysis, and so require justification. Therefore, it is the characteristics of the concept of knowledge on which empirical realists rely. It is the desire for immutable foundations at a level which constitutes the world that generates the ontology of atomistic events and closed systems responsible for the problems and errors analysed (Bhaskar, 2008).

As mentioned before, Archer's RST is grounded in Critical Realism and is premised on the idea that structures are themselves adapted and changed by active individuals (agents) doing things within them. She describes the movements as upward, where social structures are formed and downwards, where there is an understanding of actions and interactions. In support of RST, Schulze (2014) is of the opinion that curriculum dissemination encourages and facilitates the self-actualisation of the individual. Sitarz (1994) agrees with Schulze that communities must be allowed to participate directly in the management and protection of local resources. This study therefore involves teachers and analysis of related educational policies, curricula, examinations and textbooks, as they contribute to environmental education around environmental impact topics. RST is explained in aspects such as context, mechanisms and outcomes that have an effect on the analysis of the coverage, teaching and examination of environmental impact topics in the curriculum. The next section outlines population and sampling of this study.

2.11 ROLE OF FUNDISA FOR CHANGE PROGRAMME IN TEACHING ENVIRONMENTAL IMPACT TOPICS

This study evaluated the impact of the teacher training workshops co-ordinated by the Fundisa for Change Programme whose aim was to strengthen environmental learning in teacher education (Fundisa for Change, 2016). As specified by the programme, "Fundisa for Change's core objective is to strengthen the teaching of environmental concepts in schools" (Fundisa for Change, 2016). Due to continually emerging environmental crises and uncertainties, many of the environmental topics in the curriculum (CAPS) are new to teachers (DBE, 2017). Consequently, this affects how the topics are taught to learners in schools. Fundisa for Change is a collaborative partnership programme that involves many of South Africa's major environmental

organisations, including the state, universities as teacher training institutions, parastatals, NGO's and private companies, that aims to enhance transformative environmental learning through teacher education (Fundisa for Change, 2016). One of the major stakeholders of the programme are South Africa's teacher education institutions, whose objective is to improve teaching of environmental concepts and transformative environmental learning in schools. Other stakeholders include Eco-schools, the Wildlife and Environment Society of South Africa (WESSA), GreenMatter, Environment Learning and Teaching, Delta Environmental Centre, South African Universities, The Lewis Foundation, British High Commission, Murray & Roberts, German Cooperation, the Department of Environmental Affairs and the Department of Education, the Department of Water Affairs, Water Wise, South African National Parks and the South African National Biodiversity Institute (SANBI) (Fundisa for Change, 2019). Lack of engagement of partners and participants often translates into a lack of ownership of the programme and consequently a lack of commitment. Fundisa for Change programme helps teachers and teacher educators to think about these aspects (social transformation, active and critical learning, high knowledge and high skills, progression, human rights, inclusivity, environmental and social justice, valuing indigenous knowledge systems and credibility, quality and efficiency) of the curriculum, and to bring out expanded knowledge and understanding of these important aspects of the curriculum, as found in the subjects. In order to achieve its capacity-building objectives, Fundisa for Change developed numerous teacher education support materials which are provided for training in participatory manner engaging the different stakeholders in the process. The programme is also engaged in the design, implementation and evaluation of highly regarded nationally relevant capacity-building programmes for teacher educators and teachers (Fundisa for Change, 2016). It is important to mention that the South African Council for Educators (SACE) endorses training courses from this programme (Fundisa for Change.com, 2019).



Figure 2.8: Fundisa for Change stakeholders launching the programme on the 27-28 February 2014

Source: <https://www.facebook.com/Fundisaforchange/>

The Realist Social Theory (RST) states that “...social structures comprise aspects of structure, culture and agency, which interact to shape and re-shape the conditions people have for engaging in action” (Archer, 1996:64). Teachers, who are agents that engage in action in the teaching and learning system, participated in the programme hosted by Fundisa for Change. The programme was aimed at improving teachers’ knowledge, pedagogic practice and assessment skills in teaching environmental topics in the CAPS curriculum. The population for this study was based on those teachers who took part in the training in the year 2013. The Fundisa for Change programme advocates that teachers should know the environment and sustainability content in different subject disciplines as expressed in the statement: “The programme claims to equip teachers with good teaching practice, provision of teaching methods and transformative learning, learning theories, expanding the range of teaching methods used in the subject and improves the quality of teaching and learning” (Fundisa for Change, 2013: I).

Fundisa for Change (2013) also states that teachers should be part of the socio-cultural and structural factors that promote teaching and learning in the community. These factors also form part of the RST theoretical framework of this study. According to Fundisa for Change (2013), “socio-cultural factors are factors such as learners’ prior

knowledge and experiences, language, culture, histories of learners and the societal context. Structural factors are factors such as resources, availability of textbooks and relevant learning materials, size of classes, poverty conditions and structuring of the timetable”.

The programme also focusses on the understanding the environmental and sustainability knowledge included in various school subjects. Educational programmes can be used by teachers to enhance their skills and to develop materials without experiencing many problems (Pedretti & Nazir, 2014). The Fundisa for Change programme focuses on three important aspects of teaching, which are;

- Subject Content knowledge
- Teaching practice
- Assessment practice

The aspects listed above form the core elements of the Fundisa for Change programme’s principle of building quality environmental teaching and learning in South African schools by focusing on science, environment, society and sustainability (Fundisa for Change, 2013). This will assist teachers to develop environmental knowledge and skills and enable them to make reasoned choices about their lives and their teaching. It is against this background that the programme focused on understanding the environmental and sustainability knowledge included in various school subjects in the South African CAPS such as Life Sciences, Geography, Economics, Agricultural Sciences. The modules that were used by the programme to train the participants were;

1) The Teaching Biodiversity: Life Sciences Grade 10-12 module (Shava & Schudel, 2013) which consisted of three units that were based on subject content knowledge, teaching practice and assessment practice. The focus of these units are:

- Unit 1-What is Biodiversity,
- Unit 2- The Roles of Biodiversity, and

- Unit 3- Causes of Biodiversity Loss and Emerging Human Responses to Biodiversity loss.

The front page of the module is shown in Figure 7.3 below



Figure 2.9: Teaching Biodiversity: Life Sciences Grade 10-12 module front page

2) The Teaching Climate Change: Geography Grade 10-12 module (Vogel, Misser & Vallabh, 2013) consists of three units that are based on subject content knowledge, teaching practice and assessment practice. The focus of these units are;

- Unit 1- Energy Exchange
- Unit 2- Energy Resource Use and Change
- Unit 3- Responses to Energy Exchange and Climate Change

The front page of the module is shown in Figure 7.4 below

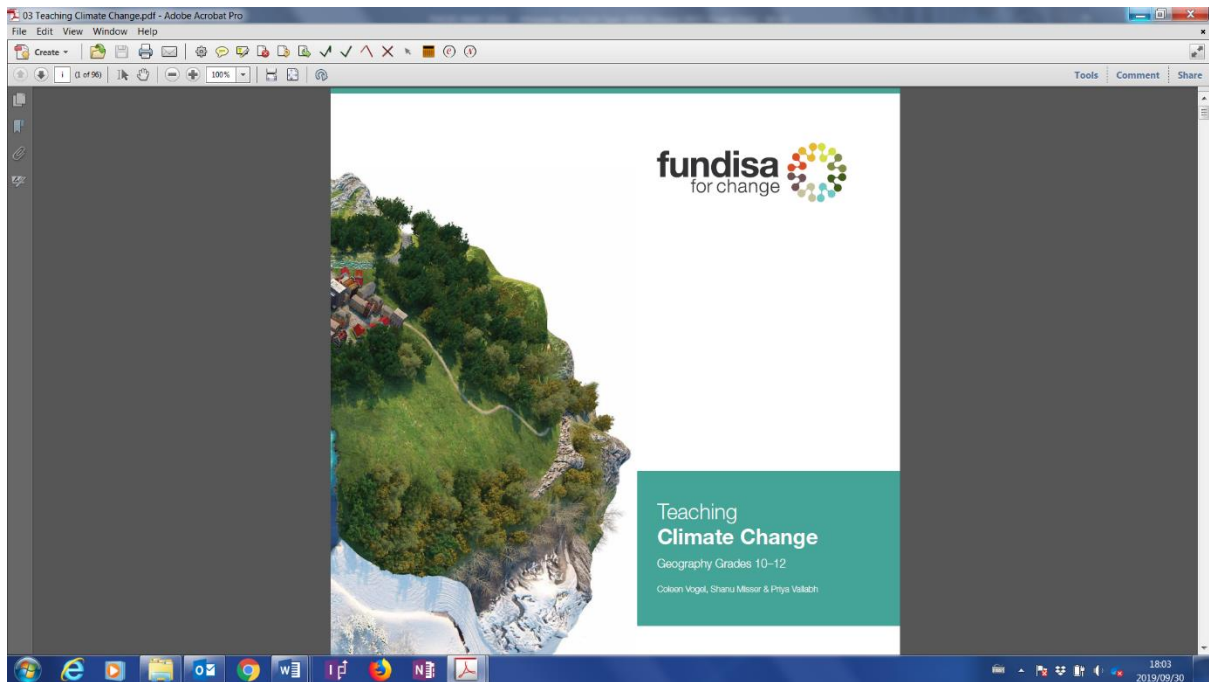


Figure 2.10: Teaching Climate Change: Geography Grade 10-12 module front page

2.12 CHAPTER SUMMARY

Chapter 2 presents key environmental impacts from a local, regional and global perspective. It can be noted from this chapter that human-induced activities are the major causes of environmental impacts such as the effects of climate change, deforestation, and biodiversity loss, depletion of ecosystems, land degradation and (air and water) pollution. Socio-economic activities have largely contributed to environmental impacts, where issues such as population growth, poverty, urbanisation, and gender inequality and consumer culture are prevalent in the world. This chapter concludes with Realist Social Theory that underpins this study. Chapter 3 follows with a discussion of the history of EE in South Africa, Southern Africa and at a Global level. Chapter 3 also provides a review on the role played by EE as a response to existing environmental impacts discussed in this Chapter.

CHAPTER 3

ENVIRONMENTAL EDUCATION AND THE CURRICULUM

3.1 INTRODUCTION

This chapter presents a general overview of the development of environmental education (EE) from a global, regional and local perspective. It also presents an overview on the importance of EE as a response to environmental impacts. In addition, this chapter also outlines the role played by teachers and environmental laws in education for sustainable development. Chapter 3 also provides different approaches used by different countries around the world in the implementation of EE in both formal and non-formal education systems. The chapter begins by providing a definition of EE that forms basic concepts analysed in this study.

3.2 ENVIRONMENTAL EDUCATION OVERVIEW

3.2.1 Brief Historic Development of EE

The development of EE has been experienced simultaneously at the global, continental, regional and national level to try to respond to environmental problems. It seems that the term 'environmental education' was first used in Fontainebleau in Paris in 1948 for the International Union for Conservation of Nature (IUCN) as a central theme for the conference (Disinger, 2005). However, Wheeler (1985) is of the opinion that the term EE first appeared in the book "Communitas" by Paul and Percival Goodman in 1947. Therefore, there appears to be a controversy on the origin of the word EE. However, it can be noted that EE has evolved from nature study, fieldwork, outdoor educations, conservation education, urban studies, global education, values education, action research, empowerment, education for sustainable development and community of practice. In contrast to Disinger and Wheeler's opinions of the origins of EE, McCrea (2006) believes that EE owes its origins to the influence of philosophers such as Jean-Jacques Rousseau (1712-1778), who felt that education should maintain a focus on the environment. This section discusses some of the key developments of EE as a response to environmental impacts from Global, Regional and South African perspectives.

3.2.2 Definitions of EE

Environmental education (EE) is seen as an effective tool to facilitate the process of fostering awareness and encouraging people to adopt environmentally friendly lifestyles in order to respond to environmental impacts (Abbas, 2003), examples of which have been discussed in Chapter 2. This study on the analysis of environmental impact topics in the South African FET phase curriculum is based on two definitions of EE, which are drawn from the IUCN conference in 1971 and UNESCO in 1977. The first definition presents that:

“EE is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among humans, their culture and biophysical surroundings. EE also entails practice in decision-making and self-formulation of a code of behaviours about issues concerning environmental quality” (IUCN; 1971)

From this definition, it can be understood that the education system needs to clarify concepts such as environmental impacts in the curriculum in order to be able to develop skills and attitudes that foster awareness that encourages people to adopt environmentally friendly lifestyles. Human derived environmental impacts have negative repercussions on environmental sustainability, hence it is important to evaluate if there is alignment between policy and practice in terms of coverage of environmental impact topics in the South African FET curriculum.

The second chosen definition of EE is based on UNESCO (1977), which highlights that:

EE fosters clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural area; provides every person with opportunities to acquire the knowledge value, attitudes, commitment and skills needed to protect the environment; and creates new patterns of behaviour of individuals, groups and society as a whole towards the environment.

The study is also associated with this second definition, which emphasises the biophysical, economic and social features that are compromised by environmental impacts and that the holistic environment should be sustained through EE. Similar to the IUCN definition, the UNESCO definition recognises educational opportunities that

should be imparted to people in order to change behaviour, values, attitudes and develop skills towards addressing environmental impacts. South Africa and other SADC countries have different definitions of the environment which highlight the importance of the holistic view of the environment, which perceives the environment as comprising biophysical, economic, social and political elements. South Africa defines the environment as;

The surroundings within which humans exist and that are made up of the land, water, and atmosphere of the earth; microorganisms, plant and animal life; any part of the combination of and the inter-relationships among and between them; and the physical and chemical. Aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing (SADC, 2012).

From the above-mentioned definition, it can be noted that EE is important as it positively influences human health and wellbeing and ensures that biodiversity and ecosystems are sustained. According to Kukreja (2017), EE is the methodology in which people seek to gain familiarity with their surroundings and secure learning, abilities, values, experiences and passion, all of which will empower them to act. Kukreja (2017) also highlights that EE is provided so that people can have a better understanding of the world around them and know how to take care of it properly so that the world can be a better place.

3.2.3 Importance of EE

Because of its inherent inter-disciplinary nature and the enormous scope of work, EE plays an important role in the existence and conservation of natural resources and the sustainability of human environment. The challenge is not only to advance the field, but also to participate in and help shape the larger movement for cultural and ecological renewal and transformation (Greenwood, 2010). In support of Greenwood, this study considers whether curriculum transformation has played a role in the coverage of the environmental impact topics. EE plays an increasingly important role in politics within and among nations (Lofdahl, 2002). The increased prevalence of environmental discussions reflects a recent and fundamental change in international policies that traces back to 1989. The constant wars experienced around the globe, when ended, not only affected environmental policies but also provided opportunities for environmental issues to be more visible on the world stage (Taylor et al., 2009).

Taylor et al. (2009) are of the view that EE effectiveness is centered on education that should take place in both formal and informal surroundings. They further insist that educational experiences should include learning in the environment, learning about and learning for the environment. The views of Taylor et al. (2009) about EE learning are supported by Di Chiro (2014:9), who points out that “EE is a social practice that aims to bring about changes and improvements in its field of action and the education for an environmentally aware and active citizenry”. Di Chiro (2014:9) further asserts, “it is essential therefore, for EE to examine the dialectics of its practice”. In other words, EE must play a role in combating the ever-increasing environmental problems (Di Chiro, 2014). The self-critique by Di Chiro is supported in this study, where document analysis will reveal the extent of coverage of environmental impact topics and whether the concept of the environment is fully and systematically represented in the South African FET curriculum. In this study, an analysis of the examinable content was done on past exam question papers to determine the frequency of the coverage of environmental impact topics found in the curriculum.

3.2.4 Different Views of EE

According to the definition given by the International Union of Conservation of Nature and Natural Resources (IUCN, 1971);

EE also entails practice in decision-making and self-formulation of codes of behaviour about issues concerning the environment. It is also the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among people, their culture, and their biophysical surroundings.

In contrast to the view of Taylor et al. (2009) above, Di Chiro (2014:9) posits that EE is sometimes criticised for the topics included in the curriculum. Di Chiro (2014:9) goes on to comment that EE in itself is a political enterprise making value judgements on who, what, where and how to educate for the environment. He likens EE to any form of education with a political inclination. I agree with the views of Di Chiro, in addition I see EE being inclined to social aspects where environmental degradation results in devastating human suffering. Similarly, Oudejans (2017) has a different view from that of Di Chiro about EE and emphasises that EE does not advocate a particular viewpoint or course of action. However, EE teaches individuals how to decide on an issue

through critical thinking and it enhances their own problem-solving and decision-making skills on what actions to be taken in alleviating environmental crises.

UNESCO (2014) states that EE is vital in imparting an inherent respect for nature amongst society and in enhancing public environmental awareness. UNESCO emphasises the role of EE in safeguarding future global developments of societal quality of life, through the protection of the environment, eradication of poverty, minimization of inequalities and insurance of sustainable development. I believe that the UNESCO view on EE encompasses all the elements of sustainability which include the biophysical, economic, social and political elements of the environment.

In addition, Ramsey and Hungerford (2002) is of the view that EE is based on knowledge of ecology and social systems, drawing on disciplines in the natural sciences, social sciences and humanities. EE reaches beyond biophysical phenomena, but it considers social, economic, political, technological, cultural, historic, moral and aesthetic aspects of environmental issues. Ramsey and Hungerford (2002) views EE as involving critical thinking and problem-solving skills needed for informed, reasoned personal decision and public action.

According to the United States Environmental Protection Agency (EPA), EE is viewed as education that increases public awareness and knowledge of environmental issues, teaches individual critical thinking and enhance individuals problem-solving and decision-making skills without advocating a particular viewpoint (EPA, 2019). I have noticed similarities in these viewpoints such as EE assist individuals in improving their critical thinking, problem solving and decision making when dealing with aspects of biophysical, social, economic and political elements of the environment. I believe that this will help individuals to make an informed decision when dealing with environmental crisis.

3.2.5 General Aims and Objectives of EE

Rioux and Pasquier (2013:695) report that the aim of teaching about the environment is to foster the acquisition of environmental behaviour in order to ensure long-term environmental protection. They further maintain that the acquisition involves developing sustainable and widely applied behaviour from the earliest possible age: sustainable because the behaviour should become an everyday and spontaneous

reflex, and widely applied in all spheres that concern environmental tolerance. On the other hand, in the school curriculum the aim of EE is to shape young people's perceptions and values about human impact on the world, and to ensure development of a sustainable future (Gwekwerere, 2014).

UNESCO developed the following objectives. These objectives are:

- Awareness and sensitivity: To help the social groups and individuals to acquire knowledge of pollution and environmental degradation.
- Knowledge and understanding: To help social groups and individuals to acquire knowledge of the environment beyond the immediate environment including distant environment.
- Attitudes: To help social groups and individuals to acquire a set of values for environmental protection.
- Skills and capacity building: To help social groups and individuals to develop skills required for making discriminations in form, shape, sound, touch, habits and habitats. Further, to develop ability to draw unbiased inferences and conclusions.
- Participation: To provide social groups and individuals with an opportunity to be actively involved at all levels in environmental decision-making.
- Action: To take appropriate measures in dealing with environmental issues in the communities

The above objectives form the basis of this study in the analysis of environmental impact topics in the curriculum.

Concerning participation, Dale and English (1999) suggest the following four areas of decision-making in environmental learning situations:

- The types of environmental issues on which decisions might be made;
- The physical setting of the prospective environmental decision, including its spatial scale;
- The types of social groups and individuals who might interact in a process leading up to an environmental decision; and
- The period within which the decision must be made.

It is important for any initiative regarding the environment to impart the four suggested areas of decision-making to ensure that programmes deliver EE in an environment that encourages the full participation of all stakeholders involved.

3.2.6 Classifications of Environmental Education

Çubukçu (2012) and UNESCO (2014) expresses that there are different classifications of EE, which they term character education. These classifications also form part of the basis for learners to be environmentally sensitive and be able to apply those values in a way that will ensure that natural resources are sustained. These classifications are described below with their significance in the environmental space. These classifications of character are:

- **Judgement and habit:** This classification emphasises a person's moral judgement and thinking while others focus on the implementation of virtuous behavior until it becomes a habit. These can help in a school environment where learners are taught environmental impact topics until they are able to practice good environmental behavior.
- **Values:** Some approaches give priority to the fundamental values such as self-discipline, courage, loyalty and perseverance while others give importance to care, kindness and friendship.
- **Focusing on environment and society:** In this situation, the character education of the individual is fitted into the norms and framework of the group.

It is important that learners are taught and shown how their actions impact and influence the environment so that they adopt attitudes and behaviour that are environmentally sensitive.

3.3 EE/ESD AS A RESPONSE TO ENVIRONMENTAL IMPACTS

According to Hill et al. (2006: 93), "nature is also viewed as a fragile natural resource that can be overexploited and degraded, jeopardising human existence". Environmental Education (EE) has been encouraged through both informal means, geared to the public, and formal means, such as its integration in the primary to tertiary level curricula (Hill et al., 2006). EE's primary role is to respond the scourge of environmental impact concerns through environmental content knowledge, awareness, change in attitudes and the provision of skills to address negative

environmental impacts. EE is also essential in shaping biophysical and human (social, economic and political) aspects of the environment. Since EE is a response to the crises emerging from human environmental impact, it is important to undertake a study that focuses on the increasing human impacts on the environment and the importance of raising knowledge, awareness, skills, attitudes, decision-making, action and behaviour to address negative environmental impacts.

This study is embedded in the definitions of EE developed by the IUCN and UNESCO, which have been presented in Section 3.1 above. In accordance with these definitions, Kyburz-Graber (2013) states that EE, as a new demand for education systems, was launched in many countries towards the last part of the 20th century as a response to the growing evidence concerning human degradation of the environment. Many documents have been written and programmes devised to curb degradation of the environment. Sitarz (1994) also notes that the increase in the world's population and unsustainable pathways of development, production and consumption, particularly in the industrialised countries, has stimulated economic growth and worsened negative environmental impacts. The nations of the world now recognise that the industrialisation and over-exploitation of the Earth's resources have degraded the environment and generated unmanageable amounts of waste and pollution. Similar to the global scenario of environmental degradation, South Africa also has been experiencing environmental degradation (DEA, 2017), hence the focus of this study on the coverage of environmental impact topics in the curriculum, related resource materials and in examinations.

This study defines environmental impact topics as coverage of knowledge on the possible adverse effects caused mainly by human practices on the environment, both locally and globally. Examples of environmental impact topics in this study include, but are not limited to, ozone depletion, global warming, energy consumption, acid rain, air pollution, marine pollution, mineral resource depletion, soil destruction, soil erosion, desertification, biodiversity loss, species extinction, waste from nuclear reactors and nuclear waste disposal. Environmental impact topics in this study also involve human environmental health and environmentally related diseases, world hunger and poverty, improper land use, poor solid waste disposal, hazardous chemicals, habitat

destruction, invasive alien species, poor water quality and wildlife management (Kukreja, 2017).

Kyburz-Graber (2013) argues that education is essential in solving environmental problems, and this research explored the coverage of environmental impact topics in the South African curriculum. In support of the aim of this study, Gough (2013) points out that the inclusion of EE in the curriculum allows for the construction of trans-cultural spaces in which scholars from different localities collaborate in reframing and disseminating their own knowledge traditions. He further states that much needs to be done in terms of research as EE continues to evolve and transform. This research explores the content coverage of environmental impact issues and their integration in the new curriculum for the South African FET phase. Gough (2013) highlights that, in EE research, there is a need for a set of strategies, embedded in values, with a specific approach to studying a phenomenon. This research also traces if there are any changes in the environmental discourse within the South African Curriculum and Assessment Policy Statement (CAPS) in the Further Education and Training phase (Grades 10-12).

Robottom (2013), in support of Gough (2013), observed that the phenomenon of environment-related education during the period from the early 1970's to the present has been marked by both continuity and contestation. He further highlights that the remarkable continuity of environment-related practice and the contestation in the language of the field is associated with "education for sustainable development" (ESD), which is discussed in Section 3.13. John, Mei and Guang (2013) suggest that in order to successfully introduce a curriculum innovation such as EE, the stakeholders need to be carefully and systematically prepared for the change. They further articulate that the stakeholders should also instigate environmental impact research to support, monitor, and evaluate the changes. Furthermore, there is a need for research and development projects to examine issues such as curriculum integration and organisational capacity, including the professional development of teachers. On this aspect, Lotz-Sisitka (2013) remarks that EE curriculum research has been shaped and influenced by Post-structuralism and Critical Realism. She further suggests that this kind of research should give emphasis to theory development, where new spaces need to be invented instead of methodology. Furthermore, Hill et al. (2006) point out

that EE should not just blindly reproduce the current realities of living with nature, but it should allow people to explore alternate realities and enable them to critically evaluate these realities and make informed decisions as to what the appropriate interaction with nature should be in their local context.

Greenwood (2013:93) concurs with Lotz-Sisitka's (2013) assertion that "reciprocally, people shape places and the material and ideological legacy of our collective inhabitation and place-making". He posits that the kind of teaching and shaping that takes place through EE will depend on the attention given to them and how we respond to them. This response supports the theoretical ideology of the Realist Social Theory (RST), which underpins this study. Although South Africa has responded to the environmental threats by signing international and regional conventions and agreements, lack of participation from citizens is a concern as documented in the 1989 White Paper on EE (Taylor et al., 2009). The White Paper on Education and Training (DoE; 1995) emphasised that EE should form part of an integrated and proactive approach to learning and is a vital element of programmes of education and training at all levels.

According to Sterling (1995), EE, as regards environmental impacts, typically challenges existing philosophies and approaches in education. He states that EE:

- is multi- and inter-disciplinary and cross-curricular;
- is a lifelong process and requires linking outside the institution;
- has an ethical dimension;
- values experiential and participative approaches; and
- should lead to action.

ESD is linked to EE through its focus on development that is sustainable. Its objective, according to Tilbury, Goldstein and Ryan (2003), includes the promotion of values and ethics at different levels in order to make an impact on people's lifestyles and behaviour and to help build a sustainable future as seen in the IUCN and UNESCO definitions of EE in Section 3.1. The study of environmental impacts is an education process designed to motivate, equip and involve individuals and social groups in reflecting on how they currently live and work and in making informed decisions,

thereby creating ways to work towards a more environmentally conducive world (Tilbury et al., 2003). This kind of EE, which is different from the traditional patterns, aims at realising adaptive management and systems thinking, which requires creativity, flexibility and critical reflection, ensuring public participation in decision-making processes.

According to Gough (2013), the description of the requirements of EE which emerged in the 1960s and early 1970s was concerned with introducing environmental content into the education curricular at all levels, promoting technical training and stimulating general awareness of environmental problems. It is evident that EE is aimed at developing and encouraging people to utilise natural resources efficiently to ensure sustainable livelihoods.

Iqbal and Arif (2011:99) contend that, “globalisation has brought a great effect to human life not only in economic issues, but also in political, social, and cultural issues”. These effects, according to Iqbal and Arif (2011), can be positive or negative, depending on the quality of human resources. They further note that human resources with low quality will fail, whereas only human resources of high quality will succeed in facing global challenges. Iqbal and Arif (2011:99) suggest that in order to produce human resources of a high quality, we need education of a high quality too. In the case of EE, it is important to ensure that learners are exposed to high quality study resources for the sustainability of the environment. Therefore, analysing the effects of changes in the curriculum will help in improving the quality of human resources on aspects such as knowledge and skills in dealing with negative environmental impacts. This will ensure that teachers are aware of the roles they must play to ensure that environmental impact topics are well-integrated in the CAPS curricular.

3.3.1 Global Responses

The history of human impacts has not been linear in terms of increases over a specific time, but there were periods of reversals in population growth and ecological changes as cultures collapsed, wars occurred, diseases struck and habitats were abandoned (Goudie, 2013). Therefore, since early colonial times, teaching young people about the natural world and their relationship has formed a special part of formal education (Irwin & Straker, 2014). The development of EE as a response to environmental impacts has its roots in the nature study movement of the 1900s, which was followed

by the conservation education programmes of the 1930's "Dust Bowl" era (McCrea, 2006). McCrea (2006) also notes that events such as the public awakening to pollution and other environmental issues that resulted in commemoration of the first Earth Day in 1970 can be seen as the roots of modern EE. Nature studies, personal skill acquisition, social development, and just enjoying nature have justified taking children and young adults into the world beyond the classroom, what was called 'outdoor education' and 'environmental education' (Straker & Irwin, 2014). Table 3.1 below shows some of the notable environmental events that have changed the way humans interact with natural surroundings.

Table 3.1: Timeline of international environmental events

Year	Environmental Event	Year	Environmental Event
1864	George Perkins Marsh, Man and Nature	1986	Chernobyl nuclear disaster
1892	John Muir founds the Sierra Club in the USA	1987	World Commission on Environment and Development (Brundtland Commission). Our Common Future
1935	Establishment of the Soil Conservation Service in the USA	1987	Montreal Protocol on substances that deplete the ozone layer
1956	Man's role in changing the face of the Earth	1988	Intergovernmental Panel on Climate Change (IPCC)
1961	Establishment of the World Wildlife Fund	1989	Global Environmental Facility
1962	Rachel Carson's Silent Spring	1992	Earth Summit in Rio and Agenda 21
1969	Friends of the Earth established	1993	United Nations Commission on Sustainable Development
1971	Greenpeace established	1994	United Nations Convention to Combat Desertification
1971	Ramsar Treaty on International Wetlands	1996	International Human Dimensions Programme on Global Environmental Change
1972	United Nations Environmental Programme (UNEP) established	1997	Kyoto Protocol on greenhouse gas emissions
1972	Limits to Growth published by Club of Rome	2001	Amsterdam Declaration
1973	Convention on International Trade in Endangered Species	2002	Johannesburg Earth Summit

Year	Environmental Event	Year	Environmental Event
1974	F.S. Rowland and M. Molina warn about CFCs and ozone hole	2007	United Nations Bali Climate Change Conference
1975	Worldwatch Institute established and Belgrade Charter	2010	United Nations Copenhagen Climate Change Conference
1979	Convention on Long-Range Transboundary Air Pollution	2010	Nagoya Biodiversity Summit and International Year of Biodiversity
1977	(UNESCO/UNEP) Tbilisi convention on Environmental Education	2012	Rio + 20 United Nations Conference on Sustainable Development
1980	IUCN's World Conservation Strategy	2015	United Nations: 17 Global Goals for sustainable development
1985	British Antarctic Survey finds ozone hole over Antarctic	2016	
1986	International Geosphere Biosphere Programme (IGBP)	2017	Paris Agreement on Climate Change

Source: Adapted from Goudie (2013)

From the development of EE as nature study, the conservation education era and the foundations of modern EE, key events must be viewed as the strong foundation for EE (McCrea, 2006). McCrea (2006) notes the Belgrade Charter, written by UNESCO in 1975, and the Intergovernmental Conference on EE in Tbilisi in 1977 as key initiatives for the development of EE as a response to environmental impacts. The most influential of all the initiatives, according to Hill et al. (2006), was the 1977 UNESCO/UNEP Inter-Governmental Conference on Environmental Education held in Tbilisi, Russia. The outcome of this conference was the Tbilisi Declaration (UNESCO/UNEP, 1977) with 12 guiding principles for EE. These principles also form the basis in the conceptualisation of the study. The Tbilisi Declaration states that EE should:

- consider the environment in its totality;
- be a continuous life-long process;
- be interdisciplinary;
- examine major environmental issues at scales from the local to the international;
- focus on current and potential environmental situations;

- promote the value of local, national and international cooperation in preventing and solving environmental problems;
- explicitly consider environmental aspects in plans for development and growth;
- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- focus particularly on learner's own community in early years;
- help learners discover the symptoms and real causes of environmental problems;
- emphasise the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills;
- utilise diverse environments and a broad array of educational approaches to teaching and learning about and from the environment with due emphasis on practical activities and first-hand experience.

I have chosen four of the 12 Tbilisi principles, which guide the research ethos of this study. These principles are as follows:

- enabling learners to have a role in planning their learning experience and providing an opportunity for making decisions and accepting their consequences, as the study elicits the extent of environmental impact topics coverage in the curriculum and how the teaching of those topics is affected by the ever-changing curriculum;
- EE should consider the environment in its totality;
- examining major environmental issues on a scale from the local to the international; and
- EE should be interdisciplinary

3.3.2 Regional Responses

The Southern African Development Community (SADC) comprises of 14 countries which are Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. According to Lotz-Sisitka (2004) and UNESCO 2015, the following have influenced EE as a response to environmental impacts in the region:

- The Tbilisi Principles (1977), which recognise EE as lifelong learning processes based on an interdisciplinary approach and diverse methods.

- Agenda 21, which calls for education and training programmes that foster public participation, recognise indigenous knowledge and a re-orientation of education towards sustainability (UNCED; 1992)
- The Earth Charter initiative (2000)
- The NGO Forums Treaty on EE for Sustainable and Social Justice Societies. The treaty highlights the role of NGO's in EE processes, the importance of mass media that serves democratic interests, recognition of indigenous peoples and their knowledge and the importance of sharing information (UNESCO, 2015)

Lotz-Sisitka (2004) mentions that EE in the SADC region has been focused on environmental and development issues for a long time and issues of sustainability have also been considered. According to SADC (2012), in 1996 the region called for a breakaway from the fragmented approaches to environmental management. The region pursued a single agenda and strategy on environmental impact assessment through EE. SADC (2012) noted that all the countries in the region needed to recognise the importance of sustainable use and management of the environment in the fight against poverty and food security. SADC reported that, although encouraging progress was made in environmental management in the region, land degradation, deforestation, loss of biodiversity, pollution, inadequate access to clean water and sanitation services and poor urban conditions continue to threaten sustainable development. According to SADC (2012), environmental challenges and social conditions continue to increase poverty, where the poor are both victims and agents of environmental degradation. I also believe that even the economically rich sectors such as industries contribute greatly to environmental degradation in the form of industrial pollution.

3.3.3 National Responses

Irwin and Lotz-Sisitka (2005), when tracing the history of EE in South Africa, note that contemporary forms of EE reached the country in the mid-1970s, stimulated by the Belgrade Charter of 1975 and the Tbilisi Principles of 1977. They noted that prior to the Belgrade Charter and the Tbilisi Principles, EE was about nature conservation and soil erosion, and it was termed "conservation education" until the late 1970s. Conservation education was later subsumed within EE and now forms an important

component in the broader field of EE (Irwin & Lotz-Sisitka, 2005). The authors revealed that the development of EE in South Africa has been met with resistance and debates about philosophical assumptions underpinning it. The ideas about EE and constructive debates in a conference on Outdoor Education held in Pretoria in 1980 influenced the hosting of the first large international conference on EE in South Africa in 1982 which took place at Treverton College, Mooi River, in KwaZulu Natal (Irwin & Lotz-Sisitka, 2005). This conference stimulated the conception of the Environmental Education Association of Southern Africa (EEASA), which is playing a significant role in coordinating EE in the subcontinental region of Africa.

According to Irwin and Lotz-Sisitka (2005), non-governmental organisations (NGOs) play an important role in ensuring that the ruling government upholds EE in South Africa. Organisations such as the Wilderness Leadership School, the Wildlife and Environment Society of South Africa (WESSA) and others recognised the importance of educating people about their environmental responsibilities and set up programmes to put these ideas into effect. “The Umgeni Valley Project (UVP), started in Natal in 1975, played a major role in the development of EE practice and theory in South Africa” (Irwin & Lotz-Sisitka, 2005). Irwin and Lotz-Sisitka (2005) noted that EEASA and WESSA were also responsible for pioneering the practice of “critical evaluation” within the field of EE. The National Parks Board, one of the leaders in theory and practice of EE, was getting support from the government in the KwaZulu Natal province. However, this situation was unfortunately not repeated in the other provinces of South Africa on ideological and political grounds. Regardless of this, Irwin and Lotz-Sisitka (2005) noted that there were several successful EE initiatives and programmes operating in the country pre-1994, especially at grassroots level.

Irwin and Lotz-Sisitka (2005) further explain that two of the most successful EE programmes in South Africa were the Bophuthatswana and the National Environmental Awareness Council (NEAC). The NEAC was established in 1974 and grew in popularity, support and effectiveness under the guidance of dedicated individuals. The authors remark that South Africa experienced several years of government resistance against the formal establishment of EE before 1989 (Irwin & Lotz-Sisitka, 2005). Irwin and Lotz-Sisitka (2005) highlight that, at tertiary levels some universities from the late 1980s and early 1990s established EE within their faculties of education as an integral part of their teacher education programmes. These

institutions were North West University, Rhodes University, the University of South Africa and the University of Stellenbosch.

The Environmental Education Policy Initiative (EEPI), a participatory state-society policy-making alliance was established in 1992 (Irwin & Lotz-Sisitka, 2005). The EEPI then changed focus to become the Environmental Education Curriculum Initiative (EECI) and its focus was to formalise education curriculum policy development (Irwin & Lotz-Sisitka, 2005). According to Irwin & Lotz-Sisitka (2005), the environment was identified for example, in Curriculum 2005 as a cross-curricular phase organiser, which required all teachers in all learning areas to consider an environmental focus. “Government recognition of the importance of including EE in a transformed education system came in June 2000” (Irwin & Lotz-Sisitka, 2005:53). The National Environmental Education Project for General Education Training (NEEP-GET) was formed to pilot the implementation of EE in the context of the new national curriculum (Irwin & Lotz-Sisitka, 2005).

Irwin and Lotz-Sisitka (2005) mention that EE has now become an integral part of all learning areas in the formal curriculum, each learning area having particular environmental content embedded within it. Therefore, this study investigates the coverage of the environmental content embedded in curriculum, the textbooks and examination question papers at the Further Education and Training (FET) phase specifically in Grade 12.

3.4 INTEGRATION OF EE IN FORMAL EDUCATION

3.4.1 Global Integration

Within European education systems, formal environmental education is provided either as a compulsory subject, as part of a compulsory subject area, or as an interdisciplinary theme in different countries (Stanisic & Marksic, 2014). In countries such as Jamaica, EE has been encouraged through both informal means, geared to the public, and formal means, such as the integration into the primary to tertiary level curricula (Hill et al., 2006). In support of Hill’s statement, evidence in empirical social research conducted in Germany has shown that “environmental consciousness and environmental behaviour are miles apart from each other” (Balderjahn, Mennicken & Vernet, 1998). According to Balderjahn et al. (1998), research findings reveal that

that while most German people are environmentally conscious, there is very little environmental activism taking place in the country. This situation can be alleviated by the formation of Non-Governmental Organisations (NGOs) to spread the importance of environmental conservation to the communities they are serving.

3.4.2 Regional Integration

Within the region, countries such as Botswana uses its Revised National Policy on education (1994) which mentions that EE should be introduced across the curriculum (UNESCO, 2017). Thus, the educational policy in Botswana stipulates that environmental impact topics should be introduced in both primary and secondary education. In the Lesotho's educational policy, EE is covered in specific subjects because it is seen as providing complementary information to primary subjects that are in line with the biophysical and human aspects of the environment. According to UNESCO (2017), Lesotho uses cross-curricular theme and issues-based approaches to include ESD in the national curriculum. Similarly, to Lesotho, Malawi's integration of EE is specific to certain subjects (Geography, Biology and Social and Developmental Studies) and not across the curriculum as in the case of Botswana (UNESCO, 2017). Likewise, in Mozambique, EE is integrated in selected subjects such as Natural Sciences, Geography, Biology, Chemistry and Physics. UNESCO's environmental scan report 2017, revealed that in Swaziland the integration of EE is in the form of themes such as water, plants and animals that cover ESD knowledge. The educational policy in Zambia stipulates integration of EE across specific subjects (Integrated Science, Biology, Geography and Agricultural Science). In Zimbabwe, the primary and secondary school syllabi have been reviewed to accommodate a number of skills such as leadership, communication and critical thinking that fall within ESD. Much of the Zimbabwean National ESD activities, apart from EE Policy which guides the integration of EE across the formal and informal education sectors, have been guided by the document entitled *ESD Action Plan, 2014 and Beyond* (UNESCO, 2017).

In this section, it emerged that all the selected countries in the region have policies that have influenced the integration of EE in the national education systems. The most common approach used to integrate ESD in the national school curriculum in the region is a fragmented approach, followed by infusion and cross-curricular

approaches. In countries like Namibia and Zambia, environmental education is a cross curriculum theme. The extent to which EE is covered in the different subjects in some of the selected countries varies from subject to subject and the level (pre, primary and secondary).

3.4.3 National Integration

In South Africa, the South African National Curriculum Statement (Grade 10-12) mentions that all subjects must contain integrated environment and sustainability content (DBE, 2016). All the subject areas have a varied extent and depth of coverage of ESD content in the curriculum. Therefore, the Curriculum Assessment Policy Statement (CAPS) requires teachers to integrate aspects of environment and sustainable development into all subjects. This curriculum integration is informed by the 1995 White Paper on Education and Training that stipulated integration of environmental education for sustainable development into all levels and phases of the education and training system (UNESCO, 2017). The approaches used in South Africa to include ESD in the curriculum are an issue-based approach and a fragmented approach.

3.5 COVERAGE OF ENVIRONMENTAL IMPACT TOPICS IN THE CURRICULUM

3.5.1 Global

Khan and Law (2015) present that, whether determined privately or by the state, developing a well-rounded curriculum is culturally and nationally bound in that different nations have different policies, programmes and institutions involved in guiding and supervising curriculum development. Khan and Law (2015) further articulate that in the existing literature on curriculum development in countries like Australia, UK and the USA, the degree and type of government involvement in the domain of higher education management varies from country to country and higher institutions should take responsibility for what is to be learnt at all school levels (Khan & Law, 2015). There is a growing need for higher education institutions to respond to the changing environment in a positive and learner-centered manner through the use of a quality curriculum; for example, a competence-based curriculum which would produce learners who are better prepared for their future tasks (Khan & Law, 2015)

As curriculum is the foundation of the teaching-learning process, all stakeholders should be involved in the design stage (Khan & Law, 2015). In designing appropriate curricula, it is important to provide knowledge and skills. Furthermore, Khan and Law (2015) confirm that the theory and practice of curriculum development in education is a constantly debated theme in academia, mainly because there are different definitions and interpretations of the term curriculum in addition to numerous approaches to curriculum design. Khan and Law (2015) insist that most importantly, the terms “curriculum” and “education”, though defined and interpreted differently in theory, nonetheless are interrelated and inseparable in practice. Therefore, “designing an appropriate curriculum is considered a foundation stone for high quality programs and services, regardless of the type of educational programs and institution” (Khan & Law, 2015).

Irwin and Straker (2015) indicate that the increasing awareness of environmental issues arising in the late 1970s and 1980s, coupled with a shift toward the pursuit of activities increasingly undertaken in outdoor education over that same timeframe, should have reduced the gap that had previously existed between EE and outdoor education. However, several participants interviewed by Irwin (2010) in Aotearoa New Zealand maintained that there was a lack of scope applied to EE in the context of outdoor education and suggested the need for a stronger and more integrated curriculum. Nevertheless, they observed that “many outdoor education programs still retained elements of conservation, learning about natural environments, and environmental care codes, suggesting historical models of EE within outdoor education were maintained by some practitioners” (Irwin & Straker, 2015). In some countries, such as Belgium, Finland, Greece, France and Spain, EE is a compulsory subject (Stanisic & Marksic, 2014). In contrast, in countries such as Serbia, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, the United Kingdom, Poland, the Czech Republic, Slovakia, Bulgaria, Belarus, Russia, Albania, Croatia, Macedonia and Montenegro, environmental content is found across several teaching subjects (Stanisic & Marksic, 2014). The section below discusses how different global countries include environmental impact topics in the curriculum.

Several countries have incorporated EE in their curriculum as a compulsory subject. A brief description of the models of Finland, Greece, France and Spain is provided below.

3.5.1.1 Finland

Jeronen, Jeronen and Raustia (2009) state that dissemination of environmental impact topics in Finland is the responsibility of two distinct groups: nature schools and environmental schools. There is a difference in objectives, tasks, target groups, type of action, staff, content taught, teaching methods and evaluation systems used by the two groups of schools mentioned above. For example, nature schools emphasise nature and the effects of human beings on the environment while environmental schools focus on the relationships between human beings and environments, and local and global environmental problems. The two groups have distinct learning approaches where nature schools focus mainly on a scientific study of nature while environmental schools focus on practical action in living environments.

According to Jeronen et al. (2008), the basis of education in Finland is provided by the constructivist pedagogy, where the roles of learners are as constructors of their own knowledge with a teacher acting as a guide and supporting the learning process. Therefore, the most widely used models in EE in Finland are the environmental behaviour model, onion model, tree model, house model and the model of ESD. These models are described below:

- The environmental behaviour model describes the development of an environmentally responsible citizen with three variables connected to each other (Jeronen et al., 2008). The most important variable, according to Jeronen et al. (2008) is environmental sensitivity, which develops based on experiences with nature. The other two variables are the knowledge of ecology and attitudes toward pollution, technology and economics.
- The onion model starts with a person experiencing parts of nature, which is followed by the environment as a whole, social meaning of the environment and environmental conflicts and action.
- The tree model encompasses all of the components of EE, which should be addressed in a systematic way where education about the environment, in the environment and for the environment go hand-in-hand, interlinked with issue-based, action-orientated and socially critical education.

- The house model emphasises that teachers should develop learner's senses and emotions that are crucial to acquiring a readiness and responsibility to solve environmental problems.

3.5.1.2 Greece

Special emphasis is placed on natural resource management in the Greek curriculum (Koutsoukos & Mouratidis, 2016), but it is optional for students from Grade 3. Environmental impact topics are taught two hours per week. It has been noted that a number of students each year choose to attend EE, which is taught by teachers with a background in topics such as agronomy and forestry (Koutsoukos & Mouratidis, 2016). The aim of EE in Greece is to broaden the learner's knowledge of natural resources, raise awareness on environmental issues and problems, develop decision-making and participatory skills and cultivate values, attitudes, and behaviours for rational natural resource management and environmental protection in general (Koutsoukos & Mouratidis, 2016).

3.5.1.3 France

Bel (2016) reveals that in France, the integration of environmental topics in the curriculum rests upon important principles, which are the right to education, enhancement of sustainable development and respect towards cultural variety. The country adopted an environmental plan on the 28th of February 2005, where the vision was to allow each pupil to gain basic knowledge on problems related to the environment before they leave school. Bel indicates that this vision allows schools in France to include in their curriculum topics such as environmental value, environmental activities and responsibility towards natural resources. The country also supports interdisciplinary infusion of EE in the curriculum and encourages schools to be open towards environmental external activities. An interdisciplinary model exists between schools and projects for EE where outside activities such as visits to museums, parks, forests and game reserves are linked with formal education in the classroom. He further mentions that the curriculum delivery of EE in France also focuses around environmental themes in subjects such as physical and sportive education, history, geography, civics and technology. The EE themes embedded in the curriculum are environmental and sustainable development, meteorology and

climate, energy, health and security. This approach is also evident in Greece as shown in Section 3.5.1.2 above.

Some countries such as the United Kingdom, Malaysia, Serbia, Canada and the Netherlands embed environmental impact topics in a combination of subjects by using interdisciplinary approach.

3.5.1.4 United Kingdom

Palmer (1998) reveals a complexity of teaching strategies in the United Kingdom (UK), which fall into three overlapping categories. These teaching categories are:

- The use of the environment as a medium for education. The environment is used as a source of stimulation for realistic activities in language, mathematics, science, art and the humanities and with the development of skills and abilities as an important purpose.
- The use of the environment as a subject for investigation. Here the educational objectives are essentially cognitive, and may be achieved through science, geography, history and other subjects or through a specifically 'non-fragmented' approach.
- The conservation and improvement of the environment as a goal of education. This is concerned with values and attitudes of natural resource conservation.

Palmer (1998) states that at the primary stage in the UK, EE is seen as involving learners in personal experiences of the environment by direct exploration with all of their senses, using the school and its immediate surroundings and going further afield when necessary in what is known as outdoor education. Palmer (1998) goes on to comment that these environments involve both the living environment in small nature reserves, school gardens or in the countryside and the built environment in street work. Palmer supports that, at this stage, emphasis should be placed on the development and knowledge of concepts of environmental impact topics. Palmer (1998) notes that teachers are expected to use these experiences to develop language of EE and scientific methods of enquiry, aesthetic appreciation and creative expression as well as to encourage the development of value judgements and an environmental ethic in learners. Learners should be introduced to the statutory and accepted codes of environmental behaviour.

In support of the above, Palmer (1998) remarks that positive plans were made for the inclusion of EE as an officially recognised cross-curricular theme in the National Curriculum for Schools in England. The highlights that the EE theme was one of the original five themes to be documented, alongside health education, education for citizenship, careers education and guidance, and economic and industrial understanding. Themes were to be regarded not as additions to be infused to the curriculum's core and foundation subjects, but as a major element of the curriculum as a whole, having progression and continuity like all other subject areas. This EE theme, together with other themes mentioned, are cross-curricular, and thus can feature in or arise out of a number of other areas of the curriculum (Palmer, 1998). Palmer further illustrates that these themes promote thinking and discussion on questions of values and belief; they contribute to knowledge and understanding and rely on practical, experiential learning and decision-making.

3.5.1.5 Malaysia

Mustam and Daniel (2016) reveal that EE has been officially integrated across the national curriculum since the nineties, where various environmental aspects were integrated into all taught subjects during classroom teaching and learning sessions. However, the integration of environmental impact topics into the curriculum was not successful. The reason for this failure was attributed to time constraints and lack of appropriate teaching resources. Although there are challenges of infusion of EE in the curriculum in Malaysia, several informal methods are being utilised to integrate EE in the curriculum where societies assist. Mustam and Daniel (2016) indicate that the integration of EE in Malaysia is carried out in subjects such as Geography, English, Bahasa Malaysia (national language) and Science. Studies on the integration of EE into these subjects reveal that knowledge among students is high and the major shortfall is the teacher's weak implementation of EE into a curriculum whose approaches did not live up to expectations as their focus was on preparing students for national examinations. The situation in Malaysia has also influenced the decision of the researcher to evaluate the coverage, teaching and examination of environmental impact topics in the South African FET curriculum.

3.5.1.6 Serbia

Maravić, Ivković, Segedinac and Adamov (2014) contend that in the Republic of Serbia environmental issues are limited to subjects such as chemistry, geography, biology and ecology. The content coverage of environmental impact topics in the curriculum constitutes of about 5.4%. Current school policy in Serbia envisages that environmental impact topics should be implemented through and after-school activities (Stanisic & Maksic, 2014). According to Stanisic and Maksic (2014), themes of EE in the curriculum comprises of environmental impact topics such as living and non-living nature and human activities and their impact on the environment.

3.5.1.7 Canada

Karrow and Fazio (2015) state that in Canada, specifically in the province of Ontario, protection of its environment and the conservation of its natural resources strengthened during the post war era between 1945 and 1995. This improvement was overshadowed by dramatic changes during the spring of 1995 where environmental laws were dismantled and resources allocated for environmental initiatives were reduced. Karrow and Fazio (2015) indicate that the secondary school curriculum was also changed. The new curriculum represented less than 5% of environmental content coverage except in Grade 7. However, in 2009, the situation changed, and an EE policy framework was adopted with a slogan “Acting today, shaping tomorrow”. Environmental impact topics were then incorporated into all subjects in the curriculum as a theme as mentioned in other countries in Europe.

3.5.1.8 Netherlands

The Centre on International Education Benchmarking (2016) notes that in secondary school curriculum in the Netherlands, the core subjects are Dutch, English, Mathematics and Man and Nature. The Man and Nature subject is an interdisciplinary subject covering man, animals and their relationship to the environment, biological and chemical functions, caring for oneself and others, the human body and research skills. Man and Society is another interdisciplinary subject focusing on formulating research questions and answering them, using sources, organising themes and ideas, citizenship, and understanding the relationship between past and current events. Art and Culture, Physical Education and Sports are other subjects in the curriculum.

3.5.1.9 Spain

Conde and Sanchez (2010) state that UNESCO-UNEP in 1978 recommended that EE should not be a separate subject in the curriculum. Spain then introduced a transversal approach in its school curriculum. They refer to the incorporation of EE as greening the curriculum, which means aligning it with the ethical, conceptual, and methodological principles underlying EE. Conde and Sanchez (2010) state that the country uses a “sword” model, where environmental themes cut through all areas of the curriculum in the form of internal or external school workshops. Other approaches to incorporating environmental impact topics in the curriculum were the “needle and thread” model, followed by the “benign kinglet” and the “infusion” model: all of these models incorporated transversal themes into the knowledge and everyday life of the schools. Conde and Sanchez (2010) suggest that greening of the curriculum should consider the following variables: organisation of the content, preparation and use of teaching materials, motivation of pupils, improving attitude and habits and evaluation of the process.

3.5.2 Different Approaches to Dissemination of Environmental Impact Topics

This section discusses other countries different approaches to EE implementation into the school curriculum. These approaches can be intra-curricula activity, use of teachers’ discretion and any other methods that the school deems necessary and appropriate at that particular time. These selected countries are discussed below which are the USA, New Zealand, Taiwan and Australia.

3.5.2.1 United States of America

The USA’s approach to EE is based on outdoor activities, where learners and teachers interact with the environment while infusing environmental values in the target audience. According to Louv (2012), The No Child Left Behind Act ignored repeated attempts to reinstate the National Environmental Education Act in the curriculum. He states that even though the government of the USA ignored calls for environmental literacy, several stakeholders such as educators and researchers continued to advocate, promote, demonstrate and document the benefits of involving children in the environment as a learning context. It was posited that young children should experience the environment through outdoor play. Louv (2012) further comments that

researchers also discovered that green play spaces have a positive effect on attention-deficit/hyperactivity disorder (ADHD) in children. This finding also led to the publication of Louv's "Last Child in the Woods, Saving our children from Nature-Deficit Disorder" (Louv, 2012).

Louv's manifesto on the causes and consequences of a number of modern society's environmental degradation problems aroused renewed interest in the outdoors, the environment, and EE. This led to the No Child Left Inside movement, which supports education in and about the environment. This later led the US government to pass the National Environmental Education Act, nicknamed the "No Child Left Inside" Act (H.R.3036 2008). Louv (2012) believes that children should be well prepared for the global threats to the environment, even though their physical contact and intimacy with nature on a day-to-day basis is minimal. Louv suggests that even children with disabilities gain enhanced body image and positive behaviour changes through direct interactions with nature. Louv further believes that society is teaching young people to avoid direct experience of nature. This is supported by Louv's (2012) assertion that public school systems, media and parents are scaring children straight out of the woods and fields. The study conducted by Louv shows that many of the parents were aware of the changes in their children brought about by spending less time in nature than they themselves did, including disappearing access to natural areas. The author believes that children are spending most of their time indoors on television and computers, as well as doing more homework; furthermore, fear of child snatching is resulting in less time spent outside in the environment.

In support of the above outdoor education, conservation education and nature study remain active fields that contribute to the knowledge of environmental impact topics and these have been permanent and mutually beneficial. EE is found in a range of content in subjects such as science, mathematics, language arts, social sciences and politics (Carter & Simmons, 2010).

3.5.2.2 New Zealand

Irwin and Straker (2015) recognise that currently there is no curriculum requirement to teach EE in Aotearoa, New Zealand. However, they admit that it is entirely at the discretion of individual schools and their school governing bodies (SGBs) to incorporate environmental impact topics in their curriculum, although the

environmental guidelines of the New Zealand Ministry of Education recommend using a whole-school approach across multiple learning areas. They indicate that EE operates both within and outside of the national curriculum. This is done because the vision and future focus of the curriculum requires all subjects to integrate key socio-cultural and environmental aspects relating to sustainability into the learning process (Irwin & Straker, 2015).

3.5.2.3 Taiwan

According to Yang (2015), we live at a time when environmental impact topics such as global warming, resource depletion, environmental pollution, climate anomalies, loss of biodiversity, deforestation, and improper development are being exacerbated. Yang further mentions that numerous developed countries have not only shown increasing concerns pertaining to the policies, regulations, and the general promotion of environmental protection and recovery, but they have also placed an increasing emphasis on EE. In Taiwan, according to Yang (2015), EE is listed as one of the seven key educational issues following the Grade 1 to 9 curriculum reform, encouraging teachers to integrate EE into the various school subjects. "In response, numerous elementary and junior high schools have established websites and formulated plans pertaining to EE, and have further promoted various environmental subjects, courses, and activities" (Yang, 2015:88). In addition, Yang notes that the regional education units in Taiwan have established EE and counseling groups in their individual jurisdictions. These efforts thus imply that EE has become a key concern in elementary and junior high schools (Yang, 2015:88).

Yang (2015) reiterates that, based on the descriptions released by the Department of Education in Taiwan (2008), there are five key aspects in their EE curriculum: environmental awareness, environmental sensitivity, conceptual knowledge and connotations, ethics and values, and skills and experiences regarding environmental activities. Although all five aspects are of equal importance, environmental awareness is the foundation, which the remaining aspects are implemented upon. Thus, environmental awareness entails the training of students' sensory awareness abilities such as observing, classifying, sequencing, determining spatial relationships, measuring, inferring, predicting, analysing, and interpreting, consequently enhancing

their awareness of environmental crises and pollution, and their appreciation of and sensitivity towards sustainability (Yang, 2015:93).

3.5.2.4 Australia

According to Effeney and Davis (2013:32), education for sustainability develops the knowledge, skills, values and worldview necessary for people to act in ways that contribute to more sustainable patterns of living. In Australia, there is an increased emphasis on sustainability in order to create education that is supported by a series of government initiatives, policy statements and whole school programmes. This has led to environmental impact topics being embedded in all school learning areas (Effeney & Davis, 2013). The increase of environmental impact topics in the curriculum has presented challenges in efficacy and content knowledge.

3.5.3 Regional Approaches

The following section highlights some of the approaches adopted by some African countries for the inclusion of EE in the curriculum. The selected regional countries are Namibia, Zimbabwe, Botswana and Zambia. It is noted that the selected countries in the Southern African region all integrate EE as an interdisciplinary approach.

3.5.1.1 Namibia

EE in the Namibian curriculum is embedded in all subjects. According to Haindongo's (2013) study, environmental learning is integrated across the curriculum where incorporating environmental topics requires knowledgeable teachers in order to relate these topics to the environment. This is a similar case in South Africa where EE is embedded across the subjects in the curriculum. The analysis of Namibian inclusion of EE in the curriculum revealed that there is more coverage of environmental topics in the Biology syllabus. This is almost the same scenario in South Africa where there is more emphasis on environmental issues in the Life Sciences curriculum. In the Geography curriculum, it covers environmental topics such as agriculture, industrial systems, leisure and tourism, energy and water resources, environmental risks and management, ecosystems, urbanisation and quality of life (UNESCO, 2017). In 2017, Namibia reviewed education for sustainable development policy that aimed at working towards integrating these current Global, Regional and National objectives in education. The mandate of the policy was to build a strong fundamental principles

incorporated within the policy and frameworks will significantly guide the mainstreaming and integrating of long-term sustainability concepts across all sectors in Namibia (Mangundu, 2017).

3.5.1.2 Zimbabwe

In 1999, the Presidential inquiry into education and training recommended the integration of EE into the school curriculum (Mukoni, 2013). This led to EE being developed to influence policy, which then led to the integration of EE in all learning institutions at various levels in the formal and non-formal sector (Shava, 2003). In the curriculum of Zimbabwe, EE is covered in carrier subjects such as Natural Science, which covers only the biophysical aspect of the environment. Curriculum greening was then suggested as one of the platforms that can be used to disseminate EE across the curriculum (Shava, 2003). National Environmental Education Policy of 2003 influenced the implementation of some environmental driven cross-cutting issues as environmental issues (UNESCO, 2017).

3.5.1.3 Botswana

In Botswana, EE integration in the curriculum traverse's subject boundaries, thus allowing teachers to collaborate on cross-syllabi content (Velempini, 2017). Subjects in the curriculum are interconnected with the intent of infusing integration in the development of schoolchildren's concept of EE (Velempini, 2017). Despite government efforts for curricular integration, it is the responsibility of the teachers to integrate environmental content in their classrooms. Against this background, integration of EE in Botswana is implemented across all school subjects. Velempini (2017) mentions that there is misalignment and continuing confusion on what the policy stipulates and how implementation is accomplished in schools. According to UNESCO (2017), in terms of subjects, most ESD-related topics such as environmental impact topics are explicit in Social Studies, Geography, Agriculture and Development Studies. However, other subjects, such as Science, provide similar opportunities for ESD. Specific environmental impact topics in the curriculum are not limited to Environmental Sciences (seasons and weather, the environment), Geography/Sciences/Agriculture (weather and climate), Mathematics (graphs), and Languages (stories, drama, role-play and debate)

3.5.1.4 Zambia

In Zambia, EE is covered in the lower, middle and upper basics of the schooling system. EE is covered mostly in subjects such as Geography, History, Social Studies and Religious Education (Kalimaposo & Muleya, 2014). According to Kalimaposo and Muleya (2014), EE is covered as components in the various subjects and that has implications on teacher competence because there are no experts specifically trained in EE as a discipline.

3.5.4 The South African Approach

According to the White Paper on Education and Training of 1995, EE in the curriculum must involve an inter-disciplinary, integrated and active approach to learning (DoE; 1995). EE is a vital element of all levels and programmes of the education and training systems in order create environmentally literate and active citizens and ensure that all South Africans enjoy a decent quality of life through the sustainable use of resources (DoE; 1995). From the above statement, it is important to note that EE in South Africa is implemented in all sectors of education and in the CAPS curriculum; it is embedded across all subjects.

However, the Department of Basic Education is not the only role player in EE/ESD in the country; the Department of Environmental Affairs (DEA) also plays an important role in EE and ESD. For instance, in 1997 the Department of Environmental Affairs (DEA) developed the White Paper on Environmental Management Policy, which consisted of seven strategic goals. Goal 5 is Environmental Education and Empowerment, the strategy being to promote the education and empowerment of South Africa's people to increase their awareness of and concern for environmental issues, and to assist in developing the knowledge, skills, values and commitment necessary to achieve sustainable development (DEA, 2017). Goal 5 is supported by the following objectives based on education and training:

- To integrate EE in all programmes, levels, curricula and disciplines of formal and non-formal education and in the National Qualification Framework.
- To integrate EE into all training and unemployment relief programmes.
- To enhance environmental literacy using forms of media.

- To ensure that EE programmes and projects foster a clear understanding of the inter-relationship between economy, social, cultural, environmental and political issues in local, national and global spheres.

In support DEA's Goal 5, CAPS principles also emphasise the importance of the inclusion of EE into the curriculum, where one of the principles highlights human rights, inclusivity and environmental and social justice as defined in the Constitution of the Republic of South Africa (DBE, 2017). CAPS advocates infusing these principles and practices into the curriculum. Therefore, the National Curriculum Statements Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (DBE, 2017). The section below discusses some guiding principles in EE implementation. In the South African curriculum, integration of environmental impact topics is across all subjects as mentioned in this section. According to DBE (2017) the following selected FET subjects shows which environmental impact topics are covered:

- FET (Agricultural Sciences): The biomes of Southern Africa, ecology and agro-ecology, interactions in ecosystems, ecological farming Sustainable utilization of natural resources, farming systems that use agro-ecological principles, water quality and management, sustainable use of water in agriculture and water use/irrigation.
- FET (Geography): The concept of development, effect of development on the environment, using resources, effects of using more non-conventional energy on the South African economy and the environment and energy management, water in the world. Furthermore, environmental topics included the world's oceans, water management in South Africa, floods, drainage systems in South Africa, fluvial processes and catchment and river management.
- FET (Life Sciences): Biosphere to ecosystems, biodiversity, the role of invertebrates in agriculture and ecosystems, population ecology, human impact on the environment: Current crises for human survival and Loss of biodiversity

According to DBE (2017) study, an analysis of the curriculum shows that in some subjects such as Life Sciences for the FET phase, more than 50% of the content is related to ESD while in languages, there is less content and ESD is expected to be

covered more through the teaching and learning methods. Although the educational policy is not specific that some subjects should have less coverage than others should in the curriculum.

3.6 IMPORTANCE OF INCLUDING ENVIRONMENTAL IMPACT TOPICS IN THE CURRICULUM AGAINST THE BACKGROUND OF ANTHROPOCENE AND THE GLOBAL ENVIRONMENTAL CRISIS

I believe that coverage of environmental impact topics in the curriculum will not only provide opportunities for experiential learning outside of the classroom, but it will enable learners in schools to make connections and apply their learning in the real world hence curbing the scourge of biological, physical, ecological, economic, cultural and political issues that affects living and non-living things. Including environmental impact topics in the curriculum will provide learners with the skills to think critical and creatively in order to make their own decisions about environmental issues affecting them.

I am of the view that the extent of environmental impact coverage in the curriculum will not only improve critical thinking to learners but also teachers can also be in a position to integrate EE practices in all learning areas as in the case of some of the countries discussed above. Learning about environmental impact topics in the curriculum will also improve responsibility of learners to take the biophysical and human environment issues urgently as they try to eradicate issues such as pollution, degradation and loss of biodiversity.

3.7 CURRICULUM CHANGE

3.7.1 The Importance of Curriculum Change in the Teaching of Environmental Education

It is inevitable that curriculum changes will occur from time to time. These changes will affect the delivery of content in schools. Lotz-Sisitka, Fien and Ketlhoilwe (2013) state that the early curriculum and learning practices were transmission-oriented and structural-functionalist in nature. They further reveal that the influence of constructivism has created space for a more open curriculum in which learners have some control over the selection, pacing, and sequencing of their curriculum and thus their learning. Lotz-Sisitka, Fien & Ketlhoilwe (2013) also state that curriculum-learning

research remains underdeveloped in the field of education and there is an ever-increasing recognition that education can no longer be about reproduction of knowledge and skills. They raise a concern as to whether the society can afford to continue to educate young people around the world for an unsustainable future. The authors believe that the curriculum and learning research on EE should nowadays develop new niches and spaces to situate it effectively within a modernist research paradigm, which does not reproduce existing cultures and practices.

EE in South Africa is a response to environmental impacts and risks (Taylor, Littledyke, Eames & Coll, 2009). Despite all of its natural resources, South Africa is not spared from threats of environmental crises such as pollution, inappropriate waste disposal and erosion. According to the White Paper on Environmental Management Policy published in 1997, establishing good governance in South Africa can only be guaranteed if it is based on a sound socio-economic framework that is environmentally sustainable. Equitable access to, and ownership and control of, renewable and non-renewable natural resources by all South Africans, black and white, poor and rich, male and female, is critical to our survival as a country. Conservation and sustainable use of these environmental resources and their protection depends on changes in behaviour by all individuals, households, and private and public institutions. These changes must affect processes of resource extraction, spatial development, appropriate and clean production, waste minimisation and pollution control strategies in order to guarantee a higher quality of life for all (Taylor et al., 2009).

Dreyer and Loubser (2014) state that curriculum development is an open-ended process that allows for reflection and regular review of the curriculum. This should enable educators of the curriculum to participate in the curriculum development process. This will also allow reflection from role-players in a spiral model of curriculum development in the form of contextualisation, participation, dialogue, reflectiveness, flexibility, democracy, constructivist approach, development of meaning and continuous learning.

3.7.2 Global

3.7.2.1 Australia

Australia like most of the nations of the world is characterised by changes in technology, politics, economy, biophysical state of the environment. Changes in the curriculum have an effect in the covering of environmental impact topics. In 1980 a curriculum reform policy course coordinating committee was established that worked with schools to establish appropriate curricula and liaison programs within communities to improve employability of students (Dilkes, 2014). In 1983 the curriculum was changed to effect the recommendations of the Beazley Inquiry, which recommended that advanced, intermediate and basic levels in the achievement certificate subjects be dismantled. A Unit Curriculum policy that between 1980 to 1998 was developed to meet the needs of senior students and there was a shift from putting the acquisition of academic knowledge first, to equally valuing the acquisition of skills (Tully, 2002). Outcomes Based Education was then established in 1998-1999 to allow students to be taught and assessed in line with their talents and abilities (Dilkes, 2014). A Curriculum Framework was established in 1999 and in 2014 it was discontinued as it was hard to follow as it allowed too many variations in implementation and it increased teacher work load (Andrich, 2009). In 2013 the Australian Curriculum was established to meet the Melbourne Declaration (ACARA, 2010). According to Dilkes (2014), The Australian Curriculum incorporated new subject areas such as Education for Sustainability as necessary knowledge area. This shows that changes in the Australian curriculum positively influenced improvement in the coverage of environmental impact topics.

3.7.2.2 China

Hua (2014) indicated that since 1978, Chinese society has become more and more open to being liberal, which was not the case before 1978. In 1986, China made Compulsory Education Law that required nine years of compulsory education thus leading to the formation of curriculum framework for personal development. This framework was then translated into a compulsory curriculum, an elective curriculum and an activity curriculum for K-12 education. According to Hua (2014), the Ministry of Education adopted the elective and activity curriculum that was cascaded to the entire country in 1992. In 2001 the State Council of China issued The Guidelines of

Curriculum Reform of K-12 Education which led to the implementation of 2001 Curriculum Reform with the focus of transforming teacher centred pedagogy to student's active learning (Hua, 2014). This new curriculum aimed at curriculum implementation from overemphasis on receptive learning, rote memory, and mechanical training to encouraging students to experience participatory knowing, inquiry learning, and hands-on projects, and to help students learn to search for, acquire, and process new information, and develop the ability of critical analysis, problem solving, communication, and cooperation (Hua, 2014). This inferred the beginning of an era where students began to interact with the environment through school projects. Hua (2014) contended that then success of the New Curriculum Reform entered a stage of reflections where criticisms were constructive and that led to revised standards of compulsory education (Grade 1-9) were issued. In 2011, China reformed the existing curriculum, which echoes the 1922 Curriculum Reform in ensuring liberalism, radicalism and conservatism. The conservatism aspect in the curriculum focussed on the biophysical and human aspects of the environment in the modern era.

3.7.2.3 Turkey

The history of Turkish school curriculum has been premised in the policy that enshrines in ESD values, as it aimed "to bring up good citizens who can adapt into their surroundings", and in 1926 it changes to "to bring up students who are sophisticated, who are giving importance to their national history and adapt to Turkish reforms" (Akinoglu, 2008). The Ministry of Education was reorganised with Law no 2287 issued in 1933. According to Akinoglu (2008) Turkish curriculum before 1950 mainly concentrated to preparation of course and course topic lists. Changes in the 1968 curriculum prepared teachers about the application of the overall teaching approach until it was changed in 1998 and compulsory education was introduced for eight years (Dulger, 2004). Another new legislation was introduced in March 2012 that prolonged compulsory education to 12 years (Dulger, 2004). Changes in the Turkish curriculum were also experienced in 2004 that involved radical reforms in relation to their political background, social basis, pace to change and vision (Akinoglu 2008). In July 2017, the Justice and Development Party government presented a new curriculum for schools, removing evolution theory and adding the concept of jihad as part of Islamic law in the curriculum (Hurriyet Daily News, 2017).

3.7.3 Regional

3.7.3.1 Zambia

Zambia has changed the curriculum several times since its independence in 1966. Most notable curriculum reforms included the 1966 Education Act that guided the education system delivery. In 1977 there was an Education Reform policy which attempted to align the education system to meet national and personal objectives. In 1992 the Focus on Learning document was developed that articulated the priorities in the delivery of school education (Zambia Ministry of Education; 1992). The National Policy on education entitled *Educating Our Future* that was implemented in 1996 reflected Zambia educational inspirations that abided by the Convention of Rights of Child which pledged to protect the rights of every child and promote a healthy, happy, and caring learning environment. This is in line with the values of EE/ESD of ensuring that education is used as a tool to impart necessary knowledge that could change the human behaviour towards being more environmentally friendly. According to Shizha and Abdi (2005), the Zambian policy meant that in the first nine years of school every child was expected to have access to basic education. In 1996, the liberalised education system allowed private organisations, non-government organisations, individuals and religious bodies to have their own schools that were recognised. Shizha and Abdi (2005) mentioned that the aim of decentralising schools was to broaden participation in the control, responsibility and accountability of educational development. The 1996 policy is still the guiding educational policies in the country.

3.7.3.2 Malawi

Malawi gained independence in 1964, where it became significant that the curriculum be changed to be relevant to the needs and challenges of the people (Lowe, 2008). According to Chirwa and Naidoo (2014), the country lacked skills in the fields of agriculture, engineering, teaching, health and construction. Malawi launched its first Educational Plan in 1973 that provided guidelines for the development of educational curriculum. The plan had the following major objective that had a positive implication for ESD. This objective was the development of a school curriculum with relevance to the socio-economic and environmental needs of the country. In 1982 curriculum was reviewed with its emphasis on agriculture which became the main subject both in Primary and Secondary school. The 1982 curriculum had 14 subjects which were more

or less similar to the colonial government curriculum. Chirwa and Naidoo (2014) indicated that the 1982 curriculum was then reviewed in 1987 because the previous curriculum was content based. Khomani (2005) stated that the 1982 curriculum was examination oriented with more emphasis on cognitive skills rather than social and practical skills. In 1985 curriculum change took place in the country with the inception of National Curriculum and Assessment Reform which led to the Second Education Plan which covered period from 1985 to 1995. New curriculum called Primary Curriculum and Assessment Reform was implemented in 2001 which focused on practical skills for entering self-employment and entrepreneurship (Chirwa and Naidoo, 2014). This current curriculum, which is outcome-based, has subjects such as Environmental Sciences that enforces the principles of ESD in contrast to the previous curriculum.

3.7.3.3 Botswana

The Botswana Revised National Policy on Education (RNPE) of 1994 strived to develop learner's skills such as critical thinking, problem solving, innovativeness, creativity and versatility which are essential to today's work environment (Tabulawa, 2009). These were the values of the Progressive Education Movement of the 1960s to 1970s which aimed at promoting quality learners. This movement failed to overcome underachievement in the 1980s and in 1990s it reoriented its implementation plans to ensure that the demands of the growing international competition were met (Rassool; 1993). The education system was then reformed in 1994 to endow students with necessary skills and appropriate attitudes with implementation of the RNPE (Tabulawa, 2009). The skills and attitudes in the RNPE enhance ESD values in the learners by ensuring that they have appropriate attitude towards the biophysical and human environment. In 2012, a new curriculum was implemented by the Ministry of Education and Skills Development called the National Curriculum Framework for All 2012. According to the Botswana Ministry of Education and Skills Development (2012), the new curriculum framework embeds cross-curricular themes that are essential for the education for all (BMoE, 2012). One of the essential cross-curricular themes is ESD. The policy stipulates that ESD enables learners to develop the knowledge, skills, attitudes and values required to become active participants, individually and collectively, in decision-making processes, both at local and global levels (BMoEE, 2012). The policy emphasis learning experience that equip and empower learners with

problem solving and decision-making skills are indispensable in the context of lifelong learning.

3.7.4 South Africa

The analysis of the South African curriculum unveils the extent of EE content coverage in CAPS and explores how teachers are delivering the content after undergoing related training programmes. This analysis shows how the education partners can maintain or improve the coverage and examinable content of environmental impacts as part of EE in the curriculum. Thus, the descriptive presentation and analysis of the South African school curriculum follows below.

In 1997, the South African Department of Education introduced outcomes-based education to overcome the curricular divisions of the apartheid past, namely Curriculum 2005, but the problem with its implementation prompted a review in the year 2000. This led to the first curriculum revision, the Revised National Curriculum Statement Grades R-9 and the National Curriculum Statement Grades 10-12 (2002). The implementation challenges resulted in another review in 2009 which revised the Revised National Curriculum Statement (2002) and the National Curriculum Statement Grades 10-12 to produce one document, the National Curriculum Statement Grades R-12 (NCS). The NCS stipulated policy on curriculum and assessment in the schooling sector. The implications of these changes led to EE being recognised in the curriculum in the form of environmental themes across some subjects such as Life Sciences, Geography, Life Orientation and Agricultural Sciences.

To improve implementation, the National Curriculum Statement was again amended, with the amendments coming into effect in January 2012. As a result, a single comprehensive Curriculum and Assessment Policy Statement (CAPS) document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12. In 2012, the two national Curriculum statements for Grades R-9 and Grades 10-12 respectively were combined into a single document which is known as the National Curriculum Statement Grades R-12, which builds on the previous curriculum but also updates it and aims to provide clearer specifications of what is to be taught and learnt on a term-by-term basis. The National Curriculum Statement Grades R-12 represents a policy

statement for learning and teaching in South African schools and comprises the following (DBE, 2014):

- (d) Curriculum and Assessment Policy Statements (CAPS) for all approved subjects listed in this document;
- (e) National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and
- (f) National Protocol for Assessment Grades R-12.

EE/ESD in the CAPS curriculum is covered and supported by one of the principles that ensures that all the subjects adheres to: Human rights, inclusivity, environmental and social justice, infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors. The National Curriculum Statement Grades R-12 aims to produce learners that are able to use science and technology effectively and critically showing responsibility towards the environment and the health of others.

3.8 SOME GUIDING PRINCIPLES IN ENVIRONMENTAL EDUCATION IMPLEMENTATION

This study reviews two guiding principles that underpin changes of the curriculum that have an effect on the implementation of EE in the curriculum as discussed below.

3.8.1 Environmental Education viewed from the Educational Environment Perspective

Khan and Law (2015) recognise that the educational environment can be viewed from two different perspectives, the internal environment and the external environment. According to Khan and Law (2015), the internal environment, which is also called the institutional environment, reflects the culture, operations, people, strategies and structures of the institution. They further mention that the history, customs and traditions, and work routines developed and maintained over a long period also make up the internal environment or organisational culture. How decisions are made and whether employees (teachers and administrative staff) are involved in managerial and

policy related decisions-making such as curriculum development are some concerns for the internal environment. The external environment of the school is classified into two sections, namely the influence of the education sector or industry and the broader general or macro environment (Khan & Law, 2015)

3.8.2 Agency and Teacher Change

Iqbal and Arif (2011:106) emphasise that “there is an urgent need to recognise teachers’ work as complex and demanding, and improvement in teacher quality requires a re-conceptualisation of how we prepare a new generation of teachers”. Teacher preparation programmes require continual innovation to develop a new generation of teachers who have the ability to promote “complex learning” in students (Iqbal & Arif, 2011:107).

Archer (1995) explains that when different elements combine to form a new phenomenon, change is seen in the final product that has been formed. Archer views change as a social theory, where individuals are held to be unshaped material which is then moulded by society into a new form. Based on Archer’s (1995) assertion, it is important to note that teachers can be influenced by the society they come from in terms of curriculum delivery. Society can influence teachers in positive or negative ways; for example, the overall behaviour of learners in the classroom influences the learning processes in the classroom. Archer (1996b) further mentions that social theory can be distinguished from organic and mechanical theories in that it can undergo a radical restructuring.

This radical reconstruction mentioned above, according to Archer (1995), results in morphogenesis, where complex interchanges produce changes in the system’s given form, structure or state. Archer (1996a) suggests that the morphogenesis perspective is not only dualistic but also sequential, from structural conditioning >social interaction >structural elaboration. Over a period, these three perspectives lead to change or transformation. This perspective can be seen in the way the South African curriculum has changed over time. Archer (1996a) highlights that change cannot happen without the influence of existing agency. An agency such as the traditional way of life enforces uniformity and continuity in collective patterns of behaviour. She points out that every contradiction represents a potential for change, which can either be recognised or ignored. She goes on to comment that the presence of variety is essential for an

adaptive system such as the curriculum viewed in this study. The alternatives must be available to receivers who are willing and able to use them (Archer; 1996). The receivers in this study are the learners in the curriculum dissemination. Archer further notes that agencies of change include social community and trust.

3.9 THE ROLE OF SOUTH AFRICAN SCHOOLS IN THE DISSEMINATION OF ENVIRONMENTAL EDUCATION

Heckman, Humphries and Kautz (2014:6) maintain that “school molds character”. They highlight that character skills consist of things like “conscientiousness, perseverance, sociability, and curiosity”. The NCS curriculum envisages students that will “be imbued with the values and act in the interests of a society based on respect for democracy, equality, human dignity, life and social justice” (DoE, 2009:8). Çubukçu (2012) also points out that character education teaches students how to make good decisions and how to behave in a manner necessary for their career development. That shows that the hidden curriculum also plays a role in the general cognitive development of students.

Çubukçu (2012) posits that in the implementation of character education, schools should not only develop learners’ cognitive abilities, but should also help learners to understand these values envisaged in the curriculum and apply them in their daily lives. She further suggests that good character education is important for providing an appropriate classroom environment and activities. This situation is necessary to define character, which includes thoughts and feelings that lead to behaviour change.

Çubukçu (2012) is skeptical about the issue of globalisation, which has brought negative social events where the boundaries of the dominant cultures which were sensitive to society and cultures are increasingly blurred. She further says that, due to globalisation, there is a growing trend of violence between generations. This leads learners to be violent, dishonest, and rebellious against parents and teachers, violating social rules, using drugs and alcohol, attempting suicide, and indulging in other self-injurious behaviours. Since schools are not only places of education, but also a social environment, they should be responsible for alleviating the vice habits of learners through the hidden curriculum. Character is built by values and needs to be developed at school level. Through the hidden curriculum, learners are able to learn acceptable

environmental behaviour that encourages efficient and sustainable utilisation of natural resources.

The above statement about the role of the hidden curriculum in EE concurs with Di Chiro's (2014) assertion that other aspects must be interrogated apart from the known impacts perpetrated by humans such as industrialisation. The hidden curriculum can play an important role in the dissemination of environmental impact topics in the CAPS curriculum. According to Çubukçu (2012), schools are responsible for individuals' academic, social and emotional development. Therefore, for the school it can be hard to serve and develop the individual as a member of the community within the framework of the official programme. The hidden curriculum is thus essential to enhance knowledge acquisition in addition to learners being exposed to academic, social and emotional development.

Concerning social and cultural activities performed in elementary schools, it can be concluded that the hidden curriculum supports the implementation process of the programmes directly and indirectly. These activities enable students to enhance communication between students and have important roles in actualising the purposes of education (Çubukçu, 2012:1530). Ryan and Bohlin (1999), as cited in Çubukçu (2012), reveal that character education in schools should be placed not only in just one lesson, but also in the whole of school life. They emphasise that schools should be transformed into a society where characteristics such as responsibility, hard work, honesty and loyalty are developed. However, it is not only schools that are responsible for character education, but society must play a role in educating learners as well. From the above assertion, it is important to note that, if the character of a learner can be nurtured in schools and in the community, environmental impact topics can be better understood. This can positively contribute to a society that is intolerant of negative environmental behaviours such as improper solid waste disposal, air and water pollution and loss of biodiversity.

3.10 ROLE OF TEACHERS IN THE DISSEMINATION OF ENVIRONMENTAL IMPACT TOPICS

One of the key components of the study is investigating teachers' integration of EE, teaching strategies, assessment and resources used in teaching. Iqbal and Arif (2011:100) state that in order to ensure a high quality of education, the Government

should select teachers based on professional competency and professional responsibility. In this case, it should be taken into account that not all of the teachers who have professional competency also have professional responsibility. According to Sonoma State University Academic Senate (2003, cited in Iqbal and Arif, 2011:100), teachers have five main areas of responsibility:

- to their subject;
- to their students;
- to the institution of which they are a part;
- to their profession; and
- to the community at large.

In support of the above five main areas of responsibility for educators, the South African Department of Basic Education prescribes norms and standards of education which educators in all areas should integrate into the learning programme. These roles according to the DBE (2014) are:

- Learning mediator: In this role, the educator mediates learning in a manner which is sensitive to the diverse needs of learners. The teacher should demonstrate sound knowledge of subject content and various principles.
- Interpreter and designer of learning programmes and materials: In this role, the teacher should be able to understand and interpret environmental content to learners and be able to design learning programmes according to the needs of learners.
- Leader, administrator and manager: In this role teachers make decisions appropriate to the level required to manage learning in the classroom.
- Community, citizenship and pastoral role: The teacher is entitled to practice and promote a critical, committed and ethical attitude towards developing a sense of respect and responsibility towards others.
- Assessor: This role entitles teachers to understand that assessment is an essential feature of the teaching and learning process and know how to integrate it into this process.
- Learning area specialist: In this role, the teacher is expected to be well grounded in the knowledge, skills, values, principles, methods, and procedures relevant to

the subject. The teacher should know about the different approaches to disseminate EE in ways which are appropriate to the learners and the context.

The roles mentioned above are essential in ensuring that teachers are well equipped to integrate knowledge and experience in the teaching of EE in schools. “The greatest problem in teaching is how to create, sustain, and motivate good teachers throughout their careers, recruiting and preparing high quality teachers must remain a priority for policymakers” (Iqbal & Arif, 2011:101). In education, according to Iqbal and Arif (2011:101), “the changes brought on by globalisation have been manifested through various channels and mechanisms as reforms of structures, modes of financing, administration and curriculum”.

A significant sense of the nature of teaching is evolving and most of the time work put in by teachers is not adequate. In addition, Iqbal and Arif (2011) suggest that teachers should be aware of the actual complexities of classroom processes and student activities, as well as how they can be organised. They point out that prospective teachers must develop larger theoretical and normative frameworks that allow for the development of a theory of education as well as a theory of teaching. However, when the new teacher education programmes lack such competencies in most countries, teachers need to be developed through in-service programmes (Iqbal & Arif, 2011). Moreover, they argue that a national uniform education for teacher education and the creation of a corollary culture for teacher education institutions undermines the development of alternative forms of teacher education, and novel approaches to curriculum development. “The articulation of distinctive, fundamentally different approaches to teacher education might have not only different emphases than standards-driven programmes, but qualitatively different purposes and orientations” (Iqbal & Arif, 2011:101).

“Teachers are more likely to produce students who are more environmentally literate if they are more knowledgeable, have positive attitudes towards the environment, and show concern for environmental problems” (Tuncer, et al., 2009, cited in Gwekwerere, 2014:199). “If teachers lack proficiency in their environmental knowledge, skills and commitment, it is unlikely they will be able to effectively lead environmental change in schools” (Gwekwerere, 2014:199). Research has shown that inadequate incorporation of EE within Teacher Education programmes is one of the obstacles to successful

implementation of EE in schools (Cutter & Smith, 2001; McKeown & Hopkins, 2002; UNESCO, 1997; Yavetz et al., 2014, cited in Gwekwerere, 2014:199). Gwekwerere (2014) further reveals that several researchers show in their studies that prospective teachers do not possess the desired knowledge and understanding and have misconceptions regarding complex issues such as environmental impact topics in the curriculum. Gwekwerere (2014:201) goes on to comment that in order to develop an enduring understanding about the environment, students need to be given opportunities to:

- develop ownership of the environmental knowledge they learn from the curriculum;
- engage in concrete experiences as an integral part of EE courses;
- work on action projects dealing with environmental issues in their communities; and
- participate in policy and decision-making processes.

These opportunities should be based on the nature of resources and the scope of the environmental topics in the material given to learners. These can be found in textbooks and other resources that can be developed by the teacher. Furthermore, “teaching that engages students to participate within a community is more likely to prepare them to become initiators and engaged participators, compared to teaching based purely on individualistic learning approaches” (Gwekwerere, 2014:201)

In support of the statement above, according to Good and Lavigne (2015), good teaching involves much more than increasing student scores on standardised achievement tests. They also note that earlier studies show that there is a low correlation between other observational measures and student achievements. Furthermore, they comment that several studies of teachers’ stability have been conducted in the context of instructional periods, using the same material on different learners and across varied content in the curriculum. Good and Lavigne (2015) also note that given the increasing changes in the curriculum, diversity of student populations, changes in the teaching force, and better statistical measures of teachers’ impact on students learning, innovative approaches would be beneficial for learners. They believe that given these changes, it is required that recommendations from recent studies should be incorporated to determine teacher effectiveness in learners

gaining knowledge and competitiveness. Therefore, this study provides a response to Good and Lavigne (2005) on proposed initiatives for better education.

Dolphin and Tillotson (2015) comment that despite contentious debates regarding teacher education practices in the United States, education reformers and policymakers are unified in their belief that teacher quality matters. It is only recently that researchers have been able to identify the true potential of high-quality teaching for learners' results over the course of their lifetime. In addition, education scholars have realised the specific need for more longitudinal, comprehensive studies of teacher preparation programmes across multiple universities and schools that investigate how learning experiences within programmes impact teacher's beliefs and instructional practices. According to Dolphin and Tillotson (2015), the emphasis on active learning promoted within many teacher preparation programmes often requires teachers to take on new, unfamiliar roles in the classroom such as teaching EE topics.

Dolphin and Tillotson (2015) support this view of the role that teachers' beliefs play in their decision-making. They maintain that research on the efficacy of teacher education programmes must explore in greater depth the interplay between the development of teachers' personal epistemologies and the link to their instructional practices. This is significant in the subjects that contain or embed environmental impact topics in the FET curriculum.

Dolphin and Tillotson (2015) go on to comment that, in order to influence policymakers, teachers should engage in studies that investigate different preparation programmes and support more robust assertions about particular approaches by including larger numbers of participants that seek to compare different programmes. This means having teams of researchers at different sites that can identify results measured by using common instruments for data collection (Dolphin & Tillotson, 2015). In teaching students about the environment, teachers should place experiences before narration and concrete examples should be used in their teaching environment (Gwekwerere, 2014).

Stanisic and Marksic (2014) further note that teachers of EE should become role models who value life and practice healthy lifestyles in order to be successful at school. They further acknowledge that teachers should not only transfer relevant information about environmental issues but must also evoke learners' personal interest and care

for environmental issues, as well as their readiness for involvement in the process of solving environmental problems. They further reveal that development of understanding implies that school learning should encourage the ability to take on other perspectives, readiness to take risks, doubting existing knowledge and posing questions.

Karpudewan, Roth and Abdullah (2012:375) suggest that assisting future teachers in changing their attitudes might lead to greater impacts of attitude change once they are in the classroom and work with their students on a daily basis. In so doing, they “help shape each pupil’s worldview, economic potential, attitude toward others in the community, participation in community decision-making, and interactions with the environment in their respective communities”. Karpudewan et al. (2012:375) draw attention to the fact that teachers tend to emphasise those attitudes that they deem important. To have any hope for a large-scale change of attitudes in some countries, it is therefore important to develop appropriate attitudes among teachers. Recent reviews of the literature show the presence of a number of studies on teachers’ attitudes toward environmental education (Karpudewan et al. 2012; Kim & Fortner, 2006). Karpudewan et al. (2012) assert that there are few studies on pre-service teachers’ attitudes toward the environment. South Africa is also not spared from this notion and that might have a negative effect on the learners’ understanding of the concepts of the environment and thus lead to degradation of the environment from generation to generation.

Therefore, “embracing multicultural education as a system of networks connecting teachers, learners, and parents with community and environment, should inculcate teacher education programmes with theoretical knowledge relative to ecological intelligence plays a critical role in addressing the culturally rooted environmental crisis” (Thoeun, 2013:8). In addition, the field of multicultural education should be broadened to include systems thinking and the current ecological crisis.

According to Stanisic and Marksic (2014:123), in some countries such as Serbia, environmental issues in the curriculum place more emphasis on the acquisition of information at the expense of developing cognitive abilities of learners. They further note a gap between environmental knowledge and environmental action and therefore

state that a teacher plays an important role in developing environmental attitudes, knowledge and habits of learners and bridging the gap that might be experienced.

According to Oguz (2004), some studies on teachers' perceptions about EE have shown that teachers show a desire to integrate the concept of environmental awareness into their teaching and they consider themselves to be environmentally aware, responsible and active citizens who support EE concepts in the curriculum. "Besides, changing the curriculum design to incorporate education with real-life green scientific problems is linked to the current priorities to promote sustainable development while ensuring the protection of the environment for future generations" (Markaki, 2014:87). Some of the criteria and rules of the best teaching practices of environmental impact topics that teachers need to implement in their teaching strategies as stated by Markaki (2014:91) are:

- Relation to a green topic and curriculum;
- Being interdisciplinary, drawing upon many academic disciplines and teaching methods;
- Relevance to the daily life of learners;
- Based on accurate and factual professional expertise;
- Connection to professions in the green labour market;
- Learning by research and inquiry;
- Activation of the students by hands-on experiences;
- Enhancement of students' information computer technology skills;
- Support of the development of social skills; and
- Adaptability of the programme or teaching strategy.

Iqbal and Arif (2011:100) state that "for education to improve, all the teachers must have a global perspective, well prepared and provided with ongoing professional development and appropriate support". This support can improve the professional development of the teachers in terms of environmental knowledge delivery within the curriculum. Iqbal and Arif (2011) further note that all teachers have to fulfill the standards of professionalism in their respective environment and state that, for this purpose, we need standards with an international scope and we need to know how to achieve these standards.

Good and Lavigne (2015:7) mention that “the history of educational reform has been one of the consistent failure because of policy makers who have repeatedly implemented simple solutions for reform and do not take into consideration of any research conducted”. They reveal that reforms are very expensive and require time to implement. Another negative effect on the curriculum shows that good teachers are often dismissed instead of ineffective teachers, and the costs of these misclassifications to teachers, schools and students are insurmountable (Good & Lavigne, 2015). As mentioned above, Good and Lavigne (2015) further identify that good teaching involves more than increasing learners’ scores on standardised achievements tests; it entails assisting learners to become better problem-finders and problem-solvers as well as encouraging student civility and social responsibility.

In support of the above statement, Berkins and Kritsonis (2007) state that a curriculum is any document or plan that exists in a school system that defines the work of teachers. In order to accomplish the purpose of the curriculum, Berkins and Kritsonis (2007) note that a curriculum should:

- i) Clarify organisational boundaries;
- ii) Define the nature of the work to be done;
- iii) Relate the major tasks to be accomplished to one another within the total work process or work flow (coordination);
- iv) Define standards by which work is to be measured or assessed;
- v) Define evaluation procedures by which work results can be compared to work performed; and
- vi) Make changes in the work performed through feedback.

3.11 IMPORTANCE OF EE PROGRAMMES TO TEACHERS

As Johnson-Pynn, Kityo and Lugumya (2014) explain, “EE programs are a major conduit in becoming aware of threats to the environment, and it is through EE programs that youth can learn to make informed decisions to conserve and improve their surroundings”. Therefore, it needs to be asked, what components of EE programs influence youth's connections to nature, ecological values and motivation to act as environmentalists? The authors answer to this is, “researchers and educators advocate for outdoor experiences in nature for children and youth” (Johnson-Pynn et al., 2014).

Iqbal and Arif (2011) contend that, in the pre-service programme, instruction in the interpretive, normative, and critical perspectives on education should serve as the rationale and goals of teacher preparation programmes. They highlight that learning may be structured around aspects of the school-society relationship, issues in educational policy or particular disciplines such as history, philosophy, and sociology of education. “Field experiences designed and supervised in collaboration with educational practitioners are appropriate components of foundational studies when those experiences contribute to students’ abilities to interpret and communicate the content and context of educational thought and practice” (Iqbal & Arif, 2011:102). This change, according to Iqbal and Arif (2011:102), “recognises the importance of such areas of study as educational psychology, curriculum and instruction, educational administration, and pedagogical methods within professional teacher preparation programs”. However, instruction in these areas is not an acceptable substitute for humanistic and social foundational studies as teacher presence is vital (Iqbal & Arif, 2011).

During the past few years, there has been an increasing comprehension of how the environmental challenges have a multidimensional effect on education. This has been a similar situation in Africa as a whole where, according to Irwin and Lotz-Sisitka (2005), Southern Africa accounts for approximately 75% of EE research studies compared to the rest of the continent. This is one of the objectives of the Fundisa for Change programme, where teachers are encouraged to network in order to enhance their knowledge of environmental impact topics across the curriculum

Markaki (2014:87) further comments on the innovations that should be adopted by some programmes with the sole aim of bringing together the latest trends in EE, well-tested and documented inquiry-based learning practices and cutting-edge technology used for educational purposes. To achieve these objectives, programmes should embrace the following:

- Successfully and permanently link EE to career contexts by properly training the next generation to respond to major issues such as sustainable development and climate change and make sound decisions for their future careers.

- Create an inventory of the most outstanding educational scenarios connecting the curricula of various countries to professions related to sustainable development, thus rendering students more active and personally and professionally responsible.
- Establish a constantly expanding network of teachers and school communities informed on the necessity of 'green living and teaching' and trained in the effective use of digital resources in science teaching.
- Circulate effective EE teaching methods through networking with relevant projects, networks and initiatives in a wide network across the globe, in order to ensure constantly increasing access and re-usability of 'green-jobs' related lesson plans with the use of inquiry-based EE education.

In support of the above, Brooks (2012:86) attests that, "social and environmental effects that our consumer decisions have in other parts of the world can be tremendously difficult to trace, imagine and control". In addition, Howard (2012) is of the opinion that our attitudes towards the environment are beginning to change and they continue to change our choices about food, consumption, transportation and culture; thus, we require new ways of thinking in a sustainable way. Howard (2012) agrees with Lake (2012) that teacher education may be reoriented for the values of sustainability and it can be undertaken only with a clear understanding of what these values are and how people best learn the value of sustainability. Therefore, this study contributes to the knowledge of how teachers could acquire environmental knowledge and be able to cascade it through the education spectrum. Programmes such as Fundisa for Change in South Africa are examples of Howard's opinion about their role in the society.

3.12 CHALLENGES FACING IMPLEMENTATION OF ENVIRONMENTAL EDUCATION

"One of the most important topics in EE is subject matter and over the last thirty decades, the Earth experienced many environmental problems" (Taskin, 2003:4). The problems, according to Taskin (2003), are population growth, poverty, inequality, desertification, drought, climate change, solid waste and hazardous substances. In support of Taskin's assertion, Lofdahl (2002) postulates that in constructing the study on global environmental degradation, it is easy to be overwhelmed by the details as

there are so many aspects that it is impossible to characterise the system or its behaviour in an analytically complete fashion.

This challenge is masked by two overarching analytic factors: scale and spatial distribution. Scale addresses the increasing globalisation economic process coupled with the degradation of the natural environment. Although environmental degradation has always been present to some extent throughout history, it is the recent, increased scale of economic activity, especially during the latter part of the twentieth century, which is of major concern (Lofdahl, 2002). Di Chiro (2014) further asserts that environmental problems are therefore social problems caused by societal practices and structures and only viewed or socially constructed as problems because of their effects on human individuals and groups; other living things and systems are affected as well. According to Di Chiro (2014), this has broad implications for environmental educators as EE is strongly oriented towards problem solving. An environmental problem must be adequately defined and understood in order for an effective EE curriculum to be created and before real solutions can be developed and undertaken (Di Chiro, 2014:10).

Unfortunately, research in education generally, and in EE in particular, has been hindered by a failure on the part of the research community to recognise the need for a more complete range of research perspectives than those customarily found, and by a failure to recognise the occasional and inevitable misapplications of technique which can occur when appropriate methodologies do not seem available (Jickling, 2014). Di Chiro (2014:12) contends that, "an adequate understanding of environmental problems requires viewing as the products of contesting discourses, activities and interactions amongst human societies through constructive debates". Simply viewing them as issues of over-industrialisation or poor management of natural resources, which can be mitigated with well-designed technical fixes, ignores the real causes of the problems. Moreover, by narrowly focusing on nature or ecological balance as the primary "victims" of the problems, they are removed from the messy realm of society and effectively depoliticised (Di Chiro, 2014:10).

Stanisic and Marksic's (2014:124) study of Serbia reveals that EE delivery in the classroom has some challenges, which include notion that teachers are expected to teach new information in a different way without any appropriate education or training.

Stanisic and Marksic (2014:124) reiterate that students are expected to apply knowledge and be proactive in relation to ecological problems of both local and global surroundings, only to find that they are unable to apply the necessary environmental concepts in their own natural environment. They also discovered that the prescribed ecological topics in the curriculum were numerous and frequently overlapped. This overlap could lead to learners being unable to grasp all of the necessary skills and knowledge in EE.

In addition, Palmer (1998) mentions that the introduction of EE into a school curriculum represents a fundamental challenge to the dominant conception, organisation and transmission of knowledge, creating for most teachers a conflict with their approach to teaching and learning. Palmer elaborates on the discrepancy between the acquisition of environmental knowledge and awareness in schools, and the action-orientated goals of EE. Stevenson (1987), cited in Palmer (1998:96), outlines a series of major contradictions between EE and schooling. In the first instance, Stevenson describes a situation in which the rhetoric of EE focuses on improving the quality of life of all people by finding ways to ensure that no nation should grow or develop at the expense of another nation and that the consumption of individuals should not be increased at the expense of other nations. This, according to Stevenson, provides the first major contradiction between EE and the traditional purpose of schools, which is to conserve the existing natural resources order by reproducing the norms and values that currently dominate environmental decision-making..

3.13 CHAPTER SUMMARY

This chapter has discussed EE overview underpinning this study, which involved historical background of EE, outlining definitions, aims, objectives and different views of EE. This chapter further discussed EE/ESD as a response to environmental impacts from global, regional and national perspective. Integration of EE in formal education from a global, regional and national perspective was also discussed in this chapter. Coverage of environmental impact topics in the curriculum from selected global, regional and national countries formed part of the discussions in this chapter. This chapter also highlights the importance of curriculum change in the coverage of environmental education from a global, regional and national perspective. Furthermore, this chapter discussed some guiding principles in environmental

education implementation, the role of South African schools in the dissemination of EE and challenges facing implementation of EE. Chapter 4 provides the research design and methods employed in the analysis of the coverage of environmental impact topics in the CAPS FET curriculum.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The previous chapter comprised a literature review on Environmental Education (EE) and discussed its historical development from a global, regional and local perspective. It also discussed the role of teachers in the curriculum and different approaches to environmental education dissemination. Environmental Education is positioned as an educational response to global environmental impacts, which are largely anthropogenic. This chapter provides an overview of the research design and methods that were employed in gathering and analysing data collected from documents and interviews with teachers about the coverage in the subject curriculum policies, teaching materials and examination of environmental impact topics in the South African FET phase curriculum. This research methodology chapter comprises of the research design, theoretical lens and research methods used in this study. According to Yin (2011), research methodology is a framework that informs the form of data collection, analysis, and interpretation that researchers propose for their studies. Similarly, Given (2008) defines research methodology as assumptions, rules, and methods that researchers use in their analysis, critique by other researchers, replication, repetition, or adaptation by other studies. In this chapter, the rationale for the application of specific procedures used to identify, select and analyse information is discussed.

The research methodology adopted in this study is shown in Figure 4.1 (a) and (b) below.

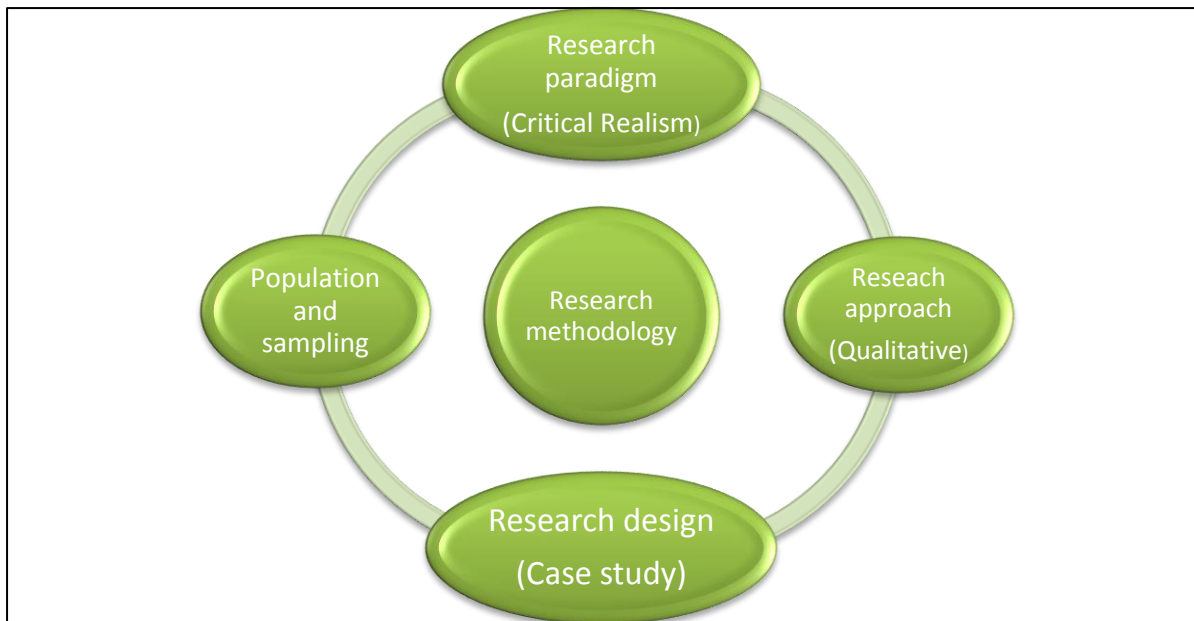


Figure 4.1 (a): Research methodology

Source: Researcher's own



Figure 4.1 (b): Research methods

Source: Researcher's own

4.2 RESEARCH PARADIGM

A research paradigm is described as a theoretical lens which provides an overall orientation on the types of questions to be asked to participants how data is collected and analysed and provides a call for change or action (Creswell, 2009). In this study, the researcher uses a Critical Realist paradigm, which leads to an inductive process of data analysis and generalisation. Critical Realism regards the production of knowledge as a social product by human beings which can change in the same way that any human product can change, as well as knowledge, that is, things that are ground within them (Howell, 2015). Howell points out that Critical Realism emphasises that knowledge is not produced by humanity, but rather discovered by them. For example, in this study, information on the coverage of environmental impact topics is already in existence and this study only analyses the data that is already in existence. Bhaskar's (1978) description of Critical Realism states that people shape their social worlds, but they are constrained by social structures embedded in their day to day social life. This is seen in this study as teachers who are agents in teaching environmental impact topics but are affected by numerous structures such as policies, examinations, community, processes, learners and so forth. The Realist Social Theory presented in Section 2.10 also affirms Bhaskar's assertion that agents do not operate independently of each other but are rational to each other. Bhaskar (1978, 1991) original three critical realism domains were; the real, the actual and the empirical. Bhaskar (1978) contends that the real is the causal mechanisms and structures that produce the actual and the actual is what happens whether observed or not. Then empirical domain is what is observed and observation usually being assumed to be not of an informal, casual, everyday kind but of a formal, analytical, theoretical kind (Bhaskar, 1991).

Houston (2014) contends that in order to grasp the significance of social structures in critical realist theory we must turn to Bhaskar's three levels of reality, which are: 1) the empirical level; 2) the actual level; and 3) the causal level. The first is reflected in what we experience in our lives through our senses. The second level is the actual level of reality of what happens regardless of our engagement with it and involves particular ways in which powers are expressed as they are triggered by causal mechanisms. The third level operates unseen and unnoticed within the empirical and actual levels and involves underlying causal properties (Bhaskar, 1978, 1991; Elger, 2012;

Houston, 2014). In this research, the empirical level is seen when teachers' application of their experiences in the coverage of environmental impact topics is used to answer the questions of this study. In the second level, this study analyses existing documents to find out how the changes in the curriculum have impacted on the content coverage in the examination of environmental impact topics. The third level is seen in this research when teacher-document interaction influences the way teacher's present content knowledge of environmental impact topics in the classroom.

Critical Realism assumes the necessary critique of the current ideology, seeking to expose dominating or oppressive relations in society (Howard, McMillen & Pollio, 2003). Howard et al. (2003) indicate that critical theory is concern with human action and interaction. Critical theory is an ongoing process that evaluates actions taken and comments on assumptions to create something better. Table 4.1 below shows the application of Critical Realism on the six major issues in this thesis.

Table 4.1: Critical Realism on the six major issues

Issues	Critical realism
Nature of reality	Textual material (Interviews and Documents) external to the human mind
Purpose of research	Uncover local instances of universal power relationships and empower the oppressed
Acceptable methods and data	Subjective inquiry based on ideology and values (Qualitative data)
Meaning of data	Interpreted through ideology (Used to enlighten)
Relationship of research to practice	Integrated activities (Interviews and documents analysis) Research guides practice
Analytical method	Abstraction and reduction

Source: Adapted from Howard et al. (2003)

In light of Critical Realism, this research uses the following stages in the research process as shown in Figure 4.2 where the researcher gathers information, asks open-ended questions, analyses data, creates appropriate categories and themes, and compares the findings with extant literature or theories. The findings are presented based on the objectives of this study in Chapter 8. Information in this study was gathered from sources: policy documents available on the DBE website, textbooks and interviews, as mentioned in Chapter 1. The collected data was analysed and

categorised based on the theoretical framework of this study which is based on RST discussed in the next section 4.5.

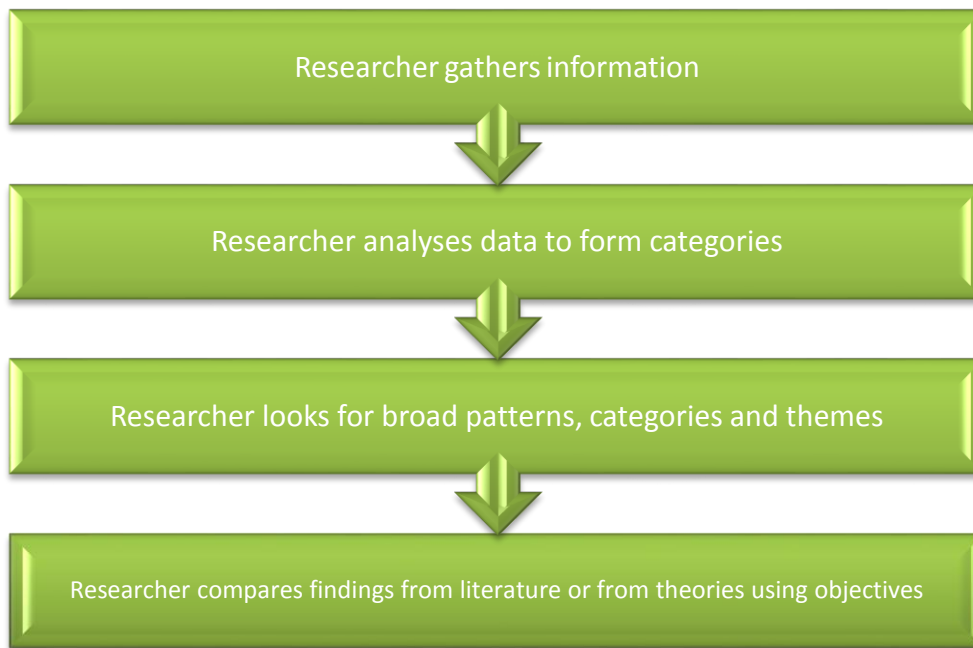


Figure 4.2: Stages in the research process

Source: Adapted from Creswell (2009:63)

Table 4.2 below depicts the interrelationship between philosophical assumptions, strategy of enquiry, methods and outcome of participant’s perspectives. This interrelationship is important in this study as it shows how the investigation was structured.

Table 4.2: Presentation of interaction between theory, methods and practices in the study

Theoretical framework	Realist social theory (Structure, culture and agency)
Paradigm	Post-positivist research (Critical realism)
Design	Case study (Teachers) and analytical study (Documents)
Research approach	Qualitative
Data collection techniques	Interviews, document review
Data collection tools	Interview guide (Teachers), Content analysis (CAPS policies, Grade 12 past examinations, diagnostic reports and textbooks)

Theoretical framework	Realist social theory (Structure, culture and agency)
Practices of research	Collecting participant's meanings, brings personal values into the study, makes interpretations of data, and collaborates with the participants.

4.3 RESEARCH APPROACH

Creswell (2009:37) defines research approach as the plans and procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis. He explains qualitative research as follows:

Qualitative research begins with assumptions, a worldview, the possible use of a theoretical lens, and the study of research problems inquiring into the meaning individuals or groups ascribe to a social or human problem. To study this problem, qualitative researchers use an emerging qualitative approach to inquiry, collect data in a natural setting sensitive to the people and places under study, and analyse data inductively to establish patterns or themes. The final written report or presentation includes “the voice of participants, reflectivity of the researcher, and a complex description and interpretation of the problem, and it extends to the literature or signals a call for action”.

In addition, McMillan and Schumacher (2010) state that a research approach describes the way on which we conduct a study, including when, from whom and under what conditions the data will be obtained. On the other hand, Johnson and Christensen (2008) believe that qualitative research can be used to describe what is seen and to come up with or generate new theories. They further reveal that qualitative research is used when little is known about a topic or phenomenon and when one wants to discover or explore further about the inquiry. This study uses a qualitative research approach, which, according to McMillan and Schumacher (2010), emphasises gathering data on naturally occurring phenomena. They reveal that most of the collected data is in the form of words rather than numbers and the researcher needs to explore and search with different methods until a deep understanding is achieved. McMillan and Schumacher (2010) summarise the major characteristics of qualitative research as a natural setting, rich description, process orientation, inductive logic, participant's perspective, emergent design, context sensitivity, direct data collection and complexity. These characteristics form the context of this study. Therefore, this

research used a qualitative research approach as it collected and unveiled meaning from descriptive data that was collected through interviews from teachers and from educational documents from the DBE.

A research approach involves a research plan and it must be done in an appropriate order. In a research design a procedure of inquiry must be specified which involves the methods of data collection, analysis and interpretations. McMillan and Schumacher (2010) further reveal that the purpose of a research design is to specify a plan for generating empirical evidence that will be utilised to provide answers to research questions. Data collected are analysed inductively to generate appropriate results. The nature of the research problem of this study required data to be collected through document analysis and in-depth interviews with participants to solicit the coverage, teaching and examination of environmental impact topics in the curriculum.

4.4 RESEARCH DESIGN

A case study and analytical design was used in this research as shown in Table 4.1 above. An analytical research design was used in the document analysis. According to Gibson and Brown (2011), document analysis can be either analytically focused or analytically filtered. An analytical focus is when data is generated in a way that is focused on the problem at hand while analytically filtered methods do not generate data, but select or filter data according their relevance to the research question (Gibson & Brown, 2011). In this study an analytically focused design was utilised in document analysis. This entailed creating discourse that was designed for generating data that was relevant to the research questions of this study. I made a critical evaluation of all relevant documents. The documents analysed included curriculum policies, past examination papers, diagnostic reports and textbooks.

For interviews with the teachers a case study design was used. McMillan and Schumacher (2010) state that a case study examines a bounded system over time in depth and employs collection of multiple sources of data found in the research setting. Creswell (2009) contends that a case study is a strategy or inquiry in which the researcher explores a programme, event, and activity, or process of one or more individuals in depth. Similarly, cases are complex organisations that have parts and act or operate in their surroundings. Creswell (2009) agrees with McMillan and Schumacher (2010) that a case can be selected for study because of its

exclusiveness. The case in this study comprised selected Grade 12 Life Sciences and Geography teachers in some of the schools in the Mpumalanga province who had undergone in-service training under the Fundisa for Change environmental teacher training programme. According to Johnson and Christensen (2008), a case study is mostly used in education where the goal is to explore a programme and to evaluate its effectiveness. Moreover, Bassey (1999) mentions in agreement with Johnson, Christensen (2008) and Creswell (2009) that one of the functions of using case studies is that it enables enquiries into educational programmes, systems, projects or events to verify their worth, as seen in the analysis of researchers, and to convey this to interested audiences. A case study allows the researcher to explore features, create interpretations and test for trustworthiness (Bassey, 1999).

4.5 POPULATION AND SAMPLING

This section describes the study's research setting, population and sampling strategy.

4.5.1 Research Setting

This study was conducted in the Mpumalanga Province, which is one of the nine provinces in South Africa. The province was chosen because some schools took part in the training programme organised by Fundisa for Change and I was residing and teaching in the province at the commencement of this research.

4.5.2 Population

The population for this study was made up of Grade 12 Life Sciences teachers who had been trained under the Fundisa for Change programme in Nelspruit in the Mpumalanga province on the modules 'Teaching Biodiversity: Life Sciences Grade 10-12' (Shava & Schudel, 2013) and The Teaching Climate Change: Geography Grade 10-12 module (Vogel, Misser & Vallabh, 2013). The Fundisa for Change environmental teacher training programme workshops were held between July and November 2013. Grade 12 Life Sciences teachers from all schools that took part in the training were invited for the interviews. The total population was twelve teachers who took part in the programme.

4.5.3 Sampling

4.5.3.1 Sampling of teachers

According to Given (2008), participants may be a variety of units of investigation and analysis at multiple levels such as individuals, families, towns and districts. This study used a purposeful sampling strategy, where information-rich participants were selected to take part. According to McMillan and Schumacher (2010), purposeful sampling involves choosing small groups or individuals who are likely to be knowledgeable and informative about the phenomenon of interest. Selection of participants, according to McMillan and Schumacher (2010), is essential when a researcher is conducting research, especially if it involves large-scale groups. The rationale for selecting these participants was based on their knowledge of the subject area (Life Sciences) and their participation in the training programme.

In addition, the sample was selected by means of the convenience sampling method. This method was chosen because data was collected from population members who were conveniently available to participate in the study. The actual sample size was determined by the number of teachers who participated in the training programme provided by Fundisa for Change. Six teachers were selected from six schools in Mpumalanga. These participants were purposefully sampled because of the training they attended on Teaching Biodiversity: Life Sciences Grades 10-12 and Teaching Climate Change: Geography Grade 10-12 conveniently sampled on the basis of their availability to participate in the research as one case.

4.5.3.2 Document analysis

Besides the participating teachers, the study also analysed relevant documents such as the Curriculum Assessment Policy Statement (CAPS), diagnostic reports from the Department of Basic Education, textbooks and past examination question papers. The analysed documents consisted of the following:

- Three textbooks on Life Sciences, Economics and Geography used by the teachers interviewed were analysed.
- Past examination question papers from 2006-2015: These past examination question papers fall within the UN Decade of Education for Sustainable development (UNDESD). This decade was used as an inclusion criterion for

selecting papers that falls within this period. The question papers were purposefully sampled and only those subjects that were taught in the schools where participating teachers for this research taught were analysed. These subjects were not limited to Life Sciences but included Geography, Agricultural Sciences, Life Orientation, English First Additional Language, Business Studies, Economics, Physical Sciences, History, Mathematics and Mathematical Literacy. These subjects were chosen due to them being branded by the DBE (2016) as the eleven key subjects in the South African education system.

- CAPS documents for those subjects mentioned above.
- Grade 12 diagnostic report for October/November 2015 final examinations.

4.6 DESCRIPTION OF THE CASE STUDY PARTICIPANTS AND ANALYTICAL DOCUMENTS

The description of the case study and documents sourced from the DBE are outlined below:

4.6.1 Case Study Profile

Teachers who participated in the Fundisa for Change environmental teachers training programme were purposely sampled as a case in this study. These teachers underwent in-service training on environmental education. The case in this study involves Grade 12 Life Sciences teachers who had been trained in Nelspruit in the Mpumalanga province in the module Teaching Biodiversity: Life Sciences Grade 10-12 (Shava & Schudel, 2013). As mentioned in section 4.6.3.1 above, 12 teachers attended the training and they formed the population of this study. Only six teachers took part in the interviews while others voluntarily withdrew. The six teachers came from six different schools from different districts in the Mpumalanga province. The profile of each teacher and their school is discussed below. All teachers attended same training and thus formed the case of this study as mentioned earlier.

4.6.1.1 Profile of Teacher 1 (Transcript 1)

Teacher 1 (pseudonym) taught in one of the schools in the Msukaligwa Local Municipality, Gert Sibande District at Elukwatini town. The home language of the area is Siswati. His school was situated in the township and starts from Grade 8 to Grade 12. The school was not poorly-resourced and parents played an important role in

ensuring that learners get the appropriate learning resources. The school had 1066 learners at the time of analysis and falls under Quintile 1, which meant that the learners do not pay school fees. The DBE provides subsidises the fees for each learner at the school. These schools are classified as non-fee schools. Based on the background of this school, the teacher was affected by a lack of resources in the school as the school was poorly resourced. Teacher 1 was a black male, 43 years of age in 2017 when interviews were conducted. I was quick to notice that he was technologically astute, and his office contained a computer and printer that he used to make copies. This teacher taught Grade 12 Geography as well as Life Sciences from Grade 10 to 12. He was responsible for teaching three classes with a total of 128 learners. Teacher 1 had been teaching for 14 years and his highest qualification was a Bachelor of Education Degree.

4.6.1.2 Profile of Teacher 2 (Transcript 2)

Teacher 2 (pseudonym) taught in Msukaligwa Local Municipality in the Gert Sibande District like Teacher 1. They shared the same home language, which was Siswati, with the difference being that Teacher 2's school was categorised as Quintile 3, which was better resourced than the school where Teacher 1 was employed. This was also a secondary school that started from Grade 8 to Grade 12 with a total of 562 learners. The school where Teacher 2 worked was still new and well-resourced and was located within well-built houses from the community (semi-urban). This school was also classified as a non-fee school. Teacher 2 attended the Fundisa for change environmental education teacher training programme and had been teaching Geography for 22 years. At the time of interview, he was acting as Principal for the school and was not allowed to have classes because of the demanding administrative duties. His experience before 2017 was vital for this study and he had a Bachelor of Education degree. Geography is one on the subjects in CAPS that has a broad coverage of environmental impact topics. Teacher 2 was 49 years old in 2017 and a black male. He was passionate about the in-service training provided by the Fundisa for change programme.

4.6.1.3 Profile of Teacher 3 (Transcript 3)

Teacher 3 (pseudonym) taught in one of the schools in the Nkomazi Local Municipality at the Ehlanzeni district as shown in a map in Figure 1.2. The school where he taught

was situated in the township and started from Grade 8 to 12. The school was classified as Quintile 1 and was under-resourced. Teacher 3 had two years of teaching experience in Life Sciences and five years of teaching Agricultural Sciences. The school where he taught had 875 learners in 2017 and he was responsible for teaching 182 learners in four classes. The home language for the area is Siswati. Teacher 3 had a Bachelor of Education degree. Due to the school being under-resourced, teachers had to improvise, and some organisations were contributing learning and teaching resources. What I vividly remembered about Teacher 3 was that he complained about teaching in overcrowded classes, which affected lesson presentations, and lack of network connectivity in the area since the school had Tablets donated to be used in Life Science lessons. This technology had become redundant since network coverage in the area was minimal.

4.6.1.4 Profile of Teacher 4 (Transcript 4)

Teacher 4 (pseudonym) taught in one of the schools in the Emalahleni Local Municipality in Nkangala District in Mpumalanga as depicted in Figure 1.2. The school was situated in the township and started from Grade 8 to 12. The school was moderately resourced and most of the resources used in teaching and learning had been donated by the neighbouring coal mines. It was a Quintile 2 non-fee school. Teacher 4 was a female and dark in complexion. She was 46 years old and had taught Life Sciences in the school since 2001. During the time of the interview in 2017, she had 16 years of teaching experience. The school she was teaching at comprised 1200 learners and she was teaching two classes in Grade 11 and 12. The home language for Emalahleni is Isipedi. Teacher 4 had a Higher Diploma in Education. The interview with Teacher 4 portrayed her as a vibrant person. She highlighted that after the Fundisa training programme she has been active in the school in terms of proper waste disposal and taking care of cleanliness in the classroom.

4.6.1.5 Profile of Teacher 5 (Transcript 5)

Teacher 5 (pseudonym) taught in the Govan Mbeki Local Municipality in the Gert Sibande District. Teacher 5 was a female and her school was situated in the township. The school was categorised under Quintile 3 and was well-resourced when compared to the other schools. The home languages for the area are Isizulu and Sesotho. Teacher 5 had been teaching for 18 years and she was 45 years old during the time

of the interview. In 2017 she was teaching Social Sciences in Grade 8 and Geography and Life Sciences in Grade 12. Teacher 5 had an Honours Degree in Education and was pursuing her master's degree in Environmental Education. She taught 173 learners from a total 1310 learners in the school. Teacher 5 was one of the participants who provided evidence of an environmental organisation formed in the school. I questioned her about the progress of the environmental organisation and what role it played in the school. The answer received was that most of the ideas came after attending the Fundisa for change teacher training programme which equipped participants with ideas of developing environmental projects in their respective schools. I noted from the interactions during the interview that she was fully involved in ensuring that the environment was sustained for future generations.

4.6.1.6 Profile of Teacher 6 (Transcript 6)

Teacher 6 (pseudonym) taught in Emalahleni Local Municipality in Nkangala District. Teacher 6 taught in a well-resourced township school where the home languages are IsiZulu and IsiNdebele. Teacher 6 was a female and was one of the youngest participants at the age of 26 years during the time of the interview. She had 5 years' experience teaching Life Sciences and Natural Sciences from Grade 8 to 12. The school where she was teaching had a total of 1231 learners from Grade 8 to Grade 12. Teacher 6 had five classes with 222 learners that she teaches. She had an Honours Degree in Education. I remember her highlighting one of the environmental impacts that had affected the area and she was wondering how people survive in Emalahleni with air pollution at its highest saturation. As the interview with her was conducted, I noted that we could smell the polluted air in the area and could not imagine that learners in the area were subjected to such polluted air. Teacher 5 also highlighted that, apart from air pollution, the drinking water from the taps was also contaminated with mine residues which were harmful not only to the land resources but also to the animals and people that drink and use the water for domestic purposes.

4.6.2 Document Analysis

This section shows tables of document analysed in this study. These documents analysed included CAPS documents, Grade 12 exit level past examination papers, textbooks and an examination diagnostic report.

4.6.2.1 CAPS documents

The document analysis in this study focused on the 11 core subjects in the Grade 12. As shown in Table 4.3 below, these subject curriculum policy documents analysed were from Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies, Economics, History, Accounting, Mathematics, Mathematical Literacy and English First Additional Language. Table 4.3 also shows the source where data was retrieved and the actual data that was required to answer the main research question of this study.

Table 4.3: CAPS subject policy analyses

Subject policy documents Analysed	Source	Data required
Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies, Economics, History, Accounting, Mathematics, Mathematical Literacy and English First Additional Language.	DBE, 2011	Total number of topics, Total number of environmental impact topics. Tuition time allocation for all the topics in the exams (weeks). Time allocation for environmental impact topics (weeks). Percentage time allocation of environmental impact topics (%). Mark allocation of environmental impact topics. Percentage coverage in the examination of environmental impact topics.

4.6.2.2 Grade 12 past examination papers

Table 4.4 below shows four subjects that were purposefully sampled based on the content analysed in CAPS subject's policies. The subjects that showed strong presentation of environmental education were then further analysed using past examination papers. Table 4.4 below also shows T1, which is the time during the old curriculum (old NCS (Grade 10-12) and T2, which is the new curriculum (CAPS).

Table 4.4: Comparison between old NCS (Grade 10-12) and CAPS coverage of environmental impact topics

Subjects Analysed	Source	Time	Date	Data required
Life Sciences Geography Agriculture Economics	DBE (2012)	T1 (old NCS (Grade 10-12)) T2 (CAPS)	2006 to 2015 (Decade of Education for Sustainable Development)	Exam year. Marks allocated for environmental impact topics out of 300 (Paper 1 and Paper 2) Percentage coverage of environmental impact topics. Average (old NCS (Grade 10-12) vs. CAPS)

4.6.2.3 Grade 12 Textbooks

Table 4.5 below shows some of the textbooks used by teachers in teaching environmental impact topics. Three subjects that were purposefully chosen for further analyses were Life Sciences, Geography and Economics.

Table 4.5 Textbook analyses

Subject Analysed	Name of the book	Publisher	Data required
Life Sciences	FOCUS Learner's Book	Longman in 2013	Total number of book pages, Number of pages with selected environmental impact topics, Number of assessment activities with environmental impact topics and Percentage of pages with environmental impact topics.
Geography	FOCUS Learners' Book	Longman in 2013	
Economics	FOCUS Learners' Book	Maskew Miller Longman in 2012	

4.6.2.4 Diagnostic report

The Table 4.6 below shows the aspects analysed in the diagnostic report. The content that was analysed in the diagnostic report from the DBE was learners' performance in environmental impact topics during October/November Grade 12 final examinations.

Table 4.6: Diagnostic report analyses

Subject Analysed	Source	Data required
Life Sciences, Geography, Agricultural Sciences and Economics.	DBE (2012)	Learner's performance in environmental impact topics during October/November Grade 12 final examinations.

4.7 DATA COLLECTION METHODS

Data was sourced from interviews and documents, which are described in the section below.

4.7.1 Interviews

Creswell (2010) points out that interviews are a useful tool when participants cannot be directly observed and that participants can provide more information during interviews, such as historical information. Furthermore, conversation modes present an opportunity for two-way interaction, where the participants can even pose questions to the researcher. Another advantage of interviews is that it allows researcher control over the line of questioning.

According to Yin (2011), in qualitative interviews a researcher can either interview a group of participants (focus group) or individuals. Qualitative interviews are distinct from other interviews because they aim at obtaining understanding from participants about their own life experiences. Yin (2011) further suggests that qualitative interviews may be longer than structured interviews and may involve a series of interviews with the same participant. In addition, qualitative interviews offer the opportunity for the researcher to understand a participant's world, which includes efforts to grasp the meanings of the participant's words and phrases. In describing their views, participants vocalise their own priorities as part of their own way of describing the world as they see it. In this research, participants were interviewed as their views were important in answering the research questions. For this study, semi-structured, face-to-face interviews were conducted with teachers. Participants were invited to take part in the interviews after school hours. Yin (2011) mentions that the relationship between the researcher and the participant is not strictly scripted in semi-structured interviews, but the researcher uses a set of questions as an interview guide (Appendix H) during the interview. This helps to keep the interview focused on the topic but still allows for further probing questions by which the researcher can elicit further information from the participant.

Darlington and Scott (2002) note that in-depth interviewing is one of the most commonly used data collection strategies in qualitative research. They emphasise that the concern of a qualitative researcher is to understand the meaning participants

derive from their experiences from their own perspective. Teachers in this study were experts in their subject disciplines and they were able to fully describe how they experience a particular phenomenon in their schools. Darlington and Scott (2002) present some of the advantages that led to the choice of interviewing as a data collection strategy in this study. One advantage is that face-to-face interaction with the participants allows them to fully explain their views on a particular question. This allows exploration of meaning of the questions and answers involved. In-depth interviews are also useful in this study because it would have been difficult to obtain data through observation due to time constraints and due to the fact that the time in which particular topics are taught is stipulated by the curriculum.

Interviews, like any other type of data collection, have limitations. Creswell (2010) mentions that some of the limitations of interviews are that of 1) providing indirect information filtered through the views of the interviewees, 2) provision of information in a designated place rather than the natural field setting, 3) researcher's presence may bias responses and, 4) participants may not be equally articulate and insightful. One of the disadvantages of interviewing is that it allows access to what participants say but not to what they practice.

4.7.1.1 Interview process

The in-depth interview process in this study involved more than the mere interviewing of participants. I also created rapport by listening, treating participants fairly, and respecting the limits of what they wanted to say. This created a connection with the participants which ensured that the exploration of the issues under discussion was not compromised. Initial contacts with the participants were made telephonically to ascertain their availability for the study as well as to present the study aims and clarify their role in the study. During the interviews, participants were allowed to direct the flow of the conversations in conjunction with the purpose of the study. An interview guide was used which showed a list of questions to be covered in the study. Questions which seemed to be challenging to participants were clarified during the actual interviews. Audio recording was used so that the interviewer and interviewee could concentrate on the questions without being distracted. Interviews in this study were recorded as my field notes in a notebook and as voice-recordings with permission granted by the participants.

4.7.2 Documents

I collected documented data in the form of public documents emanating from the Department of Basic Education (DBE) such as the Further Education and Training (FET) Curriculum Assessment Policy Statement (CAPS) documents for each subject, textbooks and past examination question papers for Grade 12. Yin (2011) indicates that document analysis involves collecting and examining objects. He states that data collected from documents can produce a variety of verbal, numeric, graphic and pictorial data forms. According to Yin (2011), data from documents can yield invaluable information about things that are not directly observable (policies, textbooks and past examination question papers). Documents are objects which provide secondary evidence but they are important in qualitative research in that the information they yield may support the primary evidence. Yin (2011) also reveals that collecting data from documents is time-consuming and special attention should be given to selecting specific aspects that will be needed in research analysis. In support of the above statement, Yin (2011) mentions tactics that are necessary to ensure that appropriate data is collected. These tactics are: first, get an idea of the full array of any type of object to be collected, such as the scope of available documents, size of documents, range of years and whether you need to collect the entire array or a sample; second, after some preliminary collecting, review the data and imagine how the collected material is likely to fit the rest of the study. This tactic can be repeated several times to ensure reliability of the information collected.

Yin (2011) highlights that documents can complement field interviews and conversations. These documents can be reviewed before the interviews take place to solicit content knowledge about the issues to be discussed in the interviews. Documents are also important in research as the inquirer can know ahead of time about the availability of various documents that can be used in the research. Yin (2011) outlines that documents can reduce the problems and challenges of reflexivity, where they cannot be influenced by the researcher as is the case in qualitative interviews.

According to Bowen (2009), in recent years, there has been an increase in the number of research reports that mention document analysis as part of their methodology. Although the increase is needed in research, Bowen (2009) points out that there is an absence of sufficient details of the procedure followed when conducting document

analysis and the outcome of the analyses of documents. Bowen (2009) defines document analysis as a systematic procedure for reviewing or evaluating both printed and electronic documents. Bowen (2009) mentions that documents contain text and images that have been recorded without the researcher's intervention. In this study, electronic documents sourced from the DBE were printed to ensure that they were available as hard copies.

The value of document analysis is that it can often be used as a means of triangulation, where a researcher can draw upon multiple sources of evidence when seeking convergence and corroboration. This can be achieved by using different sources of data or different methods (Bowen, 2009). This is done to ensure that the study is credible.

Bowen (2009) identifies five uses of documents which form part of the methodology of this thesis. These are:

- Documents can provide data on the context within which research participants operate. In this case, a context is provided on what the researcher is going to guide the interviews with participants. Documents provide background information as well as insight that helps the researcher to understand issues.
- Vital information contained in the documents can assist the researcher to develop questionnaires for interviews.
- Documents provide supplementary research data. Information deduced from documents can be important in knowledge accumulation.
- Documents can be used to track change and development.
- Documents can be analysed to verify findings or corroborate evidence from other sources.

4.7.2.1 Advantages and limitations of document analysis

Bowen (2009) lists the following advantages of document analysis:

- It is an efficient method because they require less time for analysis as it requires data selection instead of data collection.
- Many documents are available in the public domain and can be accessed without the permission of the author as they are readily available online.

- Document analysis is cost effective because data contained in the document has already been gathered and what remains is the content and quality of the document to be evaluated.
- Documents lack obtrusiveness and reactivity, and they are unaffected by the research process.
- They provide stability, exactness and coverage of long spans of time, many events and many settings.

Despite these advantages, documents analysis has the following limitations:

- Some documents are produced for a specific purpose and they cannot be generalised in a research setting because of insufficient detail.
- Documents may have a low retrievability, as access to some documents can require passwords or they may be blocked by the author for financial benefits.
- They become biased when collected not on merit but on the grounds of satisfying the intended audience.

Bowen (2009), however, states that the advantages of documents analysis outweigh the limitations mainly because of efficiency and cost-effectiveness.

4.8 DATA ANALYSIS AND INTERPRETATION

This section discusses data analysis and the interpretation of documents and interviews carried out in this study.

4.8.1 Procedure in Analysing and Interpreting the Documents in this Study

Document analysis involves skimming, reading and the interpretation of the documents (Bowen, 2009). Content analysis in this study involved the identification of meaningful and relevant information of environmental impact topics. I identified important information and separated it from that which was not pertinent (See Figure 4.3) using three stages of data collection, pre-processing and content analysis. In this study, I drew upon Loubser (2016) and the SADC (2012) Environmental Outlook report for the identification of specific environmental impact topics that formed the basis for content analysis. The coverage of environmental impact topics included the following: ozone depletion, global warming, energy consumption, acid rain, air pollution, marine

pollution, mineral resource depletion, soil destruction, soil erosion, desertification, biodiversity loss, extinction of plants and animals, nuclear reactors and waste disposal, human health and diseases, world hunger, land use, solid waste disposal, hazardous chemicals, habitat destruction, invasive species, water quality and wildlife management. When evaluating documents, it is necessary to establish the meaning of the document and its contribution to the issues being explored (Bowen, 2009). In addition, the researcher determines the relevance of documents to the research problem and purpose. The documents selected for analysis in this research were authentic, credible and contained accurate data. The documents provided coverage of the research topic broadly. Bowen (2009) explains that document analysis is a process of evaluating documents in such a way that empirical knowledge is produced and understanding is developed. Moreover, the researcher should strive for objectivity and responsiveness.

The document analysis was guided by the constant comparative method of Glaser & Strauss (1967), which is described in four stages, namely: comparing incidents applicable to each category; integrating categories and their properties; delimiting theory; and writing theory. This method involves a back-and-forth interplay with data to cluster ideas and concepts for authentic understanding and analysis of the documents. Documents were downloaded and kept in an internal and external hard drive to ensure that data was protected against the risk of being lost. Backup copies were kept on an external hard drive to prevent loss if the internal hard drive were to be attacked by viruses.

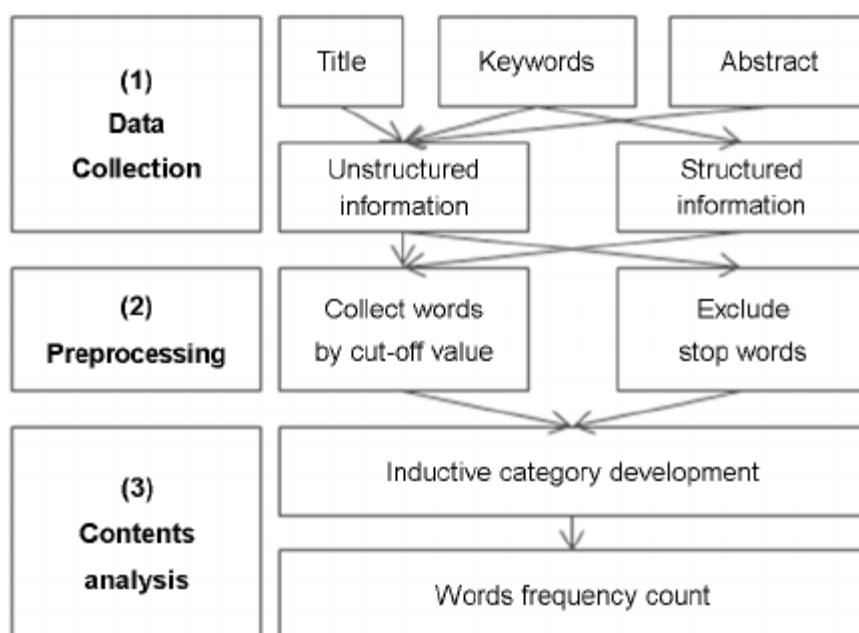


Figure 4.3: Procedure of document analysis

Source: Adopted from Rhie, Lim & Yun (2014)

4.8.1.1 Procedure of analysis and interpretation of textbooks and past examination papers

McMillan and Schumacher (2010) note that documents can be comprised of personal documents, official documents and objects. They emphasise that document collection is a non-interactive strategy for obtaining qualitative data with no reciprocity between the researcher and the participants who were involved in the research undertaken in compiling the documents. In this study, official documents such as DBE subject policies and past examination question papers were analysed and interpreted. McMillan and Schumacher (2010) mention five strategies used in analysing and interpretation of documents which were used in this thesis. These strategies are:

- Location of documents begins with entering the field and continues for the duration of the study. At this stage, the researcher anticipates the artefacts and proceeds to locate and obtain documents. In this study, documents were located on the DBE website from which past examination question papers and policies were retrieved. Textbooks used on a daily basis in the classroom were sourced from the participants.

- Identification of documents requires placing the artefact in retrievable form and cataloguing it for access. Documents can be photocopied or downloaded from the internet and coded for easier access when needed. In this study, documents were downloaded and saved in a file for subsequent analysis.
- Analysing documents involves descriptions of important aspects that could provide possible solutions to the research problems and questions. In this study, an inductive analysis was used where data were organised into codes and categories were identified. This was a process where I synthesised and made meaning from the data presented. McMillan and Schumacher (2010) further describe inductive analysis as a systematic process of coding, categorising and interpreting data to provide explanations of a single phenomenon of interest.
- Criticism of documents entails the determination of their authenticity and accuracy to identify meaning of the artefact in the social setting.
- Interpretation of meaning should be corroborated with interview data. The meaning of documents depends on the social context and other data. Document data in this study were corroborated with data from face-to-face interviews in a process of achieving triangulation.

4.8.1.2 Procedure for subject policy analysis and interpretation

McMillan and Schumacher (2010:438) explain that policy analysis evaluates government policies to provide policy makers with pragmatic, action-oriented recommendations. They further mention that policy analysis explores what is intended to be accomplished by government action as well as the cumulative effort of the actions, assumptions, and decisions of people who implement public policy. In addition, McMillan and Schumacher (2010) reveal that policy analysis can focus on 1) policy formulation; 2) implementation of programmes to carry out policies; 3) policy revision and 4) evaluation of policy effectiveness and efficiency. In this study, the researcher focused on the last aspect, which is evaluation of policy effectiveness and efficiency. The evaluation was based on the coverage of environmental impact topics in the CAPS documents, and in the relevant textbooks and examinations. Policy analysis in this study is based on a micro approach, which McMillan and Schumacher (2010) clarify as analysis that is field-based to get facts which support the qualitative approach adopted.

Bowen (2009) reveals that analysing documents involves selecting, appraising and synthesising data contained in the documents. Focused synthesis is the method of policy analysis that is used in this study. McMillan and Schumacher (2010) describe focused analysis as a selective review of written materials and prior research relevant to the policy in question. In this study, CAPS policy documents, textbooks and past examinations were reviewed to determine the extent of the coverage of environmental impact topics. McMillan and Schumacher (2010:440) state several potential benefits of policy evaluation, namely: 1) it allows planning and implementing school improvements on a systematic basis; 2) it tests several popular myths about the effects of education on student development; 3) it demonstrates professional responsibility by appraising the quality of educational programmes; and 4) it reduces uncertainty about educational practices when experience is limited and enlightens influential persons responsible for decisions and policy-making to enable them to better anticipate programme and policy issues.

In contrast to the benefits, McMillan and Schumacher (2010) identify only two possible limitations of policy evaluation, namely: i) the failure of many studies to improve educational practices and educational policy formulation and ii) the lack of appreciation from policy makers because research is only one of many influences on educational policies, practices and decisions. In this instance, policy analysis may not alleviate problems, but it can identify strengths and weaknesses, highlight accomplishments, expose faulty areas and focus on realistic policy alternatives.

4.8.1.3 Analytical research approach for documents

The study employed an analytical research design. According to McMillan and Schumacher (2010), analytical research design involves analysis of documents. McMillan and Schumacher (2010) state that in an analytical study, the researcher investigates concepts and events through an analysis of documents. In this study I analysed documents which included the CAPS documents, textbooks and past examination question papers. This study adopted McMillan and Schumacher's (2010) assertion that in analytical research, the researcher identifies, studies, and then synthesises the data to provide an understanding of a concept or past event that may or may not be observable. Therefore, authenticated documents were a major source of data (McMillan & Schumacher, 2010:24). In analytical research, the researcher

interprets facts to provide explanations of the past and clarifies the educational meanings that may be underlying current practices and issues. McMillan and Schumacher (2010) give the following examples of analytical research, which are concept analysis, historical analysis and policy analysis. This study used historical analysis where past examination papers were systematically collected and criticised in their coverage of environmental impact topics. In addition, this study also analysed policy documents and textbooks to determine the extent to which environmental impact topics were included in the curriculum. This study examined whether the CAPS policy documents principles were followed when examinations were set for the final exit school level examinations in Grade 12.

When conducting document analysis in this study, I coded, labelled and made sense of perceptions from the raw data that were collected from documents and interviews. Ely, Vinz, Downing and Anzul (2005) emphasise that when we analyse, we often stop the flow of linear and sequential presentation of data and concentrate on lifting an element out from the whole to inspect it more closely. Qualitative research analysis involves discerning the smallest elements into which something can be reduced and still retain meaning if lifted out of their immediate context and then discovering the relationships between those elements (Ely et al., 2005). On the same note, Given (2008) mentions that coding categories can range conceptually from concrete to abstract and reflect themes and patterns found within and across domains. Continuous comparisons as analytical codes emerge should produce a final set of codes that can be applied to the entire data set. In this study, the smallest elements were data that was collected through documents and in-depth interviews with the teachers. The elements in this study constituted what I deemed necessary and could make sense of out of the content being analysed.

4.8.2 Procedure in Analysing and Interpreting Interview Data

Data transcription in this study was followed by data coding and the procedure for analysis of interview data discussed below.

4.8.2.1 Data transcription

McMillan and Schumacher (2010) define transcription as the process of taking notes and other information and converting them into a format that will facilitate analysis. In

this study, data was captured as field notes and audio-recordings in the field. Yin (2011) mentions that successful recordings will help to increase the precision of the fieldwork. He believes that it is important to decide what to record and capture in the interview process. The initial notes taken in the interviews need to be refined and reviewed on a continuous basis. It is significant to record what is important and needed without disrupting the participants in the interviews. Apart from interviews, the study summarised data from documents where it was important to capture the exact words and phrases in the written material (Yin, 2011).

4.8.2.2 Data Coding

Qualitative coding is the process of generating ideas and concepts from raw data such as interview transcripts, field notes, reports and archival materials (Given, 2008). According to Given (2008), the coding process is defined as steps the researcher takes to identify, arrange and systematise the ideas, concepts and categories uncovered in the data. This process consists of identifying potential interesting events, features, phrases, behaviours, or stages of a process and distinguishing them with labels (See Figure 4.4). Given (2008) further mentions that these events can be differentiated or integrated so that they may be reworked into a smaller number of categories, relations and patterns so as to tell a story or communicate conclusions drawn from the data. Coding involves actual practice of data analysis where the researcher reads and rereads a portion of elementary data and provides labels that identify the meaning of a particular unit (Creswell, 2009; Ely et al., 2005; Given, 2008). The coded data in this study was arranged according to similarities to form categories. These categories led to the derivation of relationships, patterns and themes (Creswell, 2009; Ely et al., 2005; Given, 2008). It was important in this study that coding laid the groundwork for analysis and interpretation to address the research questions of this study stated in Chapter 1.

4.8.2.3 Procedure for analysis of interview data

According to Creswell (2009), qualitative data analysis is characterised by interactive practices where various stages are interrelated. These stages adopted from Creswell (2009) for data analysis are used in this thesis and involved the following steps:

Step 1: Organise and prepare the data for analysis. This involves transcribing interviews, typing field notes and arranging the data into different types depending on the sources of information provided. In this study, data has been organised based on the two sources used in collecting data, which were documents and interviews.

Step 2: Reading through all of the data. Creswell (2009) mentions that the second step is to obtain a general sense of the information and reflect on its overall meaning. In this study, general ideas of participants were recorded and the overall depth, credibility and use of information were outlined. At this stage of the study, general notes were written to find out about general thoughts of the data.

Step 3: Detailed analysis of the coding process is done at this stage. Data in this study is organised into segments. The coding process employed involved getting a sense of the whole; clustering of a list of topics; abbreviating the topics as codes; finding the most descriptive wording for the topics to form categories; assembling the data belonging to each category in one place; and starting a preliminary analysis.

Step 4: Use of the coding process to generate a description of the setting, people, and categories. According to Creswell (2009) and Given (2008), description involves a detailed rendering of information about people, places, or events in a setting.

Step 5: This stage involves writing up a qualitative narrative. According to Creswell (2009), qualitative narrative is a description of events and categories to convey the findings of the analysis. In the description, it might involve a detailed discussion of several categories that can present each participants' information in a table. In this study, each participants' response was categorised in table form.

Step 6: Creswell (2009) also mentions that the final step in data analysis involves making an interpretation or meaning of the data. In this step, an understanding of the inquirer brings to the study his own culture, history and experiences. This step will determine whether the findings confirm past information or diverge from it.

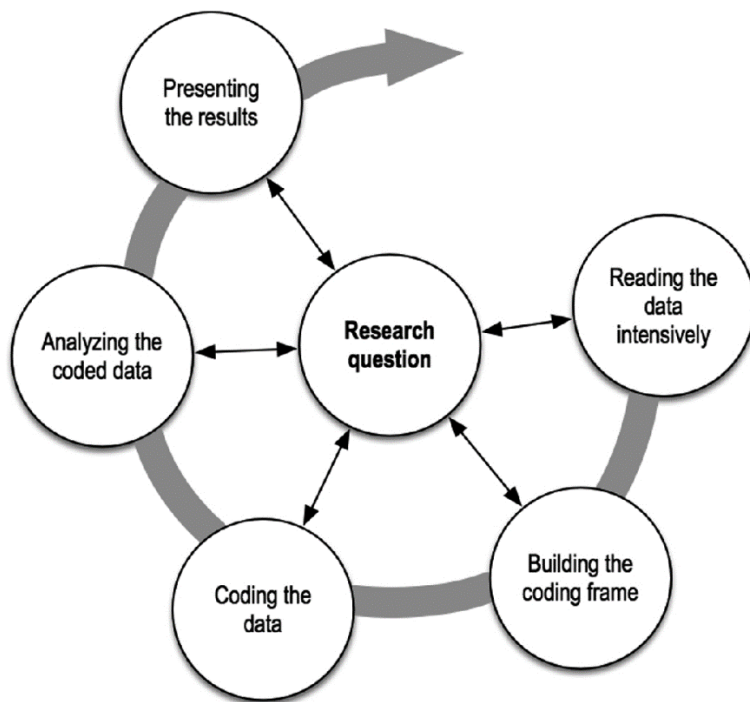


Figure 4.4: Qualitative content analysis.

Source: Adapted from Kuckartz (2019)

4.9 THE RESEARCH PROCESS

Data has been collected in phases which are outlined below.

4.9.1 Phases of Data Collection

In this study, I followed McMillan and Schumacher's (2010) data collection strategy, namely: planning, beginning data collection, basic data collection, closing data collection and completion. These strategies adopted from McMillan and Schumacher (2010:329) are discussed below.

Phase 1: Planning. The initial data collection phase started with analysing the problem and defining the research questions to determine what research methods would be used. This phase is when the researcher gains permission and locates the participants. In the analysis of environmental education teaching in classrooms, participants were located in the schools in Mpumalanga. The participants were teachers who were trained under the Fundisa for Change programme on the Teaching Biodiversity module. Participants were telephonically asked to participate in the study.

After the requests for interviewing were made, participants were requested to read and sign consent forms and return the forms to me as the researcher.

Phase 2: Beginning data collection. This involves the initial data collection from both documents and interviews. This phase established rapport with the participants. First, I searched the internet for relevant documents to be analysed. These documents included policies, textbooks and past examination question papers for Grade 12 exit level. At this stage, a pilot study of the interview guide was conducted. The pilot study assisted me in correcting some discrepancies with the line of questioning of participants. Thereafter, the sampled participants were informed of the actual dates of data collection as well as confirmation of the location where the interviews would be held. All of the arrangements were conducted telephonically. Some participants preferred to be interviewed in their schools while some preferred to be interviewed at a nearby convenient locations such as a local library.

Phase 3: Basic data collection. This phase involved actual data collection, which also marked the beginning of data analysis. I collected document data, keeping in mind a tentative idea of the data that were needed. Document analysis was a continuous activity until the final compilation stage of data, which was transcription. In this study, documents were collected from the DBE website and comprised of four sources, which were the CAPS policy documents for subjects taught in Grade 12, textbook data, the diagnostic report for 2015 and past examination question papers from the period between 2012 and 2016. This period was chosen because it was characterised by the implementation of the new curriculum for South Africa, which started in 2012, namely the Curriculum Assessment Policy Statement (CAPS).

During the interviews, I listened, recorded and wrote down participant responses. Initial descriptions were summarised and identified for later corroboration of facts and views of participants. I also noted similarities and differences of views among participants. At this stage, participants were afforded the opportunity to elaborate on their thoughts about all the questions that had been posed.

Phase 4: Closing data collection. As mentioned above, document data collection was continuous. However, the interviewing phase ceased at the time when the transcripts were compiled. During the analysis stage, some participants were telephonically asked to expand on some questions that I deemed important for the completion of

reliable transcripts. Data collection was completed by identifying possible interpretations and verifying emergent findings from the interviews and documents.

Phase 5: Completion. Completion of data collection was marked by beginning of formal data analysis and construction of meaningful ways to present the data. At this stage, I listened to recorded interviews to gather more information about the perspectives that were discussed. Field notes were also reviewed. At this stage, possible categories from the interviews were identified. The data collection period through face-to-face interviews was planned for 15 days from the 1st of March 2017 to the 15th of March 2017. Document data collection and analysis was a continuous task and it continued until transcription was completed. Once the data had been collected, data analysis and data interpretation followed.

4.9.2 Data Collection and Analysis Time Schedule

Table 4.7: Schedule for data collection and interpretation

Type of data and analysis	Research activities	Duration
Documents	Download policies, past examination question papers from DBE (Website) and acquiring textbooks used by the teachers under investigation.	JAN – MARCH 2017
Pilot study	Using the semi-structured questionnaire for interviews for conducting pilot study with two teachers.	MARCH 2017
Conducting interviews	Conducting face-to-face interviews with six teachers (Mpumalanga)	MARCH-APRIL 2017
Analysis and interpretation	Documents and interviews analysis	APRIL-JULY 2018

4.10 RIGOUR OF THE STUDY

I made efforts to ensure that data collected, analysed and interpreted in this study was protected against bias. The raw data from interviews was collected in a relatively

unstructured form such as audio-recordings and transcripts of conversations. To ensure that the findings represented the true reflection of the data collected, the following strategies were employed: triangulation, validity and reliability, the pilot study and credibility which are discussed below.

4.10.1 Triangulation

Triangulation in data collection enhances the validity of this study as sources of information emanated from teachers as well as documents. To enhance triangulation, different sources of data were used to build a coherent justification for categories. The categories were based on converging several sources of data from participants (Creswell, 2009; Yin, 2011). Yin (2011) points out that triangulation in research pertains to ways of verifying or corroborating a particular event, description or a fact reported by the study. He further mentions that triangulation in research can involve different data collection methods to ensure the validity of a study. For example, a researcher can gain information from verbal reports (interviews) and written documents. This study used both interviews and relevant documents to analyse the coverage of environmental impact topics in the curriculum. According to Yin (2011), triangulation is important in all forms of empirical research and is used to strengthen the validity of a study in the instance where data from two or more sources converge to the same finding. This converging evidence was aimed at determining if the continuous changes in the curriculum had an effect on teaching and coverage of environmental impact topics in the curriculum.

4.10.2 Trustworthiness (validity and reliability) and credibility

Yin (2011) posits that validity in a study is important as it ensures that the study properly collects and interprets data so that the findings accurately reflect and represent the real world that is studied. In addition, McMillan and Schumacher (2010) emphasise that validity in qualitative research refers to the degree of congruence between the explanation of the phenomenon and the realities of the world. McMillan and Schumacher (2010) believe that validity is ensured when interpretations have mutual meaning between the researcher and the participants. Creswell (2009) also contends that qualitative validity means that the researcher checks for the accuracy of the findings by employing certain procedures. This was the epitome of this study as it collected qualitative data that represented the real world that was studied.

Validity in this study was ensured in that interviews covered detailed and varied data and the respondents were afforded an opportunity to check the transcripts of their interviews to clarify any misinterpretations. Creswell (2009) suggests that researchers need to ensure that qualitative reliability procedures are incorporated in a study. These procedures include checking of the transcripts to make sure that they do not contain obvious mistakes made during transcription as well as ensuring the definition of codes which resemble the meaning during the process of coding.

For trustworthiness and credibility this study obtained data from different sources to ensure that findings were in line with the purpose and aim of the study. Six teachers were interviewed to explore their perspectives on the integration of environmental education, particularly environmental impact issues, in the curriculum after being trained on a programme. Follow up interviews were done to solicit additional important points that needed clarity from the participants. This research ensured that it was trustworthy because it did not focus only on participants but also focused on documents such as official subject policies, textbooks and past examination papers. Using the RST as a theoretical framework ensured that the results obtained were objective and credible. Member checks were done to ensure that participants agreed with the information transcribed from the interviews.

4.10.3 Pilot study

Two teachers participated in the pilot study. A pilot study assists the researcher to test and refine some aspects such as design, data collection instruments, and analysis plans (Yin, 2011). I conducted a pilot study that provided me with an opportunity to assess how the questionnaire guide addressed the aims and research questions of the study. The information in the pilot study assisted me in learning about the field, time needed to cover the whole interview process and was used to redefine questions in the question guide to suit the aim of the study, which was whether the teaching of environmental impact topics was affected by the shifts in the curriculum and extent of content coverage in the examinations in FET phase. According to Yin (2011), the participants in the pilot study should know that they are participating in a pilot study. Therefore, in this study of the coverage of environmental impact topics in the curriculum information was provided to participants about their role in ensuring that appropriate, reliable and valid data would be collected during the research.

4.11 ETHICAL MEASURES

Darlington and Scott (2002) point out that ethical principles guiding research should be based on beneficence and duty of care. The ethical measures are clear and congruent, and the roles of the researcher and the participants are well defined in this study. This study adopted the American Educational Research Association code of ethics which are tabled by Yin (2011:40). This code of ethics stipulates that the researcher should be professional and responsible by not fabricating or falsifying data and disclosing limitations when presenting report findings. Ethical clearance was sought and obtained from the University of South Africa (College of Education's Ethics Committee), from the Department of Basic Education (Mpumalanga Province), and I also sought consent from the participating schools and teachers.

4.11.1 Attrition

The participants were allowed to withdraw from the study if they felt uncomfortable continuing. McMillan and Schumacher (2010) mention that attrition happens in research when participants drop out or are lost in the study. In this study, all participants were informed about their right to withdraw without giving notice or suffering any consequences. In this study, twelve participants were sampled for this study and only six were interviewed. The other six participants either withdrew or could not be available to take part in the study.

4.11.2 Full Disclosure

I disclosed all of the relevant information to participants through informed consent letters. The aim of the study was fully outlined to the participants. Participants were also informed about how the study would be beneficial to teaching environmental impact topics in the CAPS curriculum. Consent letters also indicated how the participants were selected for the study and indicated the extent of participation required. Potential risks associated with participation were fully disclosed to teachers and confidentiality was guaranteed in the consent letters. The participants were advised that they would be given access to the general research findings either printed or electronically after the thesis had been accepted by the university. Letters of appreciation were sent to the participants for their role played in the interviews.

4.11.3 Voluntary Participation

Participation was not obligatory. The consent letters given to the participants emphasised that their involvement in this study was completely voluntary. As participation in the study was not mandatory, even after agreeing to take part in the study, teachers could pull out if they were not willing to proceed with the interview process. Six teachers pulled out from the study and only six were interviewed as mentioned in section 4.12.1 above.

4.11.4 Informed Consent

According to Darlington and Scott (2002), the capacity of an individual to freely give their informed consent to research is a core principle in research ethics while incentives can diminish the capacity to participate. They further mention that research subjects have a right to be informed of any limitations on the confidentiality of what they may divulge to the researcher. In this study, participants were informed about all limitations of the research and that no incentives would be given to them for participating in the study. The informed consent also stipulated that participants' data would be anonymous and data presentation would be accurate without having distortions.

4.11.5 Risks to Participants and Intrusiveness

Qualitative research methods such as open-ended interviews can be highly intrusive. It was ensured that highly personal matters such as those relating to loss of family members due to environmental issues and trauma did not form part of the interview guide. This research did not pose any threat to participants. Data was collected from participants in their preferred setting which was either at a school or at a place convenient for the teacher.

4.11.6 Privacy

Confidentiality was maintained in the way that data collection and storage systems ensured that it was not possible to identify the participants. Codes and pseudonyms were used in the analysis and interpretation of the data gathered. Access to participants' data was not possible as they were stored in an encrypted file in password-protected internal and external storage devices. This study emphasises

McMillan and Schumacher's (2010) assertion that a researcher should be responsible to ensure that confidentiality, anonymity and proper storage of collected data is a priority in research.

4.12 CHAPTER SUMMARY

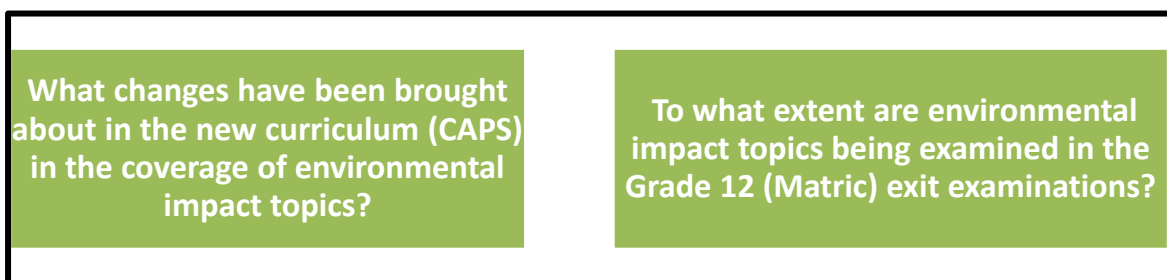
This chapter focused on the research methodology where the research design and research methods were explained. The qualitative approach, case study, analytical research design and critical realism paradigm was explained. The paradigm dictated the data collection methods and the approach to analysis and interpretation. Data sources in the form of interviews and documents were collected without any need to deviate from the initial design of this study. Chapter 5 discusses the findings of the research which focuses on the interpretation and analysis of the data derived from documents.

CHAPTER 5

RESULTS ON ANALYSIS OF DOCUMENTS

5.1 INTRODUCTION

The focus of this chapter is to address the main research question that focuses on how the shift in the curriculum has affected coverage, teaching and examination of environmental impact topics in South Africa's Further Education and Training (FET) phase. This main question is supported by two of the four sub-questions relevant to this section, which are:



The results in this Chapter are organised based on the research sub-questions. The structure of this Chapter outline is shown in the schematic diagram Figure 5.1 below.

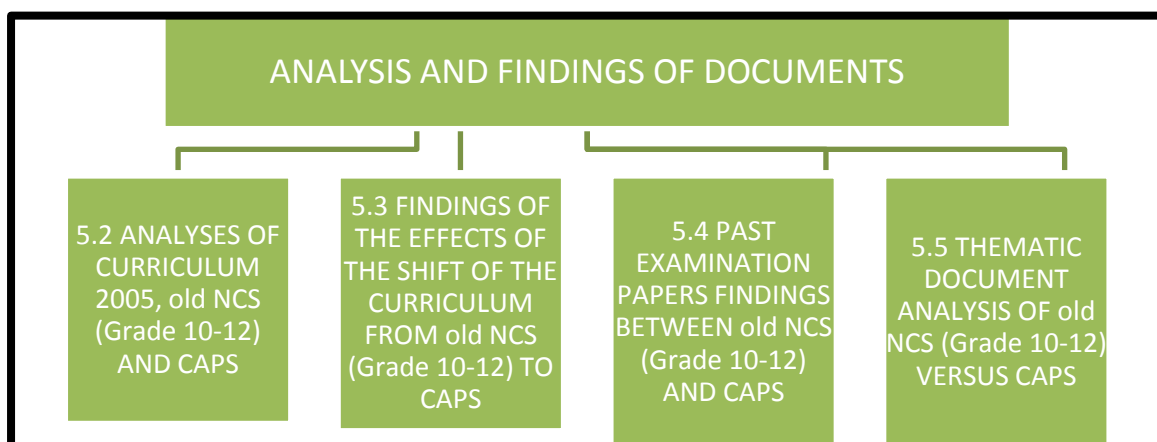


Figure 5.1: Chapter outline

The following section generally discusses environmental impact topics' coverage in Curriculum 2005. The focus of this study is not on Curriculum 2005 but on the shifts of the curriculum between old NCS (Grade 10-12) and CAPS.

5.2 ANALYSES OF CURRICULUM 2005, NCS (GRADE 10-12) AND CAPS

This section provides analyses and results of the coverage of environmental impact topics in Curriculum 2005, NCS (Grade 10-12) and CAPS. However, it should be noted that the main focus of this study is on the shift between NCS (Grade 10-12) and CAPS.

5.2.1 Analysis of Curriculum 2005

The Department of Education (DoE, 2004) explained that the South African government inherited a divided and unequal system of education from the apartheid era. This education system prepared learners to occupy different positions in apartheid society based on their racial, social, economic and political background. Prior to democracy in South Africa, the education system encouraged inequality amongst the population because learners were taught according to the racial stereotyped roles they were supposed to play in the society. Curriculum changes in South Africa started immediately after the 1994 elections. In 1996 the first major curriculum statement was Lifelong Learning through a National Curriculum Framework document (DoE, 2004). This statement was informed by the principles derived from the White Paper on Education and Training (1995), the South African Qualification Act (No 58 of 1995) and the National Education Policy Act (No 27 of 1996). According to the DoE (2004), the White Paper emphasises the need for major changes in education and training in South Africa to improve teaching and learning. The White paper further encourages a shift from the traditional aims and objectives approach to outcomes-based education (OBE).

The National Education Policy Act (No 27 of 1996) provided a platform for the development of curriculum design tools to support an outcomes-based approach. These tools were:

- Critical Cross-Field Outcomes;
- Specific Outcomes;
- Range Statements;

- Assessment Criteria;
- Performance Indicators;
- Notional Time and Flexitime;
- Continuous Assessment, Recording and Reporting;
- Phase organisers;
- Programme Organisers;
- Expected Level of Performance; and
- Learning Programmes

The first version of the new curriculum for the General Education Band, known as Curriculum 2005, was introduced to the Foundation Phase in 1997 (DoE, 2003). While there was much to commend about the curriculum, the concerns of teachers led to a review of the Curriculum in 1999 (DoE, 2003). According to the Mail and Guardian (2008) the concerns with Curriculum 2005 were:

- Teachers could not understand Curriculum 2005
- Teachers complained about increased administration work to be done
- Learners from Grade 1 to Grade 5 struggle in reading, writing and in mathematics
- It was difficult to implement the curriculum because it coincided with provinces' implementation of new policies and regulations
- Overcrowding of classes was not ideal for Curriculum 2005 experiential learning approach.

The review of Curriculum 2005 provided the basis for the development of the National Curriculum Statement for General Education and Training (Grades R-9) and the National Curriculum Statement for Grades 10-12.

5.2.1.1 Coverage of Environmental Impact Topics in Curriculum 2005

As mentioned in the curriculum design tools to support implementation of Curriculum 2005, Phase organisers were the tools where outcomes were grouped for planning purposes (Motshegoa, 2006). Environmental learning was now identified in every learning area in the new Curriculum 2005. Motshegoa (2006) posited that Curriculum 2005 had other Phase Organisers which embedded environmental learning in their teaching and learning, which were namely Society, Entrepreneurship, Personal

Development, and Health and Safety. It is important to note that environmental learning as a Phase Organiser became a tool to explore EE issues in the curriculum. This signified a change from the old education system where environmental issues were covered in a specific subject called Environmental Studies. It can be noted that the relationship between human rights, a healthy environment and social justice is addressed in all learning area statements. Environmental impact topics were embedded in learning areas such as Physical Sciences, Life Orientation, Mathematics, Biology, English and Geography. Each learning area contributed to the curriculum in that it provided a way of communicating information and promoted many of the goals of science, technology and EE. Careful choice of themes by teachers was anticipated to stimulate interest in learners of the selected themes and topics that link with the Critical and Developmental Outcomes. For example, learners need to engage with important human rights and environmental issues such as poverty, HIV/AIDS, the right to land and consumerism.

As mentioned in the section above the focus of this study is on the shift between NCS (Grade 10-12) and CAPS. However, Curriculum 2005 provided the foundation for the inclusion of environmental impact topics in the subsequent curricula. The following section provides analysis and results in the old NCS (Grade 10-12).

5.2.2 Analysis of the National Curriculum Statement (NCS) (Grade 10-12)

Curriculum 2005 was reviewed into the Revised National Curriculum Statement (RNCS) Grades R-9 in 2000 and National Curriculum Statement Grades 10-12 in 2002 (DBE, 2016). Persistent implementation challenges resulted in a review in 2009. The focus of the review meant that EE approaches in schools changed, where environmental learning was prioritised across the entire curriculum spectrum and not only in one subject. The two National Curriculum Statements were later combined in 2012 to a single policy document known as the National Curriculum Statement Grades R-12 (DBE, 2016).

Table 5.1: Major similarities and differences between Curriculum 2005 and old NCS (Grade 10-12)

CURRICULUM 2005	old NCS (Grade 10-12)
Critical outcomes	Critical outcomes
Specific outcomes	Learning area statements
Assessment criteria	Dropped
Range Statements	Dropped
Performance Indicators	Dropped
Expected levels of performance	Learning outcomes with accompanying assessment standards
Phase Organisers	Dropped
Programme Organisers	Dropped

Source: Adapted from: Chisholm et al. (2000)

As seen in Table 5.1 above, changes from Curriculum 2005 resulted in assessment criteria, range statements, performance indicators, phase organisers and programme organisers being dropped in the new NCS (Grade 10-12). Specific outcomes became learning area statements, expected levels of performance became learning outcomes and critical outcomes were not changed. The shift to old NCS (Grade 10-12) resulted in two documents as mentioned earlier, which were Grade R-9 (RNCS) in 2000 and Grade 10-12 (NCS) in 2002. It should be noted that Curriculum 2005 was not able to reach its target of being fully implemented by 2005. Curriculum 2005 failed because teachers' time, energies and attention shifted and there was not enough focus on new instructional practices. Large classes and the instability and uncertainty caused by redeployment also played a role in undermining curriculum reform. The shortages of classrooms, resources and teaching materials also affected the implementation of Curriculum 2005. The new curriculum required more experiential approaches to learning, which were impossible to implement in overcrowded classes. The section below analyses the coverage of environmental impact issues in the old NCS (Grade 10-12) policy documents and past examination papers.

5.2.2.1 Coverage of environmental impact topics in the old NCS (Grade 10-12)

In June 2000 the South African government recognised the importance of EE in the education system, and then acted swiftly to ensure that EE would become prominent in all learning areas in both the General Education and Training band (Irwin and Lotz-Sisitka, 2014). This led to EE becoming an integral part in all learning areas in Curriculum 2005. The revision of Curriculum 2005 led to the old NCS (Grade 10-12) as seen in Table 5.1 above. However, the cross-curricular phase organiser in Curriculum 2005 which required all teachers in all learning areas to consider an environmental focus was dropped by policy makers in the old NCS (Grade 10-12). In its place the National Curriculum Statement Grades R-12 has a principle of human rights, inclusivity and environmental and social justice. This principle has been extended to all learning phases of the education system where a strong environmental focus should be embedded in all subjects. It is notable that the critical distinction of EE implementation changed from being a cross-curricular phase organiser in Curriculum 2005 to being a strong focus on environmental justice which was integrated in all subjects in CAPS. This study analyses *“What changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?”* These changes will be analysed from 2006 to 2015, which is characterised by the Decade of Education for Sustainable Development (DESD). This analysis is based on the shifts between the two NCS policies and CAPS which was implemented in 2012 in Grade 12.

Post Curriculum 2005, the South African education system adopted the National Curriculum Statement, in which the Constitution of the Republic of South Africa (Act 108 of 1996) provided the basis for curriculum transformation and development in the country. In support of educational transformation, the aims of the Constitution stated were to:

- Heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights;
- Improve the quality of life of all citizens and free the potential of each person;
- Lay the foundations of a democratic and open society in which government is based on the will of the people and every citizen is equally protected; and

- Build a united and democratic South Africa able to take its rightful place as a sovereign state in the family of nations (DoE, 2003).

It can be noted that these aims of the Constitution are embedded in all of the Revised National Curriculum Statement policies for Grade 10-12 (General) that were implemented in 2002. The NCS Grade (10-12) for all subjects was based on the following principles that played a role in the integration of EE and ESD into the curriculum:

- social transformation;
- outcomes-based education;
- high knowledge and high skills;
- integration and applied competence;
- progression;
- articulation and portability;
- **human rights, inclusivity, environmental and social justice** (own emphasis);
- valuing indigenous knowledge systems; and
- credibility, quality and efficiency.

In the analysis of the principles, it can be seen that the OBE formed the foundation for the curriculum in South Africa. According to the DoE (2003), OBE encourages learners to reach their full potential by setting the Learning Outcomes (LOs) to be achieved by learners and encouraging learner-centred and activity-based approaches to education. The National Curriculum Statement builds its Learning Outcomes for Grades (10-12) on the Critical and Developmental Outcomes that were inspired by the Constitution and developed through a democratic process (DoE, 2003). Among others, one of the Critical Outcomes requires learners to use science and technology effectively and critically, showing responsibility towards the environment and the health of others (DoE, 2003). This Critical Outcome ensures that learners are able to use science to solve current environmental impacts. The second principle in old NCS (Grade 10-12) that is associated with EE/ESD is Human Rights, Inclusivity, Environmental, and Social Justice. In this principle, the policy statement tries to promote human rights, inclusivity and environmental and social justice (DoE, 2003). Therefore, all Subject Statements were infused with the principles and practices of social and environmental justice and human rights as defined in the Constitution of the

Republic of South Africa. In particular, the National Curriculum Statement Grades 10–12 (General) was sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors. The DoE (2003) stated that the National Curriculum Statement Grades 10–12 (General) adopted an inclusive approach by specifying minimum requirements for all learners. It acknowledges that all learners should be able to develop to their full potential provided they receive the necessary support. The intellectual, social, emotional, spiritual and physical needs of learners will be addressed through the design and development of appropriate Learning Programmes and using appropriate assessment instruments. The analysis of the old NCS (Grade 10-12) principles revealed that the government's focus was mainly on learners. Apart from the principles, the old NCS (Grade 10-12) for all subjects stipulated the kind of learner and teacher that was envisaged in the learning and teaching processes based on the South African constitution and the nine principles shown in the NCS Grade 10-12 subject policies. The structure of the old NCS (Grade 10-12) consisted of the following:

- An Overview Document,
- The Qualifications and Assessment Policy Framework, and
- Subject Statements

The National Curriculum Statement consisted of 29 subjects. Subject specialists developed the Subject Statements, which make up the National Curriculum Statement. The draft versions of the Subject Statements were published for comment in 2001 and then re-worked to take account of the comments received (DoE, 2008). In 2002, 24 subject statements and an overview document were declared policy through the Government Gazette. In 2004, five subjects were added to the National Curriculum Statement. The National Curriculum Statement then consisted of the Subject Statements for the following subjects:

- Languages – 11 official languages (each counted as three subjects to cater for the three levels Home Language, First Additional Language and Second Additional Language); 13 non-official languages
- Mathematics; Mathematical Literacy;
- Physical Sciences; Life Sciences
- Technology; Information Technology; Computer Applications

- Accounting; Business Studies; Economics
- Geography; History; Life Orientation; Religion Studies
- Consumer Studies; Hospitality Studies; Tourism
- Dramatic Arts; Dance Studies; Design; Music; Visual Arts
- Agricultural Sciences, Agricultural Management Practices, Agricultural Technology

Table 5.2: Environmental impact topics and content found in the Grade 12 Subjects old NCS (Grade 10-12)

SUBJECT	LEARNING OUTCOME (LO)	KEY EE/ESD THEMES/CONCEPTS
ECONOMICS	LO1: Macro-economics: The learner is able to demonstrate knowledge, critical understanding and application of the principles, processes and practices of the economy	Learners are exposed to the fundamental concepts and understanding that choice and sacrifice impact on the destiny of resources in the production process. This should not be in conflict with the priorities of the Constitution, nor should it impair the sustainability of the environment .
	LO 4: Contemporary Economic Issues: The learner is able to demonstrate knowledge, understanding and critical awareness, and apply a range of skills in dealing with contemporary economic issues.	<ul style="list-style-type: none"> • By the end of Grade 12, learners who have achieved the minimum competences for this Learning Outcome are able to demonstrate analysis and evaluation of the contemporary issues of inflation, tourism and environmental sustainability. • Analyse environmental sustainability and investigate recent international agreements in this regard (e.g. Rio de Janeiro and Johannesburg Summits). • Evaluating the composition and necessity of the public sector, problems of public sector provisioning, objectives of the public sector and its budgets, fiscal policy, including the Laffer curve, and reasons for public sector failure (infuse where appropriate: national macro- economic policy and service delivery with regard to socio-economic rights, education, health, the environment, social security; convention of the rights of the child, taxation, and compensation for human rights abuses)
BUSINESS STUDIES	LO 1: explores contemporary socio-economic issues e.g. poverty, HIV/AIDS, unemployment, gambling, skills levy, violence, crime, riots, inclusivity and their impact on businesses.	<ul style="list-style-type: none"> • Business venture addresses issues such as human rights, inclusivity and environmental issues • Critical Outcome 6: Usage of Science and Technology • Critically examine the concept of social responsibility and its implications for both business and communities.

SUBJECT	LEARNING OUTCOME (LO)	KEY EE/ESD THEMES/CONCEPTS
	LO 4: Identifies the rights and responsibilities of people in the business world	<ul style="list-style-type: none"> Assessing a business venture against criteria to measure human rights, inclusivity, and environmental issues. Know how to assess a business venture against criteria to measure human rights, inclusivity, and environmental issues. Can do this through informal surveys, interviews, etc
AGRICULTURAL SCIENCES	LO 2: Sustainable Agriculture Practices: This Learning Outcome addresses the dynamic nature of agriculture as it applies to relevant production, processing and marketing practices to sustain agriculture in a manner that does not destroy the environment	<ul style="list-style-type: none"> The learner is able to investigate, critically analyse and understand the challenging nature of agriculture, in order to plan and solve problems relating to sustainable agricultural environment. Develop a positive attitude towards Human Rights and Inclusivity, indigenous knowledge systems and HIV/AIDS Agricultural Sciences concepts and principles should demonstrate effective social, ethical and environmental responsibility. An example of this is when learners can provide effective veld management practices.
	LO 1: Investigate and Analyse LO 4: Interrelated Issues in Agriculture	<ul style="list-style-type: none"> Agricultural Sciences enables learners to work effectively with Local, National and International nature conservation organisations such as the International Conservation Union (ICU) whereby they share ideas and concepts for the development and maintenance of the environment
LIFE SCIENCES	LO 3: Life Sciences, Technology, Environment and Society	<ul style="list-style-type: none"> Learner is able to demonstrate an understanding of the nature of science, the influence of ethics and biases in the Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society. E.g. Focus of Assessment Standard 2: The learner compares and evaluates the uses and development of resources and products and their impact on the environment and society.

SUBJECT	LEARNING OUTCOME (LO)	KEY EE/ESD THEMES/CONCEPTS
		<ul style="list-style-type: none"> Learners need to understand how science relates to their everyday lives, to the environment and to a sustainable future.
GEOGRAPHY	<p>LO 2: The development of knowledge and understanding</p> <p>LO 3: The application of knowledge and skills</p>	<ul style="list-style-type: none"> Firstly, Geography studies show how spatial patterns and processes affect the way people live and interact with the environment, how physical and human processes shape the environment, and how humans interrelate with the living and non-living environment. Therefore, learners will be expected to demonstrate a fundamental knowledge of physical and human processes and the patterns which result from them, as well as the interactions between humans and the environment on local and a national scale. Secondly, Geography seeks to understand human-environment interactions. Human actions modify the environment at different scales. Likewise, the environment and the availability of resources in regions and places shape human activities and lifestyles, and ultimately their well-being. In addition, it is concerned about how people depend on, adapt to and modify environments, and gives consideration to the consequences of human actions. Lastly, learners will also be encouraged to recognise and appreciate values, attitudes and indigenous knowledge held by individuals and groups, to examine the consequences of their actions, and to make informed, logical decisions. <p><u>Climate and weather:</u></p> <ul style="list-style-type: none"> ➤ Human-made climates (urban climate).

SUBJECT	LEARNING OUTCOME (LO)	KEY EE/ESD THEMES/CONCEPTS
		<ul style="list-style-type: none"> ➤ Climate hazards and human response to these – risk and vulnerability. <u>Fluvial processes and landforms</u> ➤ Slopes: types, characteristics and significance for human activity. ➤ Mass movements and human responses. <u>People and places: rural and urban settlement</u> ➤ Human-environment interactions in rural settlements: ➤ Settlement issues: rural depopulation, closure of services, ageing of population, political influences, governance of rural settlements (local authorities, Agenda 21). ➤ Human-environment interactions in urban settlements: ➤ Settlement issues: inner city problems, renewal, urban blight, congestion, pollution and land use conflict, standards of living, political influences <u>People and their needs</u> ➤ Response of people to environmental and socio-economic injustices linked to economic activities ➤ Distribution and supply of water to South African citizens; ➤ Sustainable use and management of water. • Impact of the change of location of economic activities on people
PHYSICAL SCIENCES	LO 3: The Nature of Science and its Relationships to Technology, Society and the Environment.	<ul style="list-style-type: none"> • Learner is able to identify and critically evaluate scientific knowledge claims and the impact of this knowledge on the quality of socio-economic, environmental and human development. • Formulates strategies to conserve energy

SUBJECT	LEARNING OUTCOME (LO)	KEY EE/ESD THEMES/CONCEPTS
		<u>Evaluating the impact of science on human development:</u> 1) organic reactions on the quality of human life and the environment , 2) researches and presents arguments on the economic, social and environmental impact of various energy sources, 3) explains the dangers and impact associated with the use of organic solvents and other organic products and 4) analyses the sustainable use of energy.
HISTORY	LO 3: Knowledge construction and communication	<ul style="list-style-type: none"> The learner is able to construct and communicate historical knowledge and understanding.
	LO 4: Heritage	<ul style="list-style-type: none"> The learner is able to engage critically with heritage issues. What can we do about conservation? Understanding the skills/tools for conservation of heritage sites
MATHEMATICS	LO 4: Data Handling and Probability	<ul style="list-style-type: none"> The learner is able to collect, organise, analyse and interpret data to establish statistical and probability models to solve related problems. Solve problems involving sequences and series in real-life and mathematical situations.

In the old NCS (Grade 10-12), Economics was defined as the study of how individuals, businesses, governments and other organisations within our society choose to use scarce resources to satisfy their numerous needs and wants in a manner that is efficient and equitable (DBE, 2012). These scarce resources can be attributed to natural resources which EE/ESD is trying to ensure are not depleted and saved for future generations. The scope of this subject as shown in Table 5.2 was to prioritise the significant contemporary economic issues of poverty, redistribution of income and wealth, growth and development, globalisation, respect for the environment and human rights. The Economics scope as shown in Table 5.2 embraced features such as principles, processes and practices of the economy. This feature dealt with the concept of the efficient use of resources to satisfy the competing needs and wants of individuals and society. It included monetary and real flows in an open economy within the confines of production, consumption and exchange. In addition, the goals of the Constitution and the sustainability of the environment were acknowledged in this feature. In Economics, the learner competence descriptions as seen in Table 5.2 were to interpret and summarise information relative to prescribed content from a range of sources (e.g. when dealing with the problem of environmental sustainability).

In Business Studies, old NCS (Grade 10-12) stipulated that one of its purposes as seen in Table 5.2 was to ensure that learners were able to create business opportunities, creatively solve problems and take risks while respecting the rights of others and environmental sustainability. This learning area had as one of the principles which enforced EE/ESD integration into teaching and learning, namely human rights, inclusivity and environmental and socio-economic justice. The content in this knowledge area was based on critically examining the concept of social responsibility and its implications for both business and communities as well as to assess corporate social investment projects, including human rights issues.

DoE (2007) defined Agricultural Sciences as the study of the relationship between soils, plants and animals to produce and process food, fibre, fuel and any other agricultural commodities that have an economic, aesthetic and cultural value (DoE, 2007). EE/ESD concepts in Agricultural Sciences were embedded in where learners have to understand the application of appropriate technology in commodity production (animal and plant) and processing in a manner that will ensure sustainable agriculture. According to old NCS (Grade 10-12) for Agricultural Sciences, when South Africa

moved into a new political era in which accelerated economic growth and development were promoted, new policies on land use and land ownership had to be developed. A new approach to Agricultural education was required to address these political, social, economic and environmental conditions. That is addressing the dynamic nature of agriculture as it applies to relevant production, processing and marketing practices to sustain agriculture in a manner that does not destroy the environment. In this subject, learners were required to be sensitive towards their natural environment and to understand the socio- economic and political conditions which have an impact on the environment and on sustainable agricultural production. In Agricultural Sciences seen in Table 5.2, the analysis revealed that the policies placed more emphasis on the sustainable use of resources.

Life Sciences was defined as a subject that involved the systematic study of life in the changing natural and human-made environment (DoE, 2003). Furthermore, this systematic study as shown in Table 5.2 involved critical inquiry, reflection, and the understanding of concepts and processes and their application in society. The purpose of this subject was to allow learners to explore and apply scientific knowledge in their personal lives and as responsible citizens in ways that will contribute to a healthy lifestyle and the sustainable management of resources. This subject (Life Sciences) also enabled learners to understand biological, physiological, environmental, technological and social processes that impact on the environment (e.g. food production, distribution and consumption, health promotion, conservation, sustainable living and genetic engineering). All of these have implications for the socio-economic and technological advancement of society. Life Sciences analysis revealed that it was one of the major subjects that had a full section or knowledge focusing solely on environmental studies. Life Sciences scope in the old NCS (Grade 10-12) was based on competencies such as understanding the interrelationship of Life Sciences, technology, the environment and society, and of different attitudes and values.

Geography was defined as a science that studies physical and human processes and spatial patterns on Earth in an integrated way over space and time (DoE, 2003:9). It examined the spatial distribution of people and their activities, physical and human-made features, ecosystems and interactions between humans, and between humans and the environment in a dynamic context. Some of the aims of Geography which encourage EE/ESD are to:

- Develop knowledge and critical understanding of the changing nature and interrelatedness of human existence and the environment over space and time.
- Prepare learners to become informed, critical and responsible citizens who can make sound judgements and take appropriate action that will contribute to equitable and sustainable development of human society and the physical environment. Geography prepares learners to become responsible and competent decision makers and agents, living and working in a complex world. It encourages them to challenge and address social and environmental injustices.

The scope of Geography was to emphasise the integration of physical and human geography. In the past, these components of Geography had been treated as separate elements. However, a study of physical processes that influence soil erosion, for example, must consider how human activities on the land also contribute to the process. The geographer needs to know why soil erosion is occurring and should understand the social, political and economic circumstances that may cause people to influence the rate of soil erosion in a place or in the broader region (DoE, 2007). Learners should also explore possible responses to issues and challenges arising from human and environment interactions in a local and national context.

Physical Sciences was defined as a subject that focused on investigating physical and chemical phenomena through scientific inquiry. By applying scientific models, theories and laws it sought to explain and predict events in our physical environment. This subject also dealt with society's desire to understand how the physical environment works, how to benefit from it and how to care for it responsibly (DoE, 2003). The DoE (2003) noted that the application of Physical Sciences knowledge had a profound impact on world-wide issues and events, be they economic, environmental, ethical, political, social and technological. The EE/ESD aim of the subject was to enhance understanding that the technological applications of the Physical Sciences should be used responsibly towards social, human, environmental and economic development both in South Africa and globally. One of the competency descriptions of Physical Sciences was to describe the nature of scientific theories and identify technological developments (industry- related) which have contributed to socio-economic and human development of a community and the environment.

History was defined as the study of change and development in society over time and space. This study draws on archaeology, paleontology and oral history. Through the investigation of the past, history enables us to understand and evaluate how past human action impacts on the present and influences the future. DoE (2008) was of the view that if we teach History well, it should promote non-discrimination, raise debates, confront issues and address current social and environmental concerns.

Mathematics enables creative and logical reasoning about problems in the physical and social world and in the context of Mathematics itself (DoE, 2003:9). One of the scopes of Mathematics was to embed contexts that relate to HIV/AIDS, human rights, indigenous knowledge systems, and political, economic, environmental and inclusivity issues.

5.2.3 Analysis of the CAPS Curriculum

According to the Department of Basic Education (DBE, 2016) the National Curriculum Statement Grades R-12 (NCS) stipulates policy on curriculum and assessment in the schooling fraternity. To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012 (DBE, 2016). As mentioned earlier in this chapter, the amendments led to a single comprehensive Curriculum and Assessment Policy Statement (CAPS) was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12 (DBE, 2016).

5.2.3.1 Analysis of the changes brought by the new CAPS curriculum which affect EE Implementation

The new curriculum brought the following changes from the old curriculum. These changes have not only affected the structure but also had an effect on the coverage, teaching and examination of the environmental impact topics in the curriculum. This study explores the constant changes in the curriculum and the effect that they had on EE integration. The following changes stipulated by the DBE (2016) are:

- CAPS Foundation Phase: Instructional time will increase;
- Numeracy changed to Mathematics and Literacy to Language;
- First Additional Language was added to Foundation Phase;

- Intermediate Phase changed to six subjects instead of eight;
- CAPS Senior Phase: School-based assessment counts for 40 percent and examination counts for 60 percent
- CAPS for Further Education and Training (FET) Phase: The structure and assessment weighting has been changed for some subjects;
- All grades use the seven-point scale system;
- Learning outcomes and assessment standards have been removed and are now called content, topic and skills;
- Learning areas are now called subjects;
- CAPS requires weekly lesson plans;
- Curriculum Statements and learning programme guidelines were replaced by one document called CAPS.

Stevenson (2013) reveals that intergovernmental conferences have played a major role in the development of EE and that this change has brought about a broader trend in which educational policies are no longer exclusively developed with a national system focus but have come under the forces of globalisation. Therefore, policies in education such as CAPS have not been cushioned from these global forces. Stevenson (2013) further suggests that the processes and pressures of globalisation have produced a shift in education policy processes. In the case of South Africa, CAPS was affected by the shift in global focus in terms of teaching content on the environment. According to Stevenson (2013), policy formulation typically involves political and ideological tensions and policy texts in education such as CAPS represent those struggles, usually in the form of compromise.

5.2.3.2 Principles of the CAPS curriculum

DBE (2016) also stipulates that the CAPS curriculum is based on the following principles:

- Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population;
- Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;

- High knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects;
- Progression: content and context of each grade shows progression from simple to complex Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors;
- Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
- Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

Bearing these principles in mind will assist to verify whether the content and context of Grade 12 environmental impact topics has resulted in proper EE integration through coverage, teaching and examination. This study investigates whether the curriculum is adhering to the mandatory principles.

5.2.3.3 Goals of the curriculum

As specified above, a curriculum is a written document that consists of several elements that together guide the teacher's instruction in the classroom environment. These elements have been identified by Cross-and Conn-Powers (2014:362) as goals for children's development and learning, which are:

- Experiences through which children will achieve the goals;
- Roles for staff and parents to help children to achieve these goals;
- Materials needed to support the implementation of a curriculum

According to Cross and Conn-Powers (2014), these goals must apply to all learners and all school curricula everywhere, which includes EE themes. Cross and Conn-Powers (2014:362) reveal that it must embrace the full range of environmental crises that threaten the planet and life on it, and furthermore it must incorporate many educational disciplines from physical sciences to social sciences, arts, and humanities.

5.2.3.4 Analyses of the subjects under CAPS

This research focused on the agent's documents that are CAPS documents, past examination papers and available textbooks used by teachers in the school. Documents which are used by agents are always open to manipulation by the people who use them. Table 5.3 below is an analysis of these documents. The approach that was used to analyse the documents was content analysis. Given (2012) mentions, that content analysis concentrates on word and phrase counts as well as numerical measures of textual expressions. This method of word and phrase count is used in this study. The words that were used in soliciting data to be presented from the documents were ozone depletion, global warming, energy consumption, acid rain, air pollution, marine pollution, mineral resource depletion, soil destruction, soil erosion and desertification. Furthermore, phrases such as biodiversity reduction, extinction of plants and animals, nuclear reactors and waste disposal, human health and diseases, world hunger, land use, solid waste disposal, hazardous chemicals, habitat destruction, invasive species, water quality and wildlife management were used. These words form part of the environmental impact topics in this study.

In the CAPS curriculum, all the subjects have a section that stipulates incorporation of environmental content. One of the general principles for all subjects is that:

Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (DBE, 2017:5).

In order to support the infusion of environmental impact topics in all the subjects in the CAPS curriculum, the National Curriculum Statement Grades R-12 aims to produce learners that are able to use science and technology effectively and critically show responsibility towards the environment and the health of others. It is upon the above principle and aim that this study purposefully selected all eleven subjects that the Department of Basic Education (DBE) classifies as core subjects in the FET band. These subjects are Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies, Economics, History, Accounting, Mathematics, Mathematical Literacy and English First Additional Language. According to the data

collected from the CAPS documents, only seven subjects out of the eleven had environmental impact topics in the programme of teaching and learning. This is evident despite the fact that all eleven subjects have a principle guiding the inclusion of environmental content in teaching and learning. Table 5.3 below provides the detailed analyses and results. It has to be mentioned that in the old NCS (Grade 10-12) analysis it was not possible to analyse the environmental impact topics as shown in Table 5.3 below because learning outcomes and assessment standards were used instead of content, topic and skills.

Table 5.3: CAPS documents analysis of environmental impact topics

CAPS DOCUMENTS											
	Life Sciences	Geography	Agricultural Sciences	Physical Sciences	Business Studies	Economics	History	Accounting	Maths	Maths Literacy	English
Total number of topics	12	31	41	52	15	20	6	15	12	7	4
Total number of environmental impact topics	1	3	1	2	1	2	Sections	0	0	0	0
Tuition time allocation for all the topics in the exams (weeks)	28	27	29	29	25	26	26	24	25	24	25
Time allocation for environmental impact topics (weeks)	2.5	2	1	2	1	2	Section	0	0	0	0
Percentage time allocation of environmental impact topics (%)	9	7	3	7	4	8	N/A	0	0	0	0
Mark allocation of environmental impact topics	25 marks out of 300	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed
Percentage coverage in the examination of environmental impact topics	8%	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed	Not disclosed

The data presented in Table 5.3 reveals that subjects such as Accounting, Mathematics, Mathematical Literacy and English First Additional Language had no environmental impact topics in the programme of the CAPS document despite the principle and aim of CAPS stipulating incorporation of environmental content in the curriculum. The data also reveals that History does not have specific environmental impact topics in the CAPS; instead, the subject has sections from its six topics covering environmental impact topics. The non-coverage of environmental impact topics in the other four subjects limited the study to present the coverage of environmental impact topics in six subjects only. History is omitted because there is no specific environmental impact topic coverage. Although a few sections reveal environmental themes, they do not delve into the topics themselves. The subjects that are further analysed are Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies and Economics. Table 5.3 shows that these subjects had the following total number of topics: 12, 31, 41, 52, 15 and 20 respectively.

The analysis shows that Geography has the highest number of environmental impact topics among the six core subjects presented. Data presented in Table 5.3 also revealed that the tuition time allocated for the subjects differs for each one. In addition, what was evident was that time allocation for environmental impact topics ranged from one week to about three weeks depending on the subject needs. Table 5.3 reveals that Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies and Economics were allocated about three weeks, two weeks, one week, two weeks, one week, and two weeks respectively for teaching and learning environmental impact topics. Life Sciences was allocated more time for environmental impact topics. Apart from recording more time allocation for environmental impact topics, the CAPS document for Life Sciences stipulates the actual mark allocation of environmental impact topics in the Grade 12 final examinations. The 25 marks allocated for environmental impact topics represent 8% of the total mark composition of the paper with a total of 300 marks. Apart from Life Sciences, the results revealed that no other subjects gave a specific allocation of marks for environmental impact topics in the final examinations.

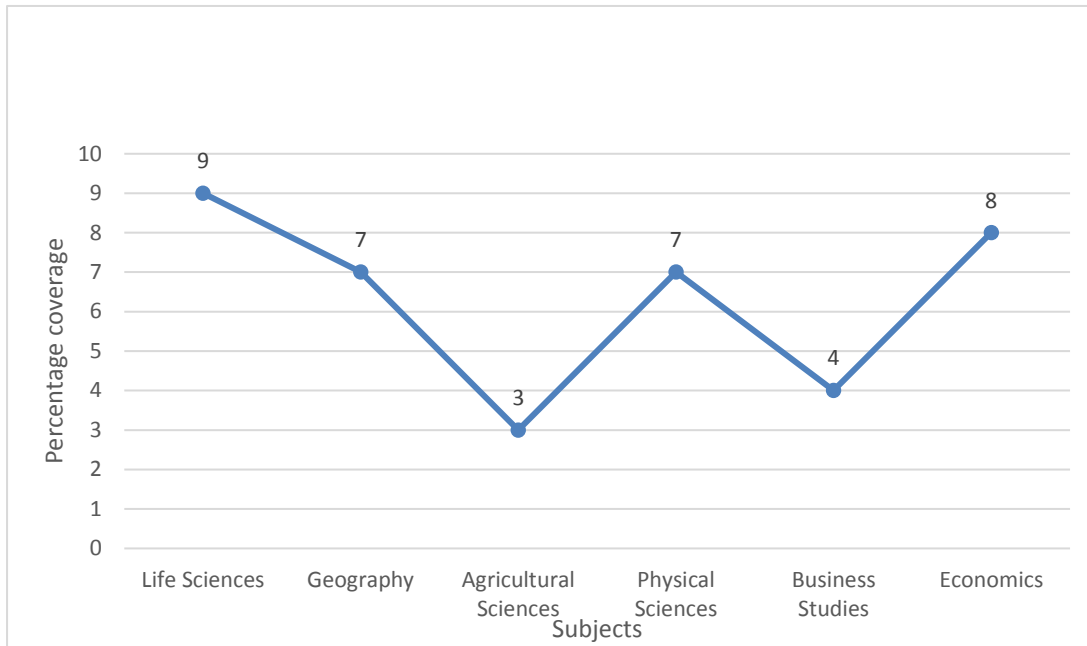


Figure 5.2: Alignment of environmental impact topics in CAPS

Supporting Table 5.3, Figure 5.2 above shows the representation of environmental impact topics in the six core subjects purposefully selected for analysis, these subjects were selected because the policy document analysis showed coverage of key environmental knowledge areas. Figure 5.2 provides results of the importance of environmental impact topics coverage in the policy document of the DBE. From the presentation of Figure 5.2 above, it is important to note that Agricultural Sciences received the lowest coverage of the environmental impact topics, according to the CAPS policy document of approximately 3%. Business Studies follows Agricultural Sciences with about 4%. The coverage of Geography and Physical Sciences is the same at 7% while Economics coverage is at 8%. Figure 5.2 also reveals that Life Sciences coverage of environmental impact topics in the CAPS document stands at 9%, which is the highest coverage when comparing among the six subjects investigated in this study. The percentage coverage of environmental impact topics was compared with the percentage of actual examination coverage to determine whether there was any alignment between the stipulated coverage and the actual examination in the Grade 12 exit level.

5.2.3.5 Coverage of environmental impact topics in CAPS

As mentioned earlier, the National Curriculum Statement Grades R-12 is based on the following principles: Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (DBE, 2016). The National Curriculum Statement Grades R-12 aims to produce learners that are able to use science and technology effectively and critically, showing responsibility towards the environment and the health of others. Table 5.4 below shows analysis of the CAPS documents on the coverage of the name of the topics and the general content that is covered in each of the seven subjects. As mentioned above, the eleven analysed subjects all have the same principle of environmental justice and the aim of showing responsibility towards the environment. The CAPS document results revealed that in subjects such as Accounting, Mathematics, Mathematical Literacy and English there was no specification of topics that teach about environmental justice, while in old NCS (Grade 10-12) it was only Accounting, Mathematical Literacy and English First Additional Language. In History, as shown in Table 5.4 below, there was only a theme of encouraging civic responsibility and responsible leadership, including raising current social and environmental concerns, but it was not followed by specific topics to be taught on environmental justice.

Table 5.4: Environmental impact topics and content found in the Grade 12 Subjects

SUBJECT	TOPICS ON ENVIRONMENTAL IMPACT	CONTENT/CONCEPT
PHYSICAL SCIENCES	Oxidation numbers and application of oxidation numbers	<ul style="list-style-type: none"> Evaluate the use of inorganic fertilisers on humans and the environment Searching for and presenting information on environmental issues related to the use of plastics Describe, using half equations and the equation for the overall cell reaction, the layout of the particular cell using a schematic diagram and potential risks to the environment of the following electrolytic processes used industrially
	The fertiliser industry (N, P, K).	<ul style="list-style-type: none"> Evaluate the use of inorganic fertilisers on humans and the Environment
BUSINESS STUDIES	<ul style="list-style-type: none"> Human rights, inclusivity and environmental issues. 	<ul style="list-style-type: none"> Create business opportunities, creatively solve problems and take risks, respecting the rights of others and environmental sustainability; Environmental issues (protection of the environment and human health by the business)
ECONOMICS	<ul style="list-style-type: none"> Tourism & Economic Redress: (Environmental sustainability) Basic economic problem: Environmental sustainability 	<ul style="list-style-type: none"> Promotion or violation of human rights and the environment (human rights and the environment) Analysis of environmental sustainability, investigating recent international agreements in this regard, for example, the Rio de Janeiro and Johannesburg summits. <ul style="list-style-type: none"> ✓ The state of the environment ✓ Measures to ensure sustainability

SUBJECT	TOPICS ON ENVIRONMENTAL IMPACT	CONTENT/CONCEPT
		<ul style="list-style-type: none"> ✓ Major international agreements (Rio de Janeiro and Johannesburg summits)
HISTORY	<ul style="list-style-type: none"> • New world order • The study of history also supports citizenship within a democracy by: encouraging civic responsibility and responsible leadership, including raising current social and environmental concerns. 	<ul style="list-style-type: none"> • Responses to globalisation, heralding an age of economic insecurity - nationalism, localisation (such as the breakup of former Yugoslavia); extremism (such as religious fundamentalism, including the Christian right wing and Islamic fundamentalism; 9/11 and its consequences; the war on terror, Iraq), as well as environmental movements.
LIFE SCIENCES	<ul style="list-style-type: none"> • Human impact on environment: current crises Grade 11 <p>In Grade 12, three of the four Knowledge Strands are addressed and serve to ensure progression. The content described in Environmental Studies: Human Impacts (Current Crises) is dealt with in Grade 11 in order to lessen the pressure in Grade 12 but this Knowledge Strand will be examined in the National Senior Certificate examination at the end of Grade 12.</p>	<ul style="list-style-type: none"> • The development of Scientific Knowledge and Understanding Scientific knowledge and understanding can be used to answer questions about the nature of the living world around us. It can prepare learners for economic activity and self-expression and it lays the basis of further studies in science and prepares learners for active participation in a democratic society that values human rights and promotes acting responsibly towards the environment. • It also helps learners to understand the contribution of science to social justice and societal development as well as the need for using scientific knowledge responsibly in the interest of ourselves, society and the environment. • The development of Scientific Knowledge and Understanding Scientific knowledge and understanding can be used to answer questions about the nature of the living world around us. It can prepare learners for economic activity and self-expression and it

SUBJECT	TOPICS ON ENVIRONMENTAL IMPACT	CONTENT/CONCEPT
		<p>lays the basis of further studies in science and prepares learners for active participation in a democratic society that values human rights and promotes acting responsibly towards the environment.</p> <ul style="list-style-type: none"> • It also helps learners to understand the contribution of science to social justice and societal development as well as the need for using scientific knowledge responsibly in the interest of ourselves, society and the environment • Biosphere to ecosystems, biodiversity, population ecology, current crises for human survival.
GEOGRAPHY	<ul style="list-style-type: none"> • Environmental impact on development and energy management. • Human- environmental interaction and social impact • Environmental quality and quality of life 	<p>Any topic in Geography can be explored by applying a conceptual framework that embraces Geography's four Big ideas which are, Human and environment interaction (Water in the world, The World's Oceans, Water management in South Africa, Floods, drainage systems in South Africa, fluvial processes. Catchment and river management)</p>
AGRICULTURAL SCIENCES	<ul style="list-style-type: none"> • Sustainable Natural resource utilisation, plant studies, ecology and agro-ecology 	<ul style="list-style-type: none"> • Better cultivation methods to sustain natural resources. • Impact of organic and inorganic fertilisers on the environment. • Environmental factors to be considered when selecting the general locality of greenhouses • Water use quality and sustainable use of water in agriculture

The analysis of the environmental impact topics found in the policy document for CAPS correlated with the analysis of the examination question papers discussed in the next section. The examination question papers for Grade 12 for subjects such as Accounting, Mathematics, mathematical Literacy, English and Geography did not show any environmental impact topics coverage. Only seven subjects had coverage of environmental impact topics and content. This lack of coverage of environmental impact topics in the policy statements had a negative impact on teachers teaching these topics during lessons as shown in teacher's views in Chapter 6 of this study.

In Physical Sciences, the analysis of the policy document in Table 5.4 revealed that the principle of environment justice, human rights and inclusivity was important. In this subject, as shown in Table 5.4, environmental impact topics such as oxidation numbers, application of oxidation numbers and the fertiliser industry were found. The content in these topics evaluated the use of inorganic fertilisers on humans and the environment. In Business Studies, a topic on human rights, inclusivity and environmental issues was found. The content in this subject was based on environmental sustainability and the protection of the environment and human health by businesses. In Economics, topics such as environmental sustainability and basic environmental economic problems in tourism and economic redress were found. In this subject the content was based on the promotion or violation of human rights and the environment, the state of the environment and measures to ensure sustainability and adherence to major international agreements. In History, themes were highlighted on environmental impact topics and the content was based on encouraging civic responsibility and responsible leadership, including raising current social and environmental concerns.

In Life Sciences, it was noted that the subject focused on the study of life at various levels of organisation and comprised of a variety of sub-disciplines or specialisations, such as environmental studies. In Grade 12, three of the four Knowledge Strands were addressed and they served to ensure progression. The content described in Environmental Studies such as Human Impacts (Current Crises), is dealt with in Grade 11 in order to lessen the pressure in Grade 12. However, this Knowledge Strand is examined in the National Senior Certificate examination at the end of Grade 12. This knowledge strand deals with the ways in which plants and animals are able to respond to their environments in order to ensure survival. Learners explore different

reproductive strategies in animals. Reproduction in humans is dealt with in more detail as a specific example of animal reproduction. This expands on the basic knowledge of human reproduction that was introduced in Grades 7 and 9. A major topic for this subject is human impacts on the environment (Current crisis). Therefore, the content in Life Sciences helps learners to understand the contribution of science to social justice and societal development as well as the need for using scientific knowledge responsibly in the interest of society, the environment and ourselves. Again, in Life Sciences the theme is used as a topic. In Geography, the main aim is making and justifying informed decisions and judgements about social and environmental issues. Based on this aim in the subject, environmental topics include environmental impact, human environmental interaction and environmental quality. The content is based on human and environment interaction on water in the world, World's oceans, water management in South Africa, floods, drainage systems in South Africa, fluvial processes, catchment and river management.

In Agricultural Sciences, the environmental impact topics are based on sustainable natural resource utilisation, plant studies, ecology and agro-ecology. In Agricultural Sciences learners will develop an awareness of the management and care of the environment, natural resources and the humane treatment of animals through the application of science and related technology. Learners will also become informed and responsible citizens in the production of agricultural commodities, caring for the environment and addressing social justice issues.

5.3 RESULTS OF THE EFFECTS OF THE SHIFT OF THE CURRICULUM FROM old NCS (Grade 10-12) TO CAPS

This section discusses the effects of the changes of the coverage of environmental impact topics from the old NCS (Grade 10-12) to CAPS. It answers one of the research sub-questions, which is, "*what changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?*" This section will discuss general results and specific results based on the breadth and depth of environmental impact topics coverage in both curricula.

5.3.1 General Similarities and Differences of Results

Based on the analysis of the two policy documents it was revealed that there was certainly a change in the coverage of environmental impact topics. It was deduced that this change mainly emanated from the structural changes in the two policies. The results of this study reveal that old NCS (Grade 10-12) and CAPS have a similar rationale, which aligns the policies with the aims of the South African Constitution, and that old NCS (Grade 10-12) further discusses principles of the curricula. They both have similar general aims that put more emphasis on knowledge, skills and values. They both have the same principles in which emphasis is placed on the values of human rights, inclusivity, environmental and social justice. I observed that the old NCS (Grade 10-12), in terms of educational principles, is fully focused on learner-centeredness and activity-based education while CAPS encourages critical thinking and an active approach to learning rather than rote learning. Furthermore, it can be mentioned that the old NCS (Grade 10-12) curricula focuses more on issues that try to address the inequalities of the past.

The structural differences between the two documents is evident in Table 5.3 where in the CAPS each subject was able to be analysed based on the number of environmental impact topics covered in the policy document. In the case of old NCS (Grade 10-12) it was not possible as environmental issues were written as themes/knowledge areas. I found analysing CAPS to be much more user-friendly than the old NCS (Grade 10-12) curricula because of the clearer design features. The old NCS (Grade 10-12) discusses the meaning of each subject as opposed to CAPS. The design features of both curricula include critical outcomes, one of which was responsibility towards society and environment. The type of learner envisaged by both curricula is similar with qualities such as creative problem solving, cooperation, self-management, good communication, and being able to apply gained knowledge to the outside real world being emphasised. NCS (Grade 10-12) included developmental outcomes and learning outcomes whereas in CAPS these are not mentioned.

The CAPS places more emphasis on content and the learning approach can be associated with a content-driven approach, while old NCS (Grade 10-12) puts more emphasis on OBE with discovery-based learning as the norm. Consequently, James (2010) noted that undergoing different degrees of transformation from a previous state

resulting, for example, in reorienting the organization of practice or supplementing and extending existing practices. The content-driven approach has led to a shift in the learning process in that a learner in CAPS becomes a recipient of a body of knowledge rather than being a participant in the learning process. Through holistic analysis of the two curricula, it can be determined that old NCS (Grade 10-12) was driven by learner-centeredness while CAPS is driven by a content-learning approach as mentioned earlier. NCS (Grade 10-12) mentions the envisaged teacher who is supposed to be qualified, competent, dedicated and caring. However, CAPS made no mention of what kind of teacher is needed to teach the curricula. The power of teachers in developing a learning programme, work schedule and lesson plan is dominant in the old NCS (Grade 10-12) compared to CAPS.

5.3.2 Results of the Depth of Environmental Impact Topics Coverage in old NCS (Grade 10-12) and CAPS

When comparing the content breadth structural differences between old NCS (Grade 10-12) and CAPS were evident. As seen in Table 5.3 in this chapter, the CAPS documents were easier to analyse, where the work schedule showed the topics to be covered and it was easier for the environmental impact topics to be identified compared to the old NCS (Grade 10-12). However, there was inconsistency in the breadth of coverage of environmental impact topics in all CAPS subjects analysed. In History it was not possible to analyse the breadth of coverage in CAPS as the knowledge areas were themes rather than topics on environmental impact topics that need to be covered in Grade 12.

In addition, subjects such as Accounting, Mathematics, Mathematical Literacy and English First Additional Language, made no mention of environmental themes nor topics in the CAPS curricula. Similarly, in old NCS (Grade 10-12), subject policies such as Accounting, Mathematical Literacy and English First Additional Language made no mention of environmental impact topics despite them having principles that encouraged values of human rights, inclusivity, and environmental and social justice. In the analysis CAPS documents, subjects had varying breadths of environmental impact coverage and the subjects analysed are listed according to the extent of environmental impact topics coverage in the policy from the highest to the lowest coverage. These subjects are, in order of environmental impact content coverage: Life

Sciences, Economics, Geography, Physical Sciences, Business Studies and Agricultural Sciences. In this study, I was able to compare the depth of environmental impact topics coverage in both old NCS (Grade 10-12) and CAPS curricula.

The results of this study revealed that in subjects such as Physical Sciences, Life Sciences and Geography there was a decrease in depth of content in CAPS when compared to old NCS (Grade 10-12). For example, in Physical Sciences, the CAPS curricula had only two topics on oxidation numbers and application of oxidation numbers (as shown in Table 5.4) where the content involves evaluating the use of inorganic fertilisers on humans and the environment while the old NCS (Grade 10-12) had Learning Outcome (LO) 3, which involved the nature of science and its relationships to technology, society and the environment. The old NCS (Grade 10-12) content involves several concepts such as that learners must be able to identify and critically evaluate scientific knowledge claims and the impact of this knowledge on the quality of socio-economic, environmental and human development. Furthermore, the learner is expected to formulate strategies to conserve energy. What was similar between the Physical Sciences content in both curricula was that learners should evaluate the impact of science on human development.

A second example of the decrease was in Geography, where in old NCS (Grade 10-12) the coverage of environmental impact topics was in LO 2: The development of knowledge and understanding, and LO 3: The application of knowledge and skills. Firstly, the content involved learners being expected to demonstrate a fundamental knowledge of physical and human processes and the patterns which result from them, as well as the interactions between humans and the environment at local and national scales. Secondly, Geography seeks to understand human-environment interactions. Likewise, the environment and the availability of resources in regions and places shape human activities and lifestyles, and ultimately their well-being. In addition, it is concerned about how people depend on, adapt to and modify environments, and gives consideration to the consequences of human actions. In summary, the Geography content involves learning about climate and weather, fluvial processes and landforms, people and places and needs. On the other hand in CAPS only topics such as environmental impacts of development and energy management, human-environmental interactions and social impact and environmental quality and quality of life were covered.

However, in subjects such as Economics, Business Studies and Agricultural Sciences there was a notable increase in the depth of environmental impact coverage in CAPS when compared to old NCS (Grade 10-12). This increase was noted in Economics where old NCS (Grade 10-12) had environmental issues embedded in LO1: Macroeconomics, where learners are exposed to the fundamental concepts and understanding that choice and sacrifice impact on the destiny of resources in the production process. This should not be in conflict with the priorities of the Constitution, nor should it impair the sustainability of the environment. In addition, old NCS (Grade 10-12) policy in Economics embeds environmental values and principles in LO 4: Contemporary Economic Issues, where the learner is able to demonstrate knowledge, understanding and critical awareness, and apply a range of skills in dealing with contemporary economic issues. Conversely, in the new CAPS subject policy, more content is based on topics in Tourism and Economic Redress: (Environmental sustainability) and Basic economic problems: (Environmental sustainability). CAPS broadly covers content on the promotion or violation of human rights and the environment (human rights and the environment), analysis of environmental sustainability and investigating recent international agreements in this regard, for example, the Rio de Janeiro and Johannesburg summits. Furthermore, Economics in CAPS covers the state of the environment, measures to ensure sustainability and major international agreements such as the Rio de Janeiro and Johannesburg summits.

Analysis of content coverage in Agricultural Sciences revealed that topics such as sustainable natural resource utilisation, plant studies, ecology and agro-ecology were covered in (CAPS) compared to LO 1: Investigate and Analyse, LO 2: Sustainable Agriculture Practices, and LO 4: Interrelated Issues in Agriculture in the old NCS (Grade 10-12). The CAPS content expected learners to know better cultivation methods to sustain natural resources and to have knowledge of the impact of organic and inorganic fertilisers on the environment. Learners should also be exposed to environmental factors to be considered when selecting the general locality of the greenhouse and water use quality and sustainable use of water in agriculture.

In conclusion, the overall structural presentation of the content in CAPS was clearer than in old NCS (Grade 10-12). I also realised that in some of the CAPS documents, the description and clearer specification of content to be covered in a particular time

makes it easier for teachers to follow a specific time frame for the topics to be taught and teachers are exposed to clear topics to be covered during the year. From the analyses it was revealed that CAPS is pitched at micro-level, where the teacher is the implementer of a developed programme. This is in contrast with the old NCS (Grade 10-12) where the policy was developed at the macro-level and focused on meeting the LOs and ASs. This implies that CAPS provides more structural content support to both novice and experienced teachers because of its prescriptive nature. From analysis of the two curricula it appears that CAPS was the ideal policy as it was easier for stakeholders to implement compared to the old NCS (Grade 10-12) in the teaching and learning of environmental impact topics.

One other observation was that in CAPS there was greater emphasis on summative assessment (controlled tests and examinations) compared to the old NCS (Grade 10-12) which placed more emphasis on formative assessment. CAPS is therefore more exam-driven. This leads to the analysis and results between CAPS and old NCS (Grade 10-12) of Grade 12 past examinations in the section below.

5.4 PAST EXAMINATION PAPERS RESULTS BETWEEN OLD NCS (GRADE 10-12) AND CAPS

This section shows analysis of content coverage depth, which in this study explores the depth at which environmental impact topics in the curriculum were covered in Grade 12 exit examinations in South Africa in old NCS (Grade 10-12) and CAPS.

5.4.1 Old NCS (Grade 10-12) versus CAPS

In order to ascertain the depth of environmental impact topics in past examinations papers from 2006 to 2015, percentages were compared against all other aspects covered in the examination paper using the marks allocated for each aspect.

Life Sciences had the following environmental impact topics as shown in Table 5.11 old NCS (Grade 10-12) and Table 5.12 CAPS: threats to biodiversity, culling of elephants that are damaging the Kruger National Park, current crisis for human survival, carbon monoxide emissions, spillage of toxic minerals such as copper and invasion of alien plants in the environment, global warming, negative effects on crops, illegal killing of wildlife, excessive fertilisation of soil and food wastage. The difference in coverage of these environmental impact topics in Life Sciences was that in old NCS

(Grade 10-12) there were themes that focussed on broad Learning Outcome 1 that was based on Life Sciences, Technology, Environment and Society while in CAPS topics specifically covered Human impact on the environment, Current crisis for human survival and Problems to be solved within the next generation. This showed that CAPS covered specific aspects on the biophysical, social, economic and political instead of broad coverage in old NCS (Grade 10-12).

Geography had the following environmental impact topics as shown in Table 5.13 old NCS (Grade 10-12) and Table 5.14 CAPS: impact of climate change, loss of biodiversity, land degradation, drought, river pollution, air pollution, health hazards caused by mines, soil destruction, improper solid waste disposal, poverty, the negative impact of human activities on wildlife, food security, effects of berg winds on veld fires, negative effects of overpopulation in urban areas, water pollution in the Vaal River, environmental impact of cyclones, high levels of pollution in the outskirts of towns, soil erosion and overstocking. The difference in the coverage between old NCS (Grade 10-12) and CAPS in this subject was that old NCS (Grade 10-12) covered Learning Outcome 1 and 2 that taught learners about the development of knowledge and understanding and Learning Outcome 3 that facilitated the application of knowledge and skills. However, CAPS covered these specific topics, understanding climate change and changing weather patterns, sustainable development principles and practices. Furthermore, CAPS covered urbanisation and land use management and sustainability, management of natural resources.

Agricultural Sciences had the following topics as shown in Table 5.15 old NCS (Grade 10-12) and Table 5.16 CAPS: threats of climate change (heat stress in pigs), adverse environmental conditions, effects of high temperatures to animals (global warming), ozone depletion, farm management (energy consumption), biodiversity reduction, land use and water quality. The difference between old NCS (Grade 10-12) and CAPS was that in old NCS (Grade 10-12), Learning Outcome 1 taught learners to investigate and analyse, Learning Outcome 2 taught learners sustainable agriculture practices and Learning Outcome 3 taught learners interrelated issues in Agriculture. In CAPS learners were taught topics related to develop an awareness of the management and care of the environment, natural resources and humane treatment of animals through the application of science and related technology. Furthermore, learners were

encouraged to be informed and be responsible citizens in the production of agricultural commodities, caring for the environment and addressing social justice issues.

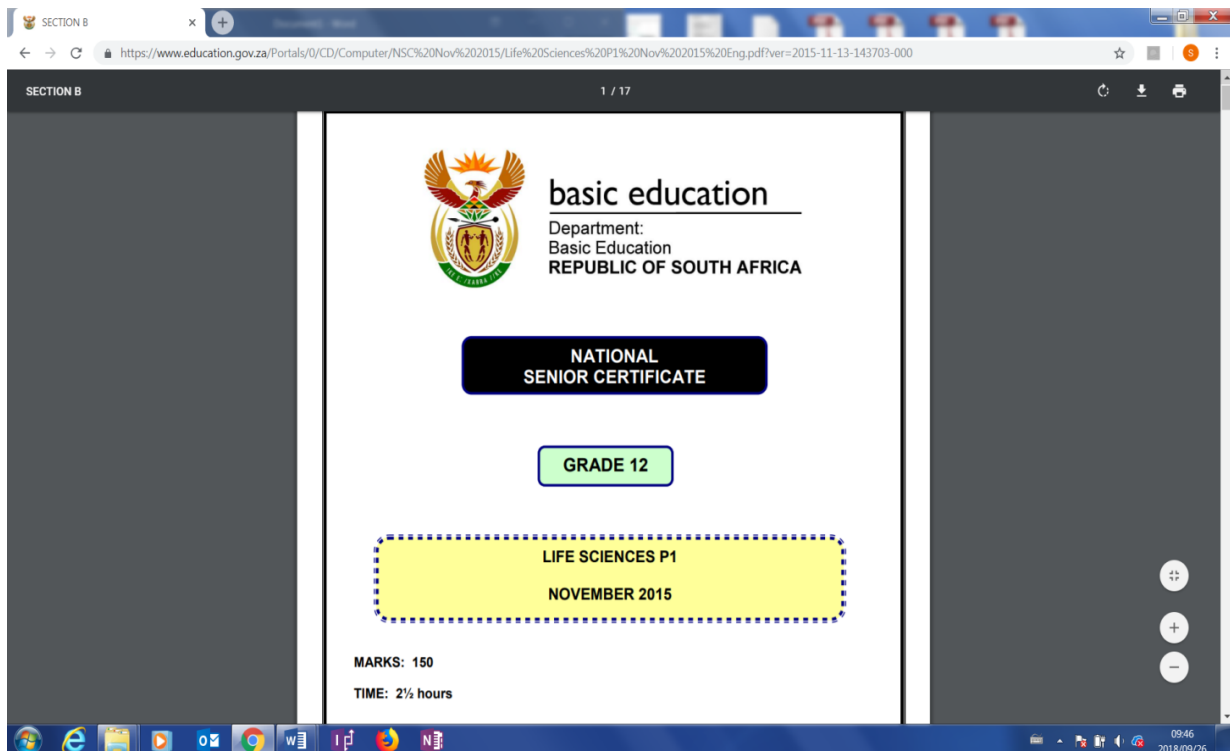
The percentage of coverage was calculated by finding the percentage of environmental impact topics in each of the Grade 12 past examination papers. Also what was covered in terms of environmental impact topics was also analysed. Only October/November past examinations question papers were used in these analyses and results. These papers were chosen because they form the basis for learners to meet the necessary requirements for admission to institutions of higher education. Another reason for selecting the October/November papers is that they are written by the majority of learners uniformly across all nine provinces of South Africa. The Examination Council (UMALUSI) moderates these examination papers for Quality Assurance in General, Further Education, and Training. Therefore, upon successful completion of the Grade 12 examinations, learners are given certificates that will provide admission to higher institutions of learning.

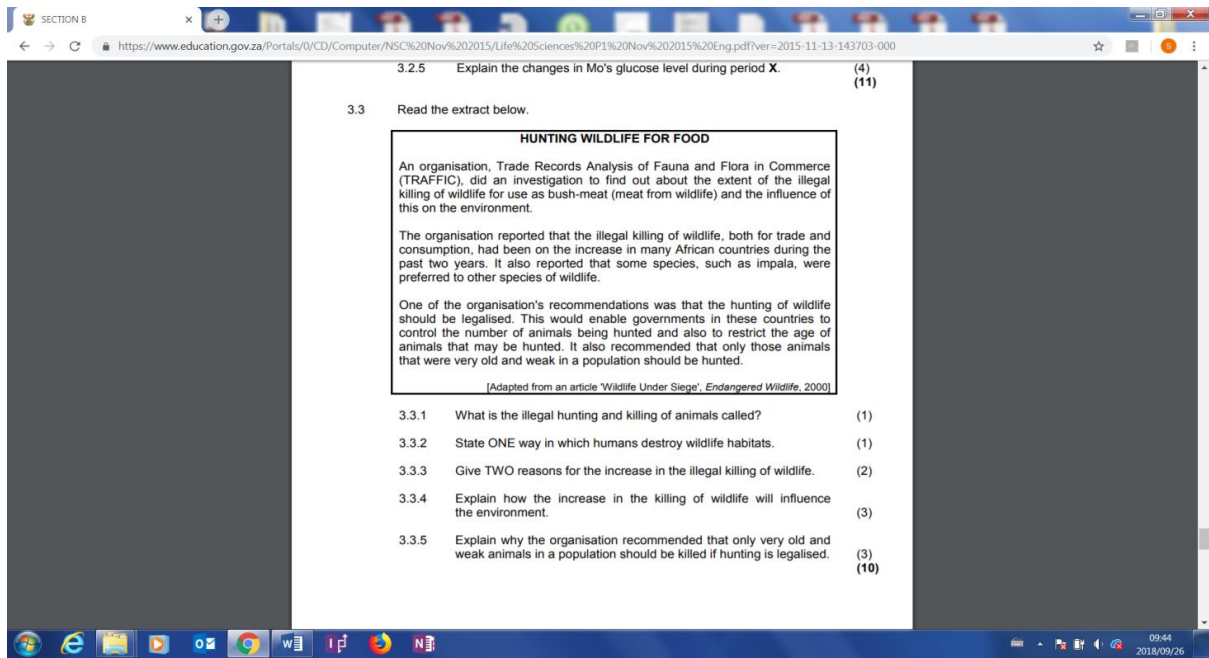
As already mentioned in this Chapter, from the year 2012, the two 2002 curricula, for Grades R-9 and Grades 10-12 respectively, were combined into a single document known as the National Curriculum Statement Grades R-12. The National Curriculum Statement for Grades R-12 known as CAPS, builds on the previous curriculum but also updates it and aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis (DBE, 2016). The CAPS accordingly replaced the Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines of National Curriculum Statement Grades R-12. Therefore, the presentation of data in this study is based on past examination papers from 2006 to 2015 that fell within the UNDES and is characterised by shifts of curricula from old NCS (Grade 10-12) to CAPS. Tables 5.5, 5.6, 5.7 and 5.8 below, show the extent of environmental impact topics in the following subjects, namely Life Sciences, Geography, Agricultural Sciences and Economics. Two subjects analysed from the year 2006 to 2015 showed no coverage of environmental impact topics, although in Table 5.3, the CAPS document reveals that some topics have environmental component in the curriculum.

Table 5.5: Showing coverage of environmental impact topics in Life Sciences

LIFE SCIENCES										
Year 2006 to 2015										
YEAR	Old NCS (Grade 10-12)						CAPS			
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marks allocated out of 300	0	0	27	31	36	19	31	33	19	23
Percentage coverage	0%	0%	9%	10%	12%	6%	10%	11%	6%	8%
Average coverage old NCS (Grade 10-12) vs. CAPS	6.2%						8.8%			

When analysing Life Sciences past examination papers the following environmental impact topics were identified: these were threats to biodiversity, culling of elephants that are damaging the Kruger National Park and current crises for human survival, carbon monoxide emissions, spillage of toxic minerals such as copper, invasion of alien plants in the environment, global warming, negative effects on crops, illegal killing of wildlife, excessive fertilisation of soil and food wastage. These environmental impact topics were accessed from the Life Sciences final examination papers from 2006 to 2015 on the DBE website <http://www.education.gov.za> in 2016. See the example of environmental impact topic on poaching in Question 3.3 of the Life Sciences October/November 2015 Paper 1 below:





Results revealed that in Life Sciences in 2006 and 2007 old NCS (Grade 10-12) no environmental impact topics were covered in the examination questions for either paper one or paper two. However, in 2010 there was a larger portion of environmental impact topics in this subject. Year 2011 was the last year of the old NCS (Grade 10-12) that was later replaced in 2012 by CAPS. “*What changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?*” To answer this sub-question, Table 5.5 also shows average percentages for the old NCS (Grade 10-12) and CAPS; that is, 6.2% and 8.8% respectively. It is evident that the shift of the curriculum from old NCS (Grade 10-12) to CAPS enhanced the coverage of environmental impact topics in the new CAPS curricula for Life Sciences as shown in Table 5.6 below.

Table 5.6: Showing coverage of environmental impact topics in Geography

GEOGRAPHY										
YEAR	Year 2006 to 2015									
	Old NCS (Grade 10-12)						CAPS			
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marks allocated out of 300	34	24	32	38	38	24	52	30	40	23
Percentage coverage	11%	8%	11%	13%	13%	8%	17%	10%	13%	8%
Average old NCS (Grade 10-12) vs. CAPS	10.7%						12%			

In Geography, past examination papers from 2006 to 2015 revealed that the following environmental impact topics were covered: these are the impacts of climate change,

loss of biodiversity, land degradation, drought, river pollution and air pollution, health hazards caused by mines, poverty, negative impacts of human activities on wildlife and food security. The following topics were also identified: effects of berg winds on veld fires, negative effects of overpopulation in urban areas, water pollution in the Vaal River, environmental impact of cyclones, high levels of pollution in the outskirts of towns, soil erosion and overstocking. The information on the past examination was sourced from the DBE website <http://www.education.gov.za/> in 2016. In Geography, the coverage of environmental impact topics in the past examination papers shows an average of 11% over the ten years under research. In this subject, the papers in 2006 and 2007 had adequate environmental impact topic coverage unlike in Life Sciences as seen in Table 5.3. In 2012, the coverage was 17%, which was the highest proportion of coverage of environmental impact topics in the years studied. In 2009, 2010 and 2014 the coverage was the same at 13% in each year. This was followed by 2006 and year 2008 with 11% each. The three years of 2007, 2011 and 2015 recorded the lowest coverage of 8% in each year. Table 5.6 also shows average percentage between the old NCS (Grade 10-12) and CAPS, namely 10.7% and 12% respectively. This showed that coverage of environmental impact topics increased in CAPS.

Table 5.7: Showing coverage of environmental impact topics in Agricultural Sciences

AGRICULTURAL SCIENCES										
	Year 2006 to 2015									
	Old NCS (Grade 10-12)						CAPS			
YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marks allocated out of 300	0	0	0	5	0	0	4	6	5	16
Percentage coverage	0%	0%	0%	2%	0%	0%	1%	2%	2%	5%
Average (old NCS (Grade 10-12) vs. CAPS)	0.3%						2.5%			

In Agricultural Sciences, past examination question papers the following environmental impact topics were identified: threats of climate change (heat stress in pigs), adverse environmental conditions, effects of high temperatures to animals, farm management, greenhouse effect and risk to environment of genetically modified plants. These environmental impact topics were sourced from the DBE website for Grade 12 exit level past examination from <http://www.education.gov.za> in 2016. Agricultural Sciences had the least coverage of all the subjects. It recorded an average

of 1% coverage of environmental impact topics in the past examinations. There is no content coverage of environmental impact topics in the 2006, 2007, 2008 and 2010 as shown in Table 5.7 above. The year 2015 had 5% of the coverage of environmental impact topics in the examination which was the highest when compared to the years of 2009, 2013, 2014 and 2012 which recorded 2%, 2%, 2% and 1% respectively. Table 5.7 also shows the average between the old NCS (Grade 10-12) and CAPS which stands at 0.3% and 2.5% respectively. This showed that coverage of environmental impact topics increased in CAPS when compared to old NCS (Grade 10-12). The coverage of environmental impact topics in Economics is presented in Table 5.8 below.

Table 5.8: Showing coverage of environmental impact topics in Economics

ECONOMICS										
	Year 2006 to 2015									
	Old NCS (Grade 10-12)						CAPS			
YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Marks allocated out of 300	0	0	16	36	2	28	54	32	16	26
Percentage coverage	0%	0%	5%	12%	1%	9%	18%	11%	5%	9%
Average old NCS (Grade 10-12) vs. CAPS	4.5%						10.8%			

In Economics, the following environmental impact topics were identified: climate change, carbon emissions, water pollution, the effects of fracking on the environment, environmental sustainability measures, conservation, non-renewable energy, dumping, acid water and other forms of pollution. These environmental topics were sourced from the DBE website <http://www.education.gov.za/> in 2016. The coverage of environmental impact topics in Economics has an average of 7%. The year 2012 had the highest coverage of 18%, followed by years 2009, 2013, 2011, 2015, 2008, 2014 and 2010 with 12%, 11%, and 9%, 9%, 5%, 5% and 1% respectively. As seen in Table 5.8, the year 2010 recorded the least percentage coverage of environmental impact topics. Table 5.5 also shows the average percentage between old NCS (Grade 10-12) and CAPS; that is, 4.5% and 10.8% respectively which showed that changes in the curriculum benefited environmental impact topics as coverage was increased in the CAPS.

In support of Tables 5.5, 5.6, 5.7 and 5.8 above, Table 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15 and 5.16 below shows the comparison and depth of environmental impact

topics over the four subjects further investigated between old NCS (Grade 10-12) and CAPS.

5.4.2 Coverage in the Policies and Examinations: Results of the Depth of Environmental Impact Topics between old NCS (Grade 10-12) and CAPS

Subjects were further analysed in terms of curricula and years of examinations between 2008 and 2015. The subjects were Economics, Life Sciences, Geography and Agricultural Sciences. As mentioned in the section above the results revealed that old NCS (Grade 10-12) was focused more upon learner competency rather than the subject content. However, in the CAPS analysis of the coverage of environmental impact topics, more emphasis was put on content. When analysing Table 5.9 on Economics, the old NCS (Grade 10-12) policy on the themes that are associated with environmental impact topics that must be taught in the classroom revealed that there was alignment of LO 1 and LO 2 with the environmental impact topics that were examined. When analysing the two policies, old NCS (Grade 10-12) and CAPS, it was observed that CAPS had only two basic knowledge areas that could be covered in the examinations. It was observed that there was alignment between the Economics old NCS (Grade 10-12) and CAPS policies. However, on the environmental impact topics that were covered in the examinations there was an increase in breadth in CAPS when compared to the old NCS (Grade 10-12) as seen in Table 5.9 and Table 5.10. The following topics were found in both policies: sustainability of natural resources, conservation, greenhouse effects, water, land and other natural resource management, climate change, environmental stress, carbon footprint, waste management, green taxes, non-renewable resources, water pollution, industrial pollution and poisoned groundwater. These topics were more broadly covered in CAPS than in old NCS (Grade 10-12). Another main difference between old NCS (Grade 10-12) and CAPS in Economics was that in the years of 2012 and 2013 there was consistency between policy and actual coverage of the topics in the examinations. Not only did the CAPS examination papers record more coverage in terms of topics but there was also a higher percentage of environmental impact topics seen in the examinations. Therefore, in Economics there was an increase in the coverage of environmental impact topics in the CAPS examination papers analysed.

In Life Sciences, one of the differences between old NCS (Grade 10-12) and CAPS is that old NCS (Grade 10-12) policy broadly illustrated the themes that should be learned in Grade 12. Conversely, CAPS stated the exact content and topics that

learners must be taught and examined in on environmental impact topics. One of the noted similarities was that the two curricula had an alignment between policy and practice in terms of the content to be taught and the coverage of environmental impact topics in the examinations. As seen in Table 5.11 and Table 5.12, the content coverage increased in the CAPS compared to the old NCS (Grade 10-12). The increase was not significant since the Life Sciences CAPS policy stipulated the actual environmental impact topics that must be covered in the actual examinations. This is one of the major positive aspects that this study discovered and one of my recommendations is that all policies should adopt the actual proportion of each segment of content in the curriculum that must be examined. This would not only assist learners and teachers when preparing for examinations but also assist the examiners with a clear view on how far they will examine a particular section of content in the examination.

This study revealed that in each year the percentage coverage of environmental impact topics was not consistent and that might apply to other subjects in the curriculum. The increase in the CAPS coverage of environmental impact topics in Life Sciences is significant as it can be assumed that the examiners were aligning the policy with the actual practice as also seen in Table 5.5. Again, it must be emphasised that Life Sciences CAPS policy can be used as a model and that all the subject policies should demarcate the amount of content to be covered in the examination in terms of percentages. This would result in less inconsistency in the actual examination of not only environmental impact topics, but all other important topics covered by the curriculum. Further analysis revealed that the Oct/Nov 2008 and 2009 Paper 2 examination for Life Sciences had the widest breadth of coverage of environmental impact topics. There were additional topics covered in the old NCS (Grade 10-12) such as the illegal harvesting of perlemoen, overexploitation of African potatoes and air pollution of sulphur dioxide. Most importantly, old NCS (Grade 10-12) and CAPS had similar coverage of topics such as carbon emission, renewable resources energy, overexploitation of fish, waste disposal, loss of biodiversity, global warming, the illegal killing of wildlife, excessive fertilisation of soil and food wastage. It can be concluded that in Life Sciences, the shift in the curriculum aligned the policy and actual examination of environmental impact topics.

In Geography was observed that the old NCS (Grade 10-12) and CAPS policies were **not aligned** and the reason was that in the old NCS (Grade 10-12) only themes and LO's were written while in the CAPS curriculum only the actual content to be taught was stipulated. The vertical alignment of policy and examination content in old NCS

(Grade 10-12) and CAPS revealed that the policies and examination content were aligned. Further analysis revealed that both policies had similar environmental impact topics such as tropical storms causing floods, climate change, soil degradation, water and air pollution, environmental dangers of berg winds' negative impact on human beings, etc. In addition, old NCS (Grade 10-12) also covered topics such as deforestation, negative impact on urban growth, etc. The shift in the curriculum increased the coverage of environmental impact topics in the examinations. This is in contrast to the results on policies that revealed that the content in old NCS (Grade 10-12) was more than that of CAPS. This is shown in Table 5.13, which reveals extensive coverage of environmental impact topics in 2008. It cannot go without notice that in 2012, under CAPS, the breadth of environmental impact topics was the highest when compared to the other years, with 2011 and 2015 recording the lowest percentages. It was also noted that Geography and Life Sciences, when compared with the other eleven subjects analysed, had the widest coverage of environmental impact topics in both the old NCS (Grade 10-12) and CAPS curricula. When comparing the topics, the old NCS (Grade 10-12) had the widest range of environmental impact topics compared to CAPS. Overall, the shift in the curriculum in Geography decreased content coverage in CAPS policy while it increased environmental impact coverage in the actual Grade 12 examinations when compared to the old NCS (Grade 10-12). The shift from old NCS (Grade 10-12) to CAPS therefore improved environmental impact topics coverage in practice.

In Agricultural Sciences, the shift in the curriculum benefited the coverage of environmental impact topics in the examinations. As seen Table 5.15, the themes mentioned in the old NCS (Grade 10-12) were general whereas in CAPS the content clearly stated what learners need to be taught. The policy coverage and examination of environmental impact topics was not aligned in old NCS (Grade 10-12). In the years 2008, 2010 and 2011, there was no coverage of environmental impact topics in the Grade 12 examinations as shown in Table 5.15. This is in contrast to CAPS, where there was vertical alignment between policy and actual examination of environmental impact topics. The results show that only in 2009 was there coverage of environmental impact topics in the examination in the old NCS (Grade 10-12). Further analysis revealed that old NCS (Grade 10-12) and CAPS had the same environmental impact topics such as the environmental impacts of genetically modified crops/plants, the threat of increased temperatures to animals and environmentally friendly farming systems. However, CAPS has additional topics such as climate change, greenhouse

effects and farm management. Out of the four subjects further analysed, Agriculture was the subject that showed the **least coverage** of environmental impact topics in Grade 12 examinations and did not adhere to the **principles of social, environmental justice and inclusivity**. It can be concluded that although the subject had improved coverage of environmental impact topics in CAPS, the total coverage was still **significantly low**.

Table 5.9: Results of environmental impact topics found in the Economics curriculum from 2008 to 2011 old NCS (Grade 10-12)

Policy Document (1)	Themes found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement Grade 10-12 (General) Economics http://www.education.gov.za Accessed: August 2016	<ul style="list-style-type: none"> LO1:Macro-economics: The learner is able to demonstrate knowledge, critical understanding and application of the principles, processes and practices of the economy LO 4: Contemporary Economic Issues: The learner is able to demonstrate knowledge, understanding and critical awareness, and apply a range of skills in dealing with contemporary economic issues. 	2008 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ Accessed August 2016)	2008: Environmental sustainability, pollution, green taxes.
		2009 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ Accessed August 2016)	2009: Environmental sustainability, global warming, recycling, illegal fishing, water pollution, land pollution.
		2010 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ Accessed August 2016)	2010: Greenhouse effects, environmental pollution, illegal fishing, imbalance ecosystem, loss of biodiversity.
		2011 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ Accessed August 2016)	2011: Sustainability of natural resources, conservation, greenhouse effects, water, land and other natural resource management, climate change, environmental stress, carbon footprint, waste management, green taxes, non-renewable resources, water pollution, industrial pollution, poisoned groundwater

Table 5.10: Results of environmental impact topics found in the Economics curriculum from 2012 to 2015 (CAPS)

Policy Document (1)	Environmental Impact Topics found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement: Curriculum and Assessment Policy Statement (CAPS) Further Education and Training Phase Grades 10-12: Economics http://www.education.gov.za Accessed: August 2016	<ul style="list-style-type: none"> • Tourism & Economic Redress: Environmental sustainability (Page 12 & 37) • Basic Economic problem: Environmental sustainability (Page 37) 	2012 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2012: Gas emissions and climate change (Global warming), Biodiversity loss, conservation of natural resources, pollution, and environmental sustainability.
		2013 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2013: Mineral resources depletion, depletion of ozone layer, recycling, green tax, acid water, water pollution, environmental sustainability, climate change, air pollution,
		2014 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2014: Environmental sustainability, conservation, depletion of natural resources (coal, oil, gas), non-renewable resources, land and water pollution.
		2015 (DBE Economics Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2015: Climate change, depletion of natural resources, green tax, carbon emission, water pollution, sustainability, land degradation,

Table 5.11: Results of environmental impact topics found in the Life Sciences curriculum from 2008 to 2011 old NCS (Grade 10-12)

Policy Document (1)	Themes found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement Grade 10-12 (General) Life Sciences http://www.education.gov.za Accessed: August 2016	LO 3: Life Sciences, Technology, Environment and Society	2008 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2008: Pollution, extinction of species, overexploitation of fish population, sustainability, water and air pollution, water borne diseases, over-exploitation of indigenous plants (African potato)
		2009 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2009: Renewable resource of energy, overexploitation of resources, industrial pollution, air pollution of sulphur dioxide, loss of biodiversity (illegal harvesting of perlemoen)
		2010 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2010: Waste disposal, recycling of waste, nitrification effects, over-exploitation of plants, carbon emission, air pollution,
		2011 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2011: Polluted environment, biodiversity, mineral residues effects,

Table 5.12: Results of environmental impact topics found in the Life Sciences curriculum from 2012 to 2015 (CAPS)

Policy Document (1)	Environmental Impact Topics found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement: Curriculum and Assessment Policy Statement (CAPS) Further Education and Training Phase Grades 10-12: Life Sciences http://www.education.gov.za Accessed: August 2016	(Revision of Grade 11 Topics) <ul style="list-style-type: none"> • Human impact on the environment (Page 51) • Current crisis for human survival (Page 51) • Problems to be solved within the next generation (page 51) 	2012 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2012: Threats to biodiversity, Culling of elephants that are damaging the Kruger National Park and current crises for human survival.
		2013 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2013: Carbon monoxide emissions, spillage of toxic minerals such as copper and invasion of alien plants in the environment.
		2014 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2014: Global warming, negative effects on crops.
		2015 (DBE Life Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2015: Illegal killing of wildlife, excessive fertilisation of soil and food wastage.

Table 5.13: Results of environmental impact topics found in the Geography curriculum from 2008 to 2011 old NCS (Grade 10-12)

Policy Document (1)	Themes found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement Grade 10-12 (General) Geography http://www.education.gov.za Accessed: August 2016	LO 2: The development of knowledge and understanding LO 3: The application of knowledge and skills	2008 (DBE Geography Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2008: Tropical storms causing floods, climate change, soil erosion, river pollution, environmental dangers of berg wind, weather warnings, environmental impact of mid-latitude cyclone, flooding, dangers of mass movement, consequences of drought, deforestation negative impacts, negative impact on urban growth on farming, food insecurity, sustainability, environmental problem resulted from mining, effects of mining on residents, air pollution,
		2009 (DBE Geography Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2009: Tropical cyclone, global warming, deforestation, poor farming, flooding, sustainability, pollution, environmental injustices, food insecurity, water scarcity,
		2010 (DBE Geography Grade 12 final paper:	2010: Prevention of air and land degradation, impact of tropical cyclone on human life,

Policy Document (1)	Themes found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
		http://www.education.gov.za/ : Accessed August 2016)	greenhouse effect, climate change, flooding effects, human causes of mudslide, effects of cyclone on farming, effects of berg winds, effects of droughts, erosion, negative effects of uncontrolled urban expansion, industrialisation environmental problems, environmental injustice,
		2011 (DBE Geography Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2011: Effects of tropical cyclone, climate change, challenges associated with flooding, effects of deforestation, mass movement effects, sustainability, effects of rapid urbanisation, water crisis,

Table 5.14: Results of environmental impact topics found in the Geography curriculum from 2012 to 2015 (CAPS)

Policy Document (1)	Environmental Impact Topics found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
<p>National Curriculum Statement: Curriculum and Assessment Policy Statement (CAPS) Further Education and Training Phase Grades 10-12: Geography http://www.education.gov.za Accessed: August 2016</p>	<ul style="list-style-type: none"> • Understanding climate change and changing weather patterns, sustainable development principles and practices (page 41) • Urbanisation and land use management and sustainability, management of natural resources (Page 8, 9 and 45) 	<p>2012 (DBE Geography Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2012: Impact of climate change, Loss of biodiversity, land degradation, drought, river pollution and air pollution.</p>
		<p>2013 (DBE Geography Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2013:Health hazards caused by mines, poverty, the negative impact of human activities on wildlife, food security.</p>
		<p>2014 (DBE Geography Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2014: Effects of berg winds on veld fires, negative effects of overpopulation in urban areas,</p>
		<p>2015 (DBE Geography Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2015: Water pollution in the Vaal River, environmental impact of cyclones, high levels of pollutions in the outskirts of towns, soil erosion, overstocking,</p>

Table 5.15: Results of environmental impact topics found in the Agricultural Sciences curriculum from 2008 to 2011 old NCS (Grade 10-12)

Policy Document (1)	Themes found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
National Curriculum Statement Grade 10-12 (General) Geography http://www.education.gov.za Accessed: August 2016	LO 1: Investigate and Analyse LO 2: Sustainable Agriculture Practices LO 4: Interrelated Issues in Agriculture	2008 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2008: None
		2009 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2009: Increase in temperature, environmental friendly farming system, environmental impacts of genetically modified crops,
		2010 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2010: None
		2011 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/ : Accessed August 2016)	2011: None

Table 5.16: Results of environmental impact topics found in the Agricultural Sciences curriculum from 2012 to 2015 (CAPS)

Policy Document (1)	Environmental Impact Topics found in Grade 12 (Policy document)	Grade 12 Examination Papers	Environmental Impact Topics found
<p>National Curriculum Statement: Curriculum and Assessment Policy Statement (CAPS) Further Education and Training Phase Grades 10-12: Agricultural Sciences http://www.education.gov.za Accessed: August 2016</p>	<ul style="list-style-type: none"> Develop an awareness of the management and care of the environment, natural resources and humane treatment of animals through the application of science and related technology (Page 13) Encourage learners to be informed and be responsible citizens in the production of agricultural commodities, caring for the environment and addressing social justice issues (Page 13) 	<p>2012 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2012: Threats of climate change (heat stress in pigs), Adverse environmental conditions,</p>
		<p>2013 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2013: Effects of high temperature to animals,</p>
		<p>2014 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2014: Farm management</p>
		<p>2015 (DBE Agricultural Sciences Grade 12 final paper: http://www.education.gov.za/: Accessed August 2016)</p>	<p>2015: Greenhouse effect, risk to environment of genetically modified plants.</p>

Tables 5.9 to 5.16 above show the coverage of environmental impact topics in four purposefully selected subjects that were Economics, Life Sciences, Geography and Agricultural Sciences. The coverage of environmental impact topics was sourced from 2008 to 2015 and these results only represent the old NCS (Grade 10-12) and CAPS curricula.

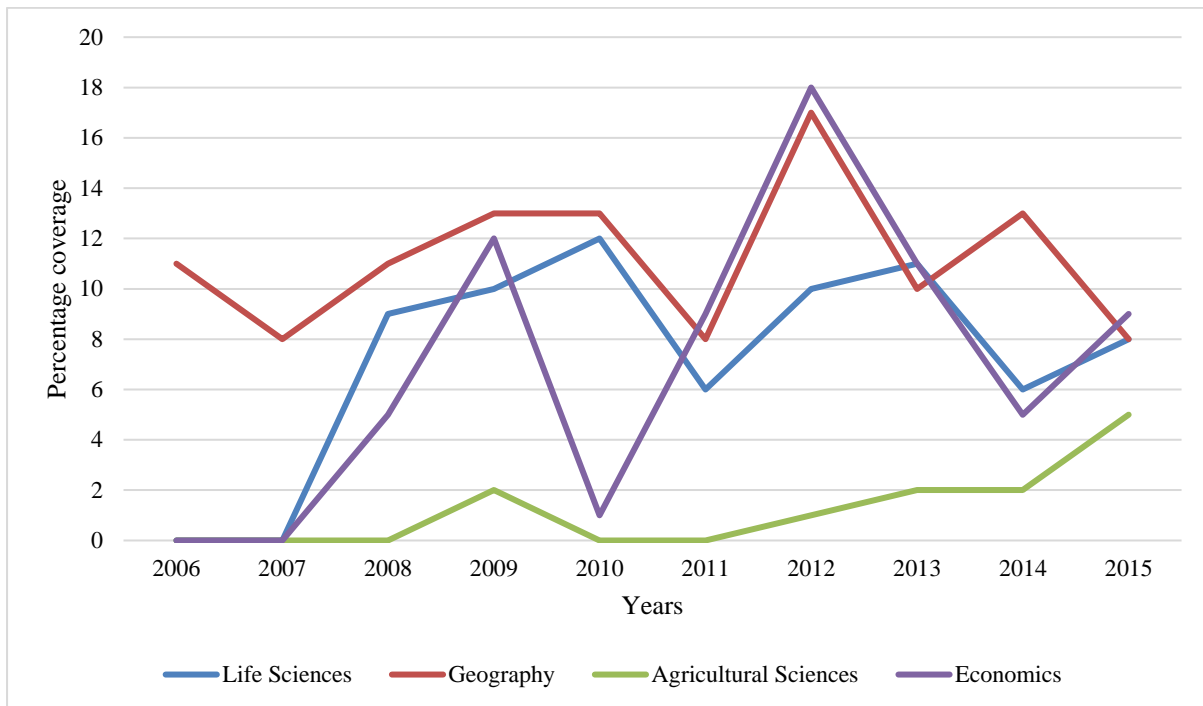


Figure 5.3: Coverage of environmental impact topics in the examinations between 2006 and 2015

The Figure 5.3 above shows that Agricultural Sciences had the lowest percentage coverage in the examinations, and this supports the CAPS document analysis outlined in the section above. Figure 5.3 clearly shows that Geography had the greatest coverage of environmental impact topics in 2012, 2014 and 2015. Only in 2013 does the coverage show a slight decline whereas Life Sciences recorded the greatest environmental impact topic coverage when compared to the other two subjects. The examination of environmental impact topics in the curriculum from 2006 to 2015 falls within the period of the UNDESD, namely, 2005 to 2014. This period was significant because the United Nations was advocating all nations to integrate the principles, values and practices of sustainable development into all aspects of education and learning. Figure 5.3 shows that in 2006, Geography had approximately 11% of environmental impact topics coverage. The graph shows that there is misalignment in

the coverage of environmental impact topics in the curriculum between the old NCS (Grade 10-12) to CAPS. The section below provides results of the coverage of environmental impact topics in some of the textbooks used by teachers who were interviewed in this study.

5.4.3 CAPS Textbooks Analysis of Environmental Impact Topics

Learner Textbooks used by the teachers interviewed in this study were also sampled purposively. This study also purposively selected four teachers' guidebooks for analysis. The selection of these teachers' guides and learner's textbooks was influenced by the fact that the teachers who were participants in this study used them. Four learner's textbooks and teachers' guides were analysed based on the coverage of environmental impact topics. As mentioned above, these textbooks for Economics, Life Sciences, Agricultural Sciences and Geography as well as teacher guides were sourced from the teachers who took part in the face-to-face interviews. Table 5.17 below shows teachers study guides and learners textbooks description for Economics, Life Sciences, Agricultural Sciences and Geography. It is important to note that all of the books analysed were published by Maskew Miller Longman in the year 2013.

Table 5.17: Teachers' study guides and learners' textbooks descriptions

SUBJECT	NAME OF TEXTBOOK/STUDY GUIDE	AUTHORS
Life Sciences	*FOCUS Life Sciences Grade 12 Learners Book *FOCUS Life Sciences Grade 12 Teachers Guide	Clitheroe F., Dempster E., Doidge M., Marsden S., Singleton N. and Aarde Van I.
Geography	*FOCUS Geography Grade 12 Learners Book * FOCUS Geography Grade 12 Teachers Guide	Dilley L., Earle J., Euston-Brown K., Keats G., Nxele A. and Ravenscroft G.
Economics	*FOCUS Economics Grade 12 Learners Book * FOCUS Economics Grade 12 Teachers Guide	Bantjes J., Burger M., Engelbrecht and Rose D.
Agricultural Sciences	*FOCUS Agricultural sciences Grade 12 Learners Book *FOCUS Agricultural Sciences Grade 12 Teachers Guide	Fontaine de J., Khumalo F., Lambrechts H., Letty B., Morrison K., Smuts A., Strydom L. and Tshaban TA.

Figure 5.4 and 5.5 below shows the FOCUS Life Sciences Grade 12 learners' textbook and FOCUS Geography Grade 12 teachers guide analysed in this study.

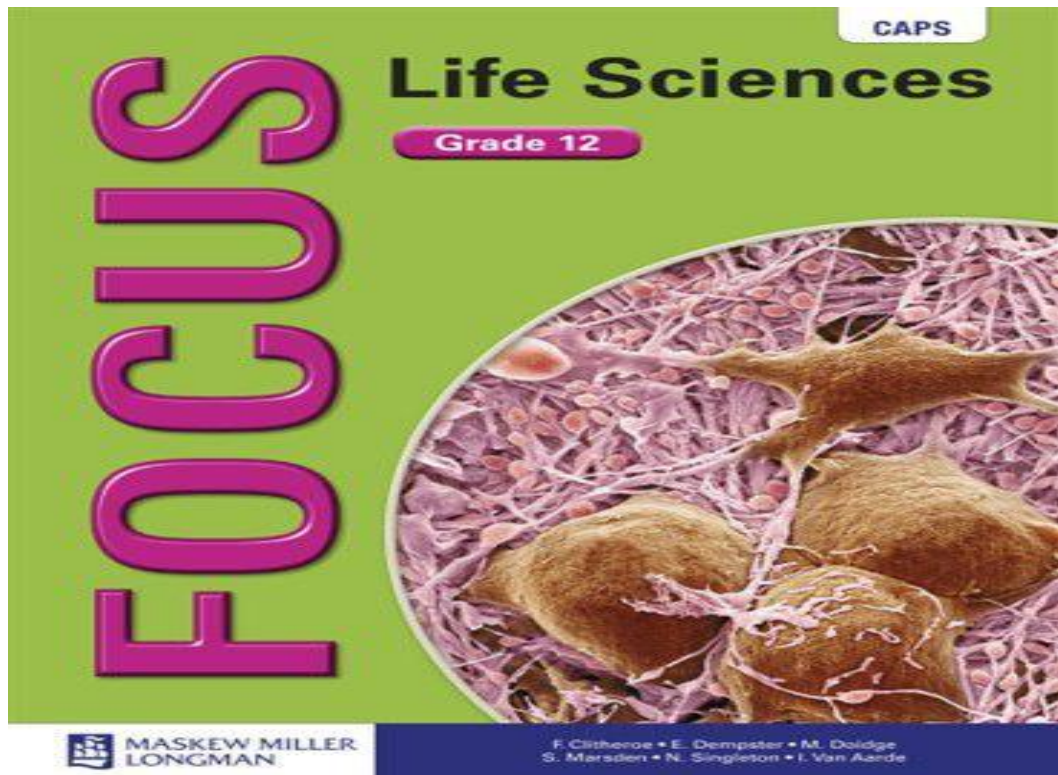


Figure 5.4: FOCUS Life Sciences Grade 12 Learners textbook

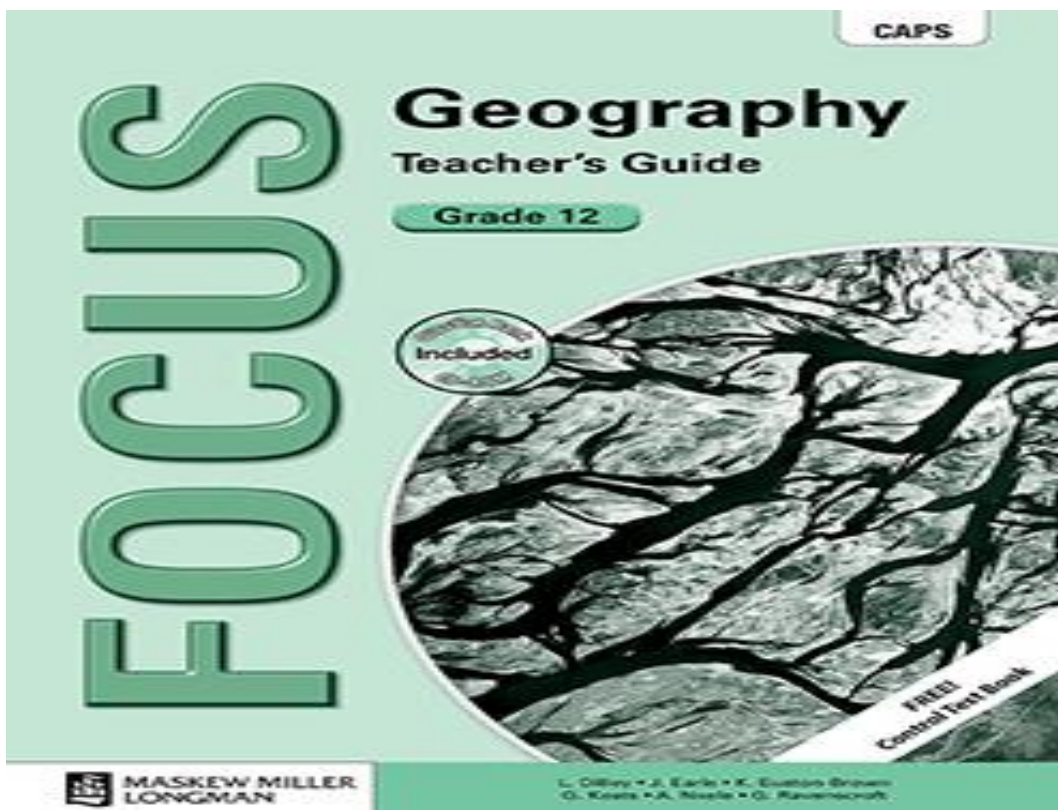


Figure 5.5: FOCUS Life Sciences Grade 12 Teachers Guide

Table 5.18: Coverage of environmental impact topics in four learners' textbooks

SUBJECTS AND ENVIRONMENTAL IMPACT TOPICS	Total number of book pages	Number of pages with selected environmental impact topic	Number of assessment activities with environmental impact topics	Percentage of pages with environmental impact topics
LIFE SCIENCES: Environmental Studies: Human impact on the environment (Revision of Grade 11: Atmosphere and climate change, water availability, water quality, food security, loss of biodiversity and solid waste disposal)	305	269-279 (10 pages)	23 mixed questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	3%
GEOGRAPHY: Concepts of pollution domes; effect of urban population on the environment; managing urban challenges; handling environmental, economic and social justice concerns; effects of mining to the environment.	311	93-121 158-169 268-275 (46 pages)	28 mixtures of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	15 %
ECONOMICS: Environmental sustainability; the state of the environment; pollution; erosion; deforestation; desertification; measures to ensure sustainability; waste management matter and threat to endangered species	300	284-305 (21 pages)	32 Mixture of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	7 %
AGRICULTURAL SCIENCES: Sustainable use of medicine, genetic modification impact, strategic management, sustainable agricultural marketing, eco labelling,	345	viii, 49, 50, 85, 131, 134, 135, 156, 220, 251, 268, 281, 291, 296, 302, 313 349,353 (18 pages)	18 Mixture of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	5%

Table 5.19: Coverage of environmental impact topics in four teachers guide books

SUBJECTS AND ENVIRONMENTAL IMPACT CONTENTS	Total number of book pages	Number of pages with selected environmental impact topic	Number of assessment activities with environmental impact topics	Percentage of pages with environmental impact topics
LIFE SCIENCES Environmental Studies: Human impact on the environment (Revision of Grade 11: Atmosphere and climate change, water availability, water quality, food security, loss of biodiversity and solid waste disposal)	221	141-144 (4 pages)	23 mixed questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	2%
GEOGRAPHY: Impact of tropical cyclones on human activities and the environment, strategies to manage effects of tropical cyclones, anticyclonic air circulation around South Africa and its influence on weather and climate, influence of local climates on human activities, concepts of pollution domes-cause and effects, social justice issues in rural areas, causes and consequences of rural depopulation.	170	iv, v, ix, x, xii, xvii, 3, 34, 42, 46-48, 53, 55, 75, 77, 90-92, 104-106, 105,120,125, 128, 136, 150,167,168 (32 pages)	28 mixtures of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	19%
ECONOMICS: Economic systems, globalisation, environmental sustainability, state of the environment, major international agreements, natural resource depletion.	192	iv, x, 49,56, 105, 143, 145,146 150-159,170,172, 175, 187,181,182, 185, (24 pages)	32 Mixture of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	13%
AGRICULTURAL SCIENCES: Sustainable agricultural marketing.	183	133 (1 page)	18 Mixture of questions (graphs, multiple choice question, descriptions and tables, case studies, essay)	1%

Among the four textbooks analysed, Geography had the highest number of pages dedicated to environmental impact topics, with 46 pages as shown in Table 5.17, while Life Sciences had the least with only 10 pages of revision content that was based on environmental impact topics. Economics had about 21 pages dedicated to environmental impact topics. The nature of environmental formative assessment in the textbooks revealed that learners were exposed to different types of questions. This is depicted by Table 5.17 where assessment was based on questions which were composed of graphs, multiple choice questions, descriptions, case studies and the use of tables. The percentage comparison of environmental coverage in the textbooks shows that Geography, Economics Agricultural Sciences and Life Sciences had 15%, 7%, 5% and 3% coverage respectively. This is also shown in Figure 5.6 below where the largest share of environmental impact topics coverage is in the subject of Geography. This comparison is similar to all of the Grade 12 study guides compared, where Geography covers a wider array of content of environmental impact topics in the Grade 12 curriculum than other subjects. The least percentage coverage of environmental impact topics is in Life Sciences, which can be attributed to the fact that in Grade 12 Life Sciences, the curriculum allows for only the revision of environmental impact content taught in Grade 11. I also discovered in these analyses of learner's textbooks and teachers' study guides that the depth and breadth of the content is different. The analysis in this study showed in Table 5.19 that learner's textbooks had the necessary in-depth breadth and scope of content in the curriculum. The teachers' study guides only showed guidelines and marking memorandum of the content that has been well explained in the learner's textbooks. In this regard, the learner's textbooks contained rich information on the coverage of environmental impact topics in the Grade 12 curriculum within each subject. This is also shown in Figure 5.6 below in subjects such as Life Sciences and Agricultural Sciences.

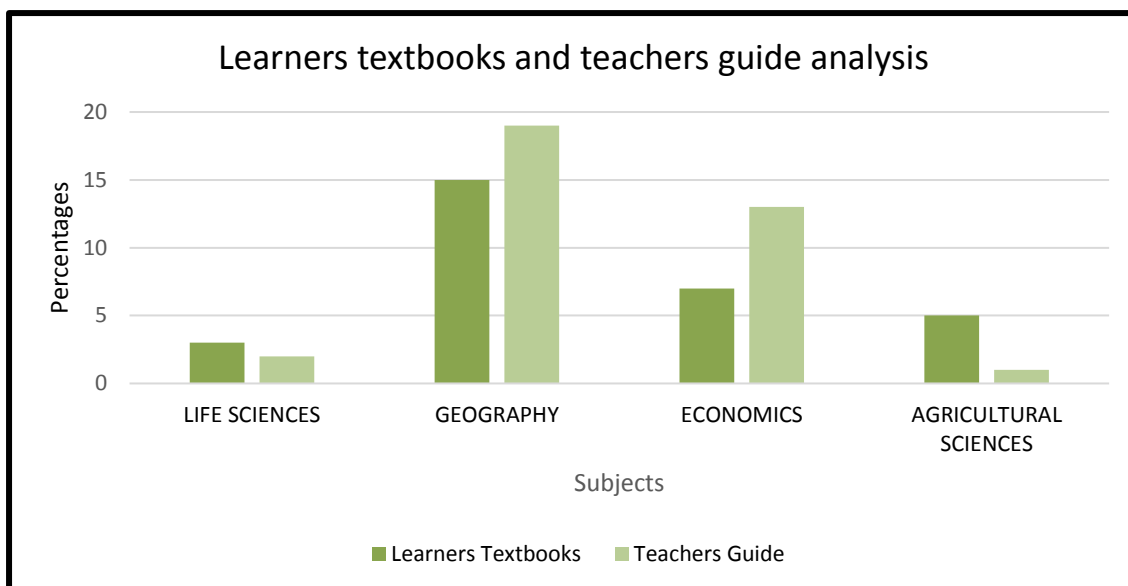


Figure 5.6: Percentage coverage of environmental impact topics in some Grade 12 textbooks

5.5 THEMATIC DOCUMENT ANALYSIS OF OLD NCS (GRADE 10-12) VERSUS CAPS

The data collected from the documents is based on grounded analysis where concepts in the form of structure, culture and agency were grouped into codes. Selective concepts resulted in categories that were grouped into an emerging theme (see Table 6.1 and Table 6.3). The analyses are presented in a schematic diagram as shown in the Figure 5.7 below

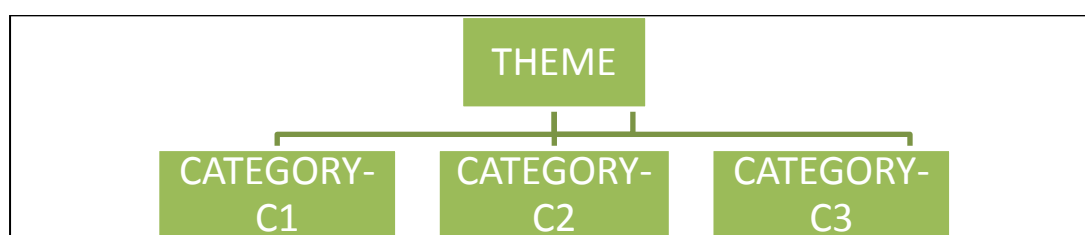


Figure 5.7: Diagrammatic presentation of the document analysis.

5.5.1 Theme: Coverage of Environmental Impact Topics in the Curriculum

This research is based on the conceptualisation of the data presented and analysed using Realist Social Theory (RST) framework developed by Archer (1993) and configured by Pawson and Tilley (1997). Four themes emerged from this study and these are tabled in Chapter 6, whereas one of the themes related to documents is

discussed in this section. The theme that emerged from document analysis is the coverage of environmental impact topics in the curriculum based on the RST theoretical framework context that comprises structure, culture, agency and relations explained in Chapter 4. Coverage of environmental impact topics emerged from the categories discussed below. The categories as shown in Figure 5.7 above are:

- 1) **C1-** Exploration of environmental impact topics in the CAPS and old NCS (Grade 10-12) policy documents and selected textbooks used by agents in the classroom;
- 2) **C2-** Exploration of environmental impact topics in the past examination question papers;
- 3) **C3-** Alignment between CAPS policy projections with past examination question papers;

5.5.1.1 C1-Exploration of environmental impact topics in the CAPS and old NCS (Grade 10-12) policy documents and selected textbooks used by agents (teachers) in the classroom.

The CAPS policy documents conform to the RST theoretical framework based on Context, Mechanisms and Outcomes configuration (CMOc) in the form of structure, culture, agency and relations. The CAPS policy is structured according to the previous curriculum old NCS (Grade 10-12) but also updates it and aims to provide clearer specifications of what is to be taught and learnt on a term-by-term basis. The following structures: examiners, policy developers, teachers, learners, SGBs, parents, and subject advisors, have emerged as agents in the learning process. CAPS policy documents stipulate what is to be learnt in different subjects of the curriculum. I believe that teachers and learners' ideas, theories, beliefs, values and arguments about subjects taught represent the culture of teaching and learning. This study's results showed that there was a significant change in environmental impact topics coverage from old NCS (Grade 10-12) to CAPS. These changes in the structural composition of environmental impact topics as noted by the RST have powers and potentials, which under certain conditions activate causal mechanisms that lead to occurrence of events (De Souza, 2014). Another notable change was that old NCS (Grade 10-12) defined each subject and provided a clear understanding to teaching and learning aspects

each subject focus area entails. For example, old NCS (Grade 10-12) defines Economics as the study of how individuals, businesses, governments and other organisations within our society choose to use scarce resources to satisfy their numerous needs and wants in a manner that is efficient and equitable. These scarce resources can be attributed to natural resources that EE/ESD are trying to ensure are not depleted and that they are saved for future generations. It can be noted that learning outcomes and assessment standards have been removed in CAPS and are now called content, topic and skills. In CAPS, learning areas are called subjects and unlike in old NCS (Grade 10-12) the teaching of environmental impact topics requires weekly lesson plans as opposed to daily lesson plans in old NCS (Grade 10-12).

The analysis of the old NCS (Grade 10-12) principles shows that the government focus was mainly on learners as opposed to CAPS which is content-driven in terms of environmental impact topics coverage. This study found that the old NCS (Grade 10-12), in terms of educational principles, was fully focused on learner-centeredness and activity-based education while CAPS encourages critical thinking and an active approach to learning. It was also noted that the old NCS (Grade 10-12) focused on addressing the inequalities of the past and that this was evident in the CAPS policy documents which has a focus on environmental and social justice. The study found that CAPS placed more emphasis on content and the learning approach that that can be associated with a content-driven approach, while old NCS (Grade 10-12) puts more emphasis on OBE, with discovery-based learning as the norm.

As mentioned earlier, the structure of old NCS (Grade 10-12) is different compared to CAPS, thus exploration of the CAPS policy documents as seen in Table 5.4 comprised of the core subjects in Grade 12. The results of this study revealed that old NCS (Grade 10-12) structure made it impossible to compare the coverage of each topic in the policy since environmental impact topics were written as themes. The core subjects further analysed in CAPS were Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies, Economics, History, Accounting, Mathematics, Mathematical Literacy and English First Additional Language. I chose these subjects because they formed part of the core subjects in Grade 12 according to the DBE (2016). The six teachers interviewed in two schools teach some of the subjects analysed and in the other four schools, the teachers taught some of the subjects. It is also important to note that both the old NCS (Grade 10-12) and CAPS

policies advocate that EE become an integral part in all learning areas, which was helped by the National Curriculum Statement Grades R-12 principle of human rights, inclusivity and environmental and social justice.

According to Dreyer and Loubser (2014:128), the Environmental Education Policy Initiative (EEPI) suggested four main policy options for introducing EE into the formal education system. One of the suggested options that was implemented in the South African curriculum was teaching EE as a component in the subjects offered by the DBE. It is against this background that components of EE such as environmental impact topics extent of coverage are being investigated in this study. As seen in Table 5.3, the CAPS documents for subjects such as Accounting, Mathematical Literacy, Mathematics and English First Additional Language do not contain environmental impact topics in the programme despite the aim and principles mentioning the inclusion of environmental topics in the curriculum. This could have had negative implications in the teaching and learning of environmental impact topics and also in examinations.

I was surprised by the analysis in Table 5.3 that some subjects did not embed EE themes in the curricula as mentioned above. In my view, the non-inclusion of EE in some subjects' curricula is derailing efforts made by different countries' initiatives in ensuring that their people have knowledge about environmental impacts, which could change negative environmental behaviour into positive environmental behaviour. On the same note, History in both policies (old NCS (Grade 10-12) and CAPS) does not have specific environmental impact topics, but some sections do have topics covering environmental impact topics.

The implication of the results are that it is difficult to incorporate EE topics in some subjects even though the policy stipulates the inclusion of these topics. On the same note Bas (2013) indicates that it is a challenge to structures in the education sector to reflect EE curricula into practice and even sometimes impossible. This statement is supported by the study's results, which discovered that in some subjects no trace of EE was found in the documents.

The non-coverage of environmental topics in the CAPS documents of some subjects in the first phase of analysis compelled the researcher to reduce the number of subjects that were analysed from 11 to 6 for the second phase of analysis. The

subjects that were further analysed in the second phase are Life Sciences, Geography, Agricultural Sciences, Physical Sciences, Business Studies and Economics. However, in old NCS (Grade 10-12) there were only Economics, Physical Sciences, Geography and Agricultural Sciences to be analysed. The results in Table 5.3 reveal that the subjects analysed had a number of topics ranging from 12 to 52, with Physical Sciences recording the highest number. It was impossible to replicate the analysis for old NCS (Grade 10-12) because of the structure of the policy documents where the content was in themes rather than topics as shown in CAPS.

In the CAPS policy analyses, Physical Sciences, despite having the highest number of topics recorded, only had two environmental impact topics as seen in Table 5.3. Using the results of the policy documents, I suggest that policy makers should ensure that all aspects or components of curricula to be implemented should be appropriately proportioned. The apportioning of the different themes such as EE with certain breadths of coverage in all subjects will assist in ensuring that all non-compliance by some subject's policy developers is avoided.

Furthermore, Life Sciences recorded the highest time allocation for environmental impact topics, accounting for about three weeks in the year. The allocation of time for Geography, Physical Science and Economics is only two weeks per year when using the school calendar. According to the CAPS policy documents, the percentage time allocation of environmental impact topics was 9% for Life Sciences, 8% for Economics, 7% for both Geography and Physical Sciences, 4% for Business Studies and 3% for Agricultural Sciences as seen in Table 5.3 and Figure 5.5. Thus, the average extent of coverage of environmental impact topics in the South African curriculum was at 6.3%. These results reveal that the breadth of coverage of environmental impact topics was not consistent in all of the subjects that have been analysed. This inconsistency can be attributed to different subject policy makers who did not adhere to the principle of inclusion of environmental education in all subjects. As a result, these lead to the cultural changes of an action context which shapes and is shaped by groups of individuals (Archer, 1996). As seen in Table 5.3, some subjects had no space for the inclusion of environmental impact topics in their curricula. The non-compliance of some subject policy makers to include environmental impact topics in the curricula undermines efforts by the government to ensure that education is one of the platforms that can be used to ensure that literate citizens are environmental aware. It can be

noted that subjects such as Accounting, Mathematical Literacy, Mathematics and English have not developed curricula that ensure that education for sustainable development is encouraged at all times. It can be deduced from the study that the non-inclusion of environmental impact topics in some subjects mentioned above spreads a negative culture to stakeholders that environmental topics are not necessary to their teaching. This can have negative implications, such as promoting the opinion that an EE curriculum is impossible to put into practice. As mentioned above the non-compliance of policy makers is against the principle of the CAPS curriculum, which highlights the issues of progression:

Progression: content and context of each grade shows progression from simple to complex Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors (DBE, 2016)

What changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?

The major changes that were brought by the shifts of the curriculum from old NCS (Grade 10-12) to CAPS in the policy statements were revealed in subject policies such as Economics, Business Studies and Agricultural Sciences, where there was a notable increase in the breadth of environmental impact coverage in CAPS compared to old NCS (Grade 10-12) as shown in Table 5.19 below. Another major change in the curriculum was seen in the CAPS policy subject statements revealing that in subjects such as Physical Sciences, Life Sciences and Geography there was a decrease in the breadth of content in CAPS when compared to old NCS (Grade 10-12). It has to be mentioned that the comparison of policies is completely different from the comparison made in the depth of the coverage of environmental impact topics in the past examination papers, where results are discussed in the next section. This section only focuses on the breadth of environmental impact topics only as found in the policy documents.

Table 5.20 Summary of the breadth of environmental impact topics coverage in the policy documents

DECREASE OR INCREASE OF THE BREADTH IN CAPS vs. old NCS (Grade 10-12) POLICIES	
INCREASE	DECREASE
Economics Business Studies Agricultural Sciences (in CAPS when compared to old NCS (Grade 10-12))	Physical Sciences Life Sciences Geography (in CAPS when compared to old NCS (Grade 10-12))

This study also provides an analysis of textbooks used by the participants in schools. The three textbooks analysed were from Life Sciences, Geography and Economics. The subjects were analysed according to the total number of book pages against the number of pages with environmental impact topics. The presentation of this data is seen in Table 5.17. In Life Sciences, environmental topics that were analysed included atmosphere and climate change, water availability, water quality, food security, loss of biodiversity and solid waste disposal as seen in Table 5.17. All of these topics in Life Sciences were fully taught in Grade 11 but were only revised in Grade 12 and therefore the percentage coverage in the Grade 12 textbook was 2% because the topics were only in Grade 12 for revision purposes.

The analysis also revealed that the Geography textbook had about 15% of environmental impact topics coverage. The environmental topics that were covered were of concepts such as pollution, effects of urban population on the environment, managing urban challenges, handling the environment, economic and social concerns and effects of mining on the environment. The coverage of environmental impact topics in the textbook was higher than required by the CAPS policy document. This may be attributed to the fact that the textbook coverage has to explore all of the environmental impact topics in detail and learners are exposed to a large variety of information.

The Economics textbook analysed comprised of the following environmental impact topics: environmental sustainability, the state of the environment, pollution, erosion, deforestation, desertification, measures to ensure sustainability, waste management matter and threats to endangered species. Different trends were observed in the

content analysis of Economics. The difference was that the overall coverage of the topics in the textbook is 7%, which was lower than the CAPS subject policy for Economics, which is 8%. The inconsistency in the coverage of environmental topics between policy and textbooks might result in agents being confused about teaching the topics in terms of the depth and breadth of the teaching of environmental topics in the classroom. This inconsistency could result in less teaching of environmental impact topics in the classroom. This could have a negative impact on how learners are being taught environmental impact topics, which could result in more negative behaviour towards sustainable living and development.

These results conform to Archer's (1996) assertion of the realist social theoretical framework that institutional structures are sets of related objects and practices that are carried out by human resources and can relate to the context of action. In agreement, Di Chiro (2014) further asserts that environmental problems are social problems caused by societal practices and structures and only viewed or socially constructed as problems because of their effects on human individuals and groups. Moreover, other living things and systems are affected as well. The agency of teachers to engage in action or non-action is seen in this section, where the structural and cultural conditions play an important role in influencing decisions taken by teachers due to the inconsistency in coverage of environmental impact topics between the old old NCS (Grade 10-12) and new CAPS curriculum. The idea that environmental impact topics are inconsistently covered in all subjects' policies and textbooks can inculcate a culture where teachers have different responses towards teaching of these topics to learners. This does not only influence structures such as teachers and examiners, however, as learners are also affected by the inconsistency of environmental impact topics coverage in documents. Environmental education should not be seen as a section for some subjects only, but it should be incorporated in all subjects and there should be consistent coverage of the topics yearly.

5.5.1.2 C2- Exploration of environmental impact topics in the past examination question papers

The second category of document analysis in the study is the exploration of environmental impact topics in the past examination papers. As discussed in Section

5.5.1.1 above, 11 subjects were chosen for analysis and the CAPS policy documents stipulates that all subjects must have coverage of EE.

The analysis of past examination papers was based on the breadth and depth of environmental issues embedded in the question papers. The breadth was characterised by environmental impact topics, which included but were not limited to ozone depletion, global warming, energy consumption, acid rain, air pollution, marine pollution, mineral resource depletion, soil destruction, soil erosion and desertification. Furthermore, some topics were biodiversity reduction, extinction of plants and animals, nuclear reactors and waste disposal, human health and diseases, world hunger, land use, solid waste disposal, hazardous chemicals, habitat destruction, invasive species, water quality and wildlife management. The period of analysis was from the year 2006 to the year 2015. These years fell within the UNDESD, which is also characterised by the shifts of the curriculum from the old old NCS (Grade 10-12) to the CAPS curriculum.

This analysis is based on four subjects out of eleven sampled for analysis because no trace of environmental impact topics coverage was found in the other seven subjects, in both old NCS (Grade 10-12) and CAPS.. The analysis of past examination papers is therefore based on four subjects, which are Life Sciences, Geography, Agricultural Sciences and Economics as seen in Table 5.9 to Table 5.16.

All of the October/November papers for each subject from 2008 to 2015 were analysed for evidence of breadth of environmental impact topics as the curriculum policy stipulated and more information is discussed in Section 5.5 on how the analyses were done in this research. As shown in Table 5.5, Life Sciences average coverage was about 6.2% in old NCS (Grade 10-12) before the shift of the curriculum in the year 2012 and in the new CAPS curriculum, it was 8.8%. The results show that the shifts in the curriculum improved the depth of content coverage of environmental impact topics in the Grade 12 examination from 2006 to 2015. The significant improvement of the coverage is likely to influence teachers and learners in gaining in-depth knowledge of environmental impact topics to aid in their livelihoods. In the subject of Life Sciences, it was observed that one of the similarities was that the two curricula had alignment of policy and practice in terms of the content to be taught and utilised practice on the ground in the coverage of environmental impact topics in the examinations as seen in

Table 5.11 and Table 5.12. It can be noted that the increase of depth of coverage in the examinations in this subject is in line with the policy proportion of 8% coverage of environmental impact topics that must be in the examinations. This is one of the major positive initiatives that this thesis has discovered, and recommendations are that all policies should implement the actual proportions of each content area in the curriculum that must be examined like in Life Sciences. This implies that learners, teachers and examiners will have more knowledge that is adequate about the extent of environmental impact coverage in the summative assessment.

The CAPS curriculum, as analysed in this study, is driven by examinations, which could be detrimental in ensuring that learners are able to grasp as much information from other resources without being pressured to pass the examinations for progression. I argue that examinations that are formative assessment in nature can be used for progression and they have to carry the same weight as summative assessment, in contrast to what teachers have said in Chapter 6. If the culture of teaching and being involved in formative assessment can be cascaded to summative assessment, learners and teachers will have more time to concentrate on other topics in all subjects. Hence, environmental impact topics will be prioritised as shown in the diagnostic report.

In Geography, the average coverage of environmental topics in the old NCS (Grade 10-12) is about 10.7% and in the CAPS, it is about 12%. This result is similar to Life Sciences, which also shows that the CAPS curriculum has increased the content of environmental impact topics in the summative assessment. When comparing the topics, it can be mentioned that the old NCS (Grade 10-12) had the widest range of environmental impact topics when compared with the CAPS. It can therefore be concluded that the change in the Geography curriculum has resulted in decreased the breadth coverage in new CAPS document but increased environmental impact percentage coverage in the actual Grade 12 examinations when compared to the old NCS (Grade 10-12).

In Agricultural Sciences, the coverage of environmental impact topics in the examination is minimal. The old old NCS (Grade 10-12) curriculum had an average of 0.3% compared to CAPS with an average of 2.5% as shown in Table 5.4, indicating an increase in the content coverage in the examinations. In Agricultural Sciences, the

change in the curriculum benefited the coverage of environmental impact topics in the examinations. The policy coverage and examination of environmental impact topics were not aligned in old NCS (Grade 10-12). The term “alignment” in this study means the comparison between policy and examination coverage as seen in Table 5.15 and Table 5.16.

Table 5.5 shows the average coverage percentage of examination of the environmental impact topics in Economics. The results show that in the old NCS (Grade 10-12) the average is 4.5% compared to CAPS with an average of 10.8%. Economics’ breadth of content coverage in the examination shows a significant difference of 6.3%. As a result, the changes to the curriculum increased coverage of environmental impact topics in the examinations. Out of all four subjects that were further analysed in this research, Economics had the highest coverage of environmental impact topics in the examination in the new CAPS curriculum followed by Geography as seen in Figure 5.2. I have noticed a surprising element in that some subjects have different degrees of percentage coverage of environmental impact topics in the curriculum. The observed difference does not occur across subjects, but it occurs yearly, as can be seen in Tables 5.5 to Table 5.8. The results reveal that there is no alignment even within a subject in consecutive years when comparing percentage coverage from 2006 to 2015.

Certainly, the content coverage of environmental impact topics in the curriculum has an effect on the way teachers prepare and use documents for lessons and examination practices. This research revealed that past examination question papers were used most of the time when preparing learners for the examinations in Grade 12. The study also showed that past examination papers assist teaching by showing the depth to which a topic has to be taught in the classroom, how learners are supposed to respond to particular questions and provide learners with an idea of the examination itself before sitting for the final examinations. All of these aspects confirm the existing views that the structural condition of the examination papers influences the actions of both teachers and learners who are agents in the school environment. This study’s argument is that this emerging culture of using past examination papers for studying and revision is retarding learners from knowing about other topics in the curriculum that have inferior coverage in the examinations. In conclusion, it can be mentioned that all the four subjects analysed, namely Life Sciences, Economics, Geography and

Agricultural Sciences revealed that the percentage of coverage of environmental impact topics in the examinations increased after the shift of the curriculum from old NCS (Grade 10-12) to CAPS. Hence, there is an emergence that is always actively-dependent on whether teachers in this study slip into designated pre-existing cultural positions to engage (or not) in social practices that lead to costs and benefits (Archer, 1995). In this study the increased in coverage of environmental impact content in the CAPS will be beneficial to both teachers and learners.

5.5.1.3 C3- Alignment between CAPS policy projections with past examination question papers

RST framework can be applied in the way past examination question papers are aligned with the CAPS policy projections. The structure of CAPS in terms of content coverage has influenced the structure of the content of environmental impact topics in the examinations. The policy documents for all eleven core subjects chosen for this study were analysed. Table 5.3 depicts the total number of topics, total number of environmental impact topics, tuition time, percentage time allocation for environmental impact topics in weeks and mark allocation in the examinations for environmental impact topics in each subject. Again, as seen in section 5.6.1.1 above, policy documents for subjects such as Accounting, Mathematics, Mathematical Literacy and English First Additional Language did not include specific content for environmental impact topics in their outline. In contrast, the general aim of these subjects clearly mentions that they are based on the following principles: human rights, inclusivity and environmental and social justice. Infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa was not evident. Therefore, these subjects were removed from the second phase of analysis.

The analysis of alignment was thus based on the four subjects analysed in section 5.5.1 above, namely Life Sciences, Geography, Agricultural Sciences and Economics. Firstly, Life Sciences policy document shows coverage of about 8.9% of environmental impact topics when compared to an average of 8.8 % actual examinations in the CAPS curriculum. The results of Life Sciences show an insignificant difference of 0.1% and this study concludes that in Life Sciences there is alignment between CAPS policy projections and the actual examinations in the new curriculum from 2012 to the year

2015. It can be mentioned that the CAPS policy projections in Life Sciences specifically mention the number of marks that must be allocated to the topic in the final examinations. Based on the alignment it can be concluded that specifying the depth of content coverage in the examinations also assists examiners to fully adhere to the policy projections. I therefore suggest that the alignment of policy and summative assessment of Life Sciences should be implemented by other subjects in the curriculum. This study proved that properly defined percentage coverage of any topic coverage in the policy document positively influences alignment in the examinations. However, in Life Science each year the percentage coverage of environmental impact topics was not consistent.

Secondly, in Geography the depth of environmental impact topics in the CAPS document is about 7.4% compared to the actual depth of coverage in the examination of 12%. The difference between CAPS policy projections and the actual examinations is 4.6%. Geography shows a misalignment between the CAPS policy requirements and actual examinations of environmental impact topics from the year 2012 until the year 2015. Although more content was covered in the examinations, it can be noted that the misalignment could contribute to teachers being aware of how to assist learners with revision because of the broad coverage of environmental impact topics in past examination question papers. I believe that teachers could develop a culture of teaching more environmental impact topics in the classroom as they can be influenced by the extent of coverage in the actual examinations.

Thirdly, in the Agricultural Sciences CAPS policy, requirements for environmental impact topics is about 3.4% compared with 2.5% average coverage in the past examination question papers. In this subject, it can be concluded that the 0.9% difference is significant, therefore there is alignment between CAPS policy projections and content coverage of environmental impact topics in past examinations.

Lastly, in Economics, CAPS policy requirements account for about 7.7% of environmental impact topics while past examinations show an average of about 10.8%, showing a greater coverage of environmental impact topics in the examinations than the policy required. In agreement with these results, Khan and Law (2015) mention that the alignment in coverage between the curriculum published by the educational institutions and the curriculum actually taught by the teachers in their

classrooms would enhance teaching of environmental impact topics in the classroom. The curriculum taught in the classroom is actually comprised of the content that is finally used as examinable content for learners.

5.5.2 Analysis of the National Senior Certificate Diagnostic Report on Environmental Impact Topics

The National Senior Certificate diagnostic report for Nov/Dec 2016 is a detailed per-question analysis of learner's responses, which indicates weaknesses from the examinations (DBE, 2017). Uncovering misconceptions or error patterns for learners can help teachers to improve teaching and assessment of challenging questions (DBE, 2017). In this study, four subjects were purposely selected to be analysed since their content contains environmental impact topics. These subjects were Agricultural Sciences, Life Sciences, Economics and Geography.

Firstly, in Agricultural Sciences, the report mentioned that learners were still struggling with environmental impact terms used in the summative assessment, which are the examinations. Teachers were encouraged to give learners terms and concepts used in teaching environmental impact topics distributed monthly (DBE, 2017:32).

Secondly, the diagnostic report stated that in Economics learners performed poorly in the examinations and teachers were advised to use CAPS past examination papers to prepare for future examinations. The report mentioned that most learners confused the concept of greenhouse gasses with green gasses. The diagnostic report also highlighted that learners could not clearly differentiate between conservation and preservation on the environmental sustainability topics (DBE, 2017:66). The report further mentioned that, in Economics, environmental impact topics were poorly answered, where learners battled to explain how consumers fail to protect the environment. The report further highlights that learners regard environmental sustainability topics as unimportant, hence they have difficulty in correctly answering the questions being posed in the examinations (DBE, 2017:67).

Thirdly, in Geography, the diagnostic report mentioned that one of the poorly done sections was on the negative effects of humans on the environment. In this section, most learners' answers revealed that they knew that erosion and deposition play a role in degradation, but they could not elaborate further. This study found that learners

were taught skills required for the reading and interpretation of questions that focus on detrimental effects on climate change. The analysis of examination question papers also revealed that while learners could describe the activities of inhabitants in informal settlements, they were not able to evaluate the impact of these activities on the environment.

Lastly, in Life Sciences, the diagnostic report stated that learner's performance revealed that the questions on environmental studies, which were taught in Grade 11, were not revised properly or covered again in Grade 12 (DBE, 2017:122). The report further mentioned that textbooks cannot be used without consulting or being guided by CAPS and Examination Guideline documents for Life Sciences. The report also revealed that learners performed badly, with an average of 42%, in Question 3 whose sections contained environmental impact topics compared to Question 1, Question 2 and Question 4 that had an average of 57%, 43% and 45% respectively. The average percentage per sub-question revealed that the topic of pollution had the worst performance when compared with the other sub-questions in the examination papers from 2013 to 2016.

According to the diagnostic report for 2016, most learners did not specify the impact that thermal pollution has on both the quality of water and biodiversity. From the analysis of the diagnostic report, it is important that human impacts are adequately taught in Grade 11 and fully revised in Grade 12 to ensure that learners are exposed to questions based on information from extracts on environmental impact topics. As seen in this section, the diagnostic report is an important document that can be used by teachers in ensuring that learners perform well and understand environmental impact topics. In terms of the RST framework, the diagnostic report is a structural component that can be used effectively by agents who are teachers and learners in developing understanding of important aspects in teaching environmental impact topics. This study shows that the education sector uses documents such as diagnostic reports to equip teachers in ensuring that learners pass the examinations (See section 5.5.2). The next section presents conclusions of the document results and analysis.

5.6 CONCLUSION OF THE STRUCTURAL, CULTURAL AND AGENTIAL DIMENSION OF DOCUMENTS

In this study, the RST comprised framework for analysing the educational social structure in this study on the extent of coverage of environmental impact topics in some selected subjects in the CAPS curriculum. In the investigation of documents, social structures comprise dimensions of structure, culture and agency, which interact to shape and re-shape the conditions people have for engaging in action.

5.6.1 Structural Dimension of Documents

In this study, the structural dimension of documents entailed investigating relevant documents to identify the extent of coverage of environmental impact topics in the curriculum. Furthermore, in this study, social structures are activity-dependent, requiring agents (teachers and policymakers) to engage in social activities in order to sustain or transform them. The structural dimension provides agents with contexts within which to pursue activities and interests (De Souza, 2017). The structural dimension of documents that were investigated in this study were DBE documents, which comprised of the CAPS policy documents, past examination question papers and selected textbooks used by agents. The study showed that social structures play an important role in ensuring that educational change takes place despite challenges in implementation of educational policies (See Chapter 5). Documents as structures play an important role in ensuring that the necessary information on environmental impact topics is disseminated as it is presented in the documents. It is then the duty of the stakeholders to implement policies in a progressive manner.

The investigated policy documents indicated that there is provision for EE in the curriculum. All of the policy documents allow EE to be taught in all subjects. However, the study realised that policy implementation was a challenge where further investigation was instituted in only some selected subjects that had environmental impact content. This study has noted that in the Life Sciences subject policy, the extent of coverage of environmental impact topics was strictly specified and that allowed examiners to be able to include the necessary proportion of environmental topics in the summative assessment. In contrast, when the structure of other subjects' examination papers was analysed, the extent of coverage of environmental topics was of varying degrees. The implication of misalignment of environmental impact topics

within subjects, across subjects and between years of examination affects change, which can then enhance or compromise education for sustainable development. However where there is greater coverage in the examination of environmental impact topics teachers will be encouraged to incorporate more environmental impact topics in their teaching.

5.6.2 Cultural Dimension of Documents

In this study, cultural dimension of documents is affected by ideational influences, which have an influence on agential activities, and may be consistent with or contradictory to prevailing, dominant ideas held by other groups or individuals, thereby facilitating or hindering change. In this study, teachers' (who are agents) commitment to teaching learners depends on several structural aspects such as the usage of past examination papers as one of the main resources in teaching environmental impact topics. The extent of a particular topic being covered in the previous examination greatly influences or changes the way teachers, examiners and policy makers will emphasise that particular topic in the classroom and examination papers. For instance, when environmental impact topics are inconsistently covered in the examinations, teaching and learning will tend to either devote more time for the topics or less time for the topics, thus enhancing or hindering knowledge accumulation in the learning process.

The education system in South Africa is examination-oriented and learners are progressed to the next level of education based on how they were able to memorise and pass the examination and not by how they are able to use the knowledge acquired in the classroom to effect change in their lives. Structures such as schools and teachers are evaluated according to the number of learners that pass examinations at the end of the year. It is my opinion that the implication of this examination oriented system affects the teaching of environmental impact topics, as seen in the results of the study that in some subjects' past examination question papers there was no coverage of these topics, yet policy suggests that EE must be incorporated in all subjects. This study's results show that the culture of curriculum developers of not aligning policy and practice had a negative influence on the teaching and learning culture. Teachers and learners are greatly influenced by documents and what content is covered in the documents. The non-inclusion of environmental impact topics in the

examination of subjects such as English First Additional Language, Mathematics, Mathematical Literacy and Accounting negatively affects the way teachers prepare lessons for environmental impact topics. The belief and commitment to teaching EE for these subjects becomes low due to misalignment in the documents. This study has revealed that the culture of examiners not interpreting the policies well, leads to a compromised culture of teaching and learning in terms of coverage of environmental impact topics in documents. This might deprive learners of their right to know about measures to be taken to live in a health environment. However in subjects such as Life Sciences, Agricultural Sciences and Economics, there was alignment between policy and actual practice and that will influence positive integration of environmental impact topics in the classroom.

5.6.3 Agential Dimension of Documents

This study has discovered that documents have agential effects on teaching environmental impact topics. One of these effects can be that teachers who are agents in this study as mentioned above are affected by the extent of topic coverage in the documents such as policy and examinations. Teaching might be affected in that teachers take action or no action depending on what has been developed and experienced in previous years in terms of content coverage in documents. The implication of teachers to be influenced by the agential effect of coverage can have a negative or positive influence in the way they teach in the classroom. Chapter 6 of this study shows that teachers devote their time to teaching environmental impact topics using different teaching strategies. Nonetheless, if the policy makers and examiners do not align what is in the policy with practice, it is likely that teachers will tend to concentrate on teaching and revising topics that have a wider coverage in the final year exit examinations because of the agential effects of the documents. Therefore, the extent of coverage can hinder or transform pedagogy in the classroom. In this study, it appears that the agential effect of the documents influences educational structures where they develop a culture of reliance on documents in shaping a lesson in the classroom. Consistent or greater coverage of environmental impact topics will result in teachers focusing more on teaching these environmental impact topics. Hence, I strongly argue that EE should not be seen as a piece of content that can be integrated across all subjects, but it should rather be a separate subject that is made compulsory in all phases like Life Orientation.

5.7 SYNTHESIS OF THE DOCUMENTS RESULTS AND ANALYSIS

This Chapter answered this research sub-question: “*what changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?*” In ensuring that this question is answered, the results and analysis of data for this study revealed that all CAPS subjects should have components of EE, which is supported by the policy documents. The study also revealed that CAPS documents for subjects such as Accounting, Mathematical Literacy and English First Additional Language did not contain environmental impact topics in the programme despite the aim and principles mentioning the inclusion of environmental topics in the curriculum. It can be deduced that the non-inclusion of EE components in the subjects’ policy documents can influence a negative culture among teachers not to teach EE to learners in the classroom. This can have a negative influence on social structures such as learners and teachers as they would not be able to practice or inculcate positive environmental behaviour respectively. The study also revealed that Physical Sciences, despite having the highest number of topics, recorded only two environmental impact topics as seen in Table 5.3. One of the major changes that has been seen in this study is that subjects such as Physical Sciences, Life Sciences and Geography had a wider coverage of environmental impact topics in the old NCS (Grade 10-12) when compared to the CAPS. However, subjects such as Economics, Business Studies and Agricultural Sciences had improved coverage of environmental impact topics in CAPS policy documents. It is worth noting that in the second phase analysis of examination coverage of four subjects that had environmental impact content, which were Life Sciences, Economics, Agricultural Sciences and Geography, it was noted that they all recorded an increased percentage of coverage in CAPS when compared to old NCS (Grade 10-12) as seen in Tables 5.5 to 5.8.

It is also important that policy makers include all aspects or components of curricula to be implemented in the curriculum as well as the appropriate apportioning of the different themes such as EE with a certain breath of coverage in all subjects. The results showed that the breath of coverage of environmental impact topics was not consistent in all of the subjects that were analysed. This inconsistency can be attributed to different subject policy makers who do not adhere to the principle of inclusion of environmental education in all subjects. As seen in table 5.3 some subjects have no space for the inclusion of environmental impact topics in their curricula. The

non-compliance of some subject policy makers to include environmental impact topics in the curriculum seems to undermine efforts by government to ensure that education is one of the platforms that can be used to ensure that literate citizens maintain a healthy environment and do not deplete natural resources. It was also found that subjects such as Accounting, Mathematics Literacy, Mathematics and English could not develop curricula that strives to ensure that education for sustainable development is encouraged at all times.

It is also important to highlight that the CAPS curriculum has detailed presentations of what is to be taught in the classroom compared to old NCS (Grade 10-12). To illustrate the observable changes documents analysis for Table 5.5, Table 5.6, Table 5.7 and Table 5.8 all show that before 2012 the coverage of environmental topics was less than in CAPS, which is the period after 2012. This study also revealed inconsistency in the coverage of environmental topics between policy and textbooks. The implication of this inconsistency is that agents might be confused about how they will position themselves in terms of teaching the topics in future. I am of the opinion that EE cannot be seen as a section for some subjects only but it should be equally incorporated into all subjects and there should be consistent coverage of these topics in all subjects as depicted in the CAPS policy.

The second sub-question the study answered was: *“to what extent are environmental impact topics being examined in the Grade 12 (Matric) exit examinations?”* In providing answers for this question, past examination question papers from the DBE were analysed. Firstly, the results showed that four subjects out of eleven have coverage of EE components even though the CAPS policy stipulates that components of EE that must be covered in the curriculum. These subjects with EE components were Life Sciences, Geography, Agricultural Sciences and Economics. The implication of non-coverage of EE components in the summative assessment can lead to a culture in teaching and learning of concentrating on teaching components in the curriculum that are examinable. Apart from the four mentioned above, the other subjects showed no coverage of environmental impact topics coverage. This confirms the results of policy documents where components of EE were not included for teaching and learning. These subjects were Accounting, Mathematical Literacy, Mathematics and English First Additional Language.

Secondly, in Life Sciences average coverage before the shift of the curriculum in the year 2012 was about 6.2% and in the new CAPS curriculum, it was 8.8%. The implication of these results is that the shifts in the curriculum improved the breadth of content coverage of environmental impact topics in some subjects. The significant improvement in coverage is likely to influence teachers and learners to have more in-depth knowledge of environmental impact topics in their livelihood. The four subjects analysed revealed similar results where the CAPS coverage of EE components in examinations improved compared to the old curriculum. The improvement has brought a positive change in CAPS to align the policy with practice. The results of the study also reveal that the constant coverage of environmental impact topics in the examination, as revealed from the teacher interviews, affects the way teachers prepare for future examination of the learners. It is evident in this research that teachers use past examination question papers for practicing for the forthcoming examinations (as seen in Chapter 6). The culture of using past examinations to prepare final year learners is evident in this study and it implies that inconsistency can be detrimental in the teaching and learning of EE components in the classroom because of the examination driven teaching and learning approach. In support of this, Gough (2013) points out that the inclusion of EE in the curriculum allows for the construction of transcultural spaces in which scholars from different localities collaborate in reframing and disseminating their own knowledge traditions, and states that much needs to be done in terms of research about it as EE continues to evolve and transform.

I strongly believe that examinations, which are summative assessment in nature, should carry the same weight as formative assessment. For example, a learner's final progression mark should comprise of 50% from formative assessment and 50% summative assessment. I suggest that examinations should not be allocated a higher proportion of percentage in order to progress learners. This will allow teachers and learners to have more time to concentrate on other topics in all the subjects. This will lead to topics such as environmental impact topics being recognised as one of the core components of the curricula.

Thirdly, Economics had the highest coverage of environmental impact topics in the examination in the new CAPS curriculum followed by Geography as seen in Figure 5.3. I was surprised to note how some subjects had different degrees of coverage of environmental impact topics in the curriculum. The observed difference did not occur across subjects, but it occurs yearly. The results revealed that there was no alignment

even within a subject in consecutive years. It is important to note that in all of the subjects analysed, each year had different proportional coverage of environmental impact topics. As mentioned above, this can lead to a culture of paying more attention to teaching EE components in the classroom when the coverage is more and less attention will be given to these topics when coverage in examinations is less.

Lastly, the study also revealed that past examination papers assisted teachers to know the depth and breadth to which a topic has to be taught in the classroom, how learners are supposed to respond to particular questions and provide learners with an idea of the examination itself before sitting for the final examinations. This study's 'closing argument is that the emerging culture of using past examination papers for studying and revision could enhance learners understanding of environmental impact topics. However if the coverage of EE content is less in the examinations that could retard learners from knowing more EE content in school as teachers will tend to concentrate on topics that are likely to be covered in the examinations.

This study focused on the alignment between CAPS policy projections with past examination question papers. The alignment analysis was thus based on the four subjects analysed in section 5.6.1.1 and 5.4.2 above, namely Life Sciences, Geography, Agricultural Sciences and Economics. Firstly, the results of Life Sciences show a difference of 0.1% and thus this study concludes that in Life Sciences there was alignment between CAPS policy projections and the actual examinations in the new curriculum from year 2012 to 2015. The implication of this alignment is that it can contribute to teachers having confidence that what they are teaching in the classroom will eventually be part of the summative assessment at the end of the year. Based on the alignment it can be concluded that specifying the depth of content coverage in the examinations also assists examiners to fully adhere to the policy projections. In this study, I propose that the alignment of policy and summative assessment observed in Life Sciences can be adopted by other subjects in the curriculum. A properly defined breadth of any topic coverage in the policy document positively influences alignment in the examinations.

Secondly, in Agricultural Sciences CAPS policy requirements for environmental impact topics was about 3.4% compared with 2.5% average coverage in the past examination question papers. In this subject, it can be concluded that the 0.9% is insignificant, therefore there was alignment between CAPS policy projections and content coverage of environmental impact topics in past examinations. Lastly in

Geography and Economics, there was a misalignment between the policy and actual coverage in the examinations. It can be argued that the alignment could contribute to teachers being aware of how to assist learners with revision because of the increased coverage of environmental impact topics in the past examination questions. This misalignment affirms Khan and Law's (2014) results that there is a significant difference between the curriculum published by the educational institutions and the curriculum actually taught by the teachers in their classrooms.

This study discovered that teaching and learning in CAPS is examination-driven. The implication of an examination-orientated curriculum is that learners only strive to pass the examinations and progress to the next level without even practicing what they have been taught. This leads to the results of the National Senior Certificate diagnostic report on environmental impact topics. The diagnostic report also shows that in Economics, learners performed poorly in the examinations and teachers were advised to use NSC/CAPS past examination papers to prepare for future examinations. The diagnostic report for 2016 also revealed that in Life Sciences most learners did not specify the impact that thermal pollution has on both the quality of water and biodiversity. From the analysis of the diagnostic report, it is important that human impacts are adequately taught in Grade 11 and fully revised in Grade 12 to ensure that learners are exposed to questions based on information from extracts on environmental impact topics. This study discovered that the education sector uses documents such as diagnostic reports to equip teachers in ensuring that learners pass the examinations. The overall results of the diagnostic report show that learners struggle to pass the sections on EE in the Grade 12 examination. This could be attributed to misalignment in the coverage of environmental impact topics in the documents and teachers' ability to teach EE in the classroom.

In sum, the structural dimension of documents which comprised of the CAPS policy documents, past examination question papers and selected textbooks seemed to influencing agents on the content that can be taught to learners. These lead to cultural practices of teachers to teach environmental topics that have high probability of being examinable at the end of the year. This cultural practice tend to deprive learners to know about environmental content that are essential for environmental values and principles. The results of this study concurs with the assertion of Archer (2013) RST that stated structural conditioning occurs because social structures necessarily pre-exist the actions that transform them as they provide the conditions within which actions occur. The actions in this study are ideational influences, which have an

influence on agential activities (teaching), and may be consistent with or contradictory to prevailing, dominant ideas held by other groups or individuals, thereby facilitating or hindering change (De Souza, 2017). Hence, teaching might be affected in that teachers take action or no action depending on what has been developed and experienced in previous years in terms of content coverage in documents.

5.8 CHAPTER SUMMARY

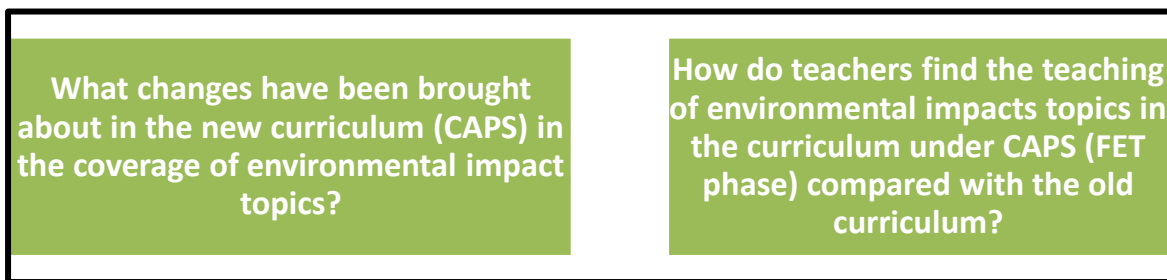
This chapter presented and analysed documents based on the following aspects: curriculum development effects on EE, curriculum design orientations, integrative approach to EE development, challenges faced by curriculum development which influences EE implementation, role of South African schools in the dissemination of EE and importance of curriculum change in the teaching of EE. This Chapter further provided results and analysis of CAPS documents, which comprised of policy documents, Grade 12 exit level past examination question papers, Grade 12 textbooks for selected subjects and an analysis of the National Senior certificate diagnostic report. Chapter 6, which follows, presents and analyses interviews from teachers who were participants of this study.

CHAPTER 6

RESULTS ON ANALYSIS OF TEACHERS' INTERVIEWS

6.1 INTRODUCTION

The focus of this chapter is to address the main research question on whether the shift in the curriculum has affected coverage, teaching and examination of environmental impact topics in South Africa's Further Education and Training (FET) phase. This main question is supported by the following two of the four sub-questions of the study shown below:



The analysis from face-to-face interviews in this chapter is organised into categories and themes in response to research sub-questions. The structure of this chapter outline is shown in the schematic diagram (Figure 6.1) below:

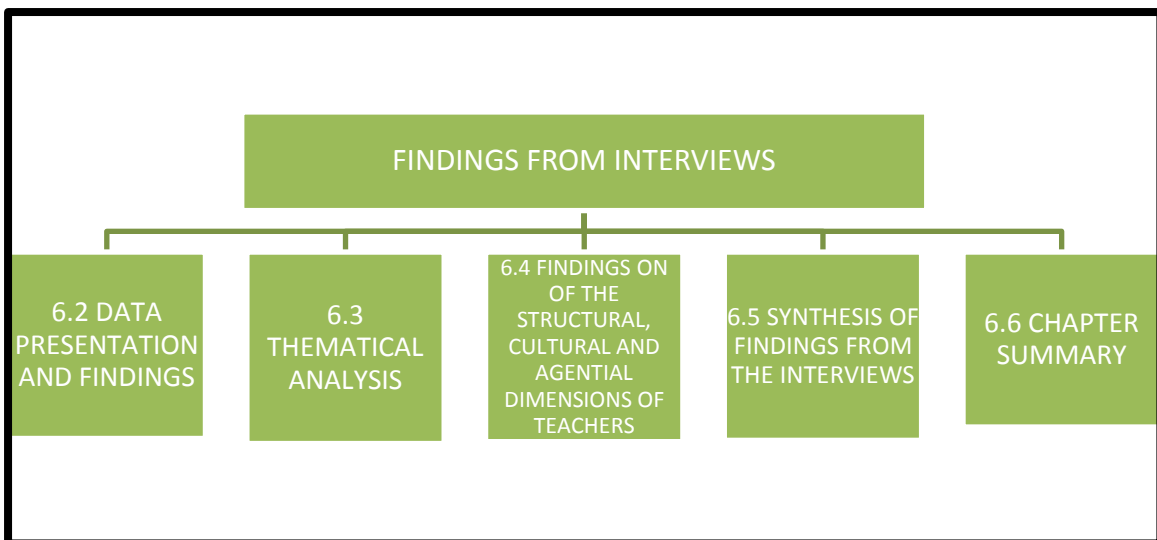


Figure 6.1: Chapter Outline

6.2 DATA PRESENTATION AND RESULTS

This section describes data collected using a qualitative research approach. This study used a case study research design of teachers trained by the Fundisa for Change programme in Mpumalanga Province on which to base the analysis of the coverage, teaching and examination of environmental impact topics in the curriculum. Data was drawn from interviews with teachers. The objectives of the interviews were to determine how the changes in the South African FET curriculum affected the content, teaching and examination of environmental impacts topics in schools. It is important to emphasise that the comparison was solely based on old NCS (Grade 10-12) and CAPS. The section below provides presentation and analysis of teachers' views based on the objective described above for this study.

Semi-structured face-to-face interviews conducted in the Mpumalanga Province were aimed at establishing whether teachers were effectively incorporating environmental topics in their lessons prior to and after the training programme. The RST framework that is characterised by the context, mechanism and outcomes was used in this study. The framework is discussed in Chapter 4. Teachers responses from the researcher's interview question guide fall under the outcomes segment, which epitomises knowledge that can reflect transformation due to new knowledge, and invariance or reproduction of old knowledge. Responses from the teachers were coded based on the mechanisms that are related to the emergent properties in an action context of structure, culture, agency and relations as seen in Table 6.2.

6.2.1 Description of Codes used for Analysis

Table 6.1 below provides the analysis of the interviews based on the RST framework that comprises of the pre-existing aspects of structure, culture and agency postulated by Archer (1995) and configured by Pawson and Tilley (1997). De Souza (2013) provides the analysis of the context, mechanism and outcomes configuration (CMOc) on how structure, culture, agency and relations interact in the community as discussed in Chapter 4.

Table 6.1: Codes used in the analysis

CODES OF CATEGORIES	DESCRIPTION OF CODES
SRP	Pre-existing aspect of structure with mechanism related to roles and positions.
SP	Pre-existing aspect of structure with mechanism related to practices
SR	Pre-existing aspect of structure with mechanism related resources
SPR	Pre-existing aspect of structure with mechanism related to processes
CS	Pre-existing aspect of culture with mechanism related ideas or propositional formulations about structure
CC	Pre-existing aspect of culture with mechanism related ideas or propositional formulations about culture
CA	Pre-existing aspect of culture with mechanism related ideas or propositional formulations about agency
CR	Pre-existing aspect of culture with mechanism related ideas or propositional formulations about relations
CV	Pre-existing aspect of culture with mechanism related values and rules
AB	Pre-existing aspect of agency with mechanism related to belief
AA	Pre-existing aspect of agency with mechanism related to reasons for action or non-action
RD	Pre-existing aspect of relations with mechanism related duties/responsibility
RR	Pre-existing aspect of relations with mechanism related to rights
RP	Pre-existing aspect of relations with mechanism related to power
T1, T2, T3, T4	Category based on Teacher collaborations
C1, C2, C3, C4	Category based on Coverage of environmental impact topics
F1, F2, F3, F4	Category based on Fundisa for Change
E1, E2, E3, E4	Category based on Effects of changes of the curriculum

6.2.2 Presentation and Analysis of the Interviews

Table 6.2: Presentation of participant's data based on the context, mechanism and outcomes configuration (CMOc)

CONTEXT	MECHANISMS (CODES)	OUTCOMES/CHARACTERISTICS/EPISTEMOLOGY
Pre-existing aspects	Related to the following emergent properties in an action context	Transformation, invariance or reproduction of those aspects of structure, culture, agency and relations
Structure (Autonomous)	Mechanism related to roles and positions (SRP) see table 6.1 for the list of acronyms	<p>What are the teaching methods you use when teaching environmental impact topics?</p> <ul style="list-style-type: none"> One that is interesting, in environment I give the learner topics to go and research about certain topics (global warming, changing patterns of weather, erosion, ozone layer depletion), however some learners are not keen in doing research and come and do presentation. (Category T2) I make them watch videos, especially when it comes to endangered species and poaching and extinction (Category T2) In most cases, we use group discussions. (Category T2)
	Mechanisms related to practices (SP)	<p>How is the coverage of the new CAPS curriculum compared with the previous curriculum?</p> <ul style="list-style-type: none"> In terms of topics they link, from Grade 10-12, we often complained that there is no link. CAPS have added more relevant content than the previous curriculum; however, it is good. (Category E1) The new curriculum, it covers more aspects than the previous one and it is more detailed and it has a lot of work but it has more information and is detailed compared to the previous curriculum. (Category E1)
	Mechanisms related to resources (SR)	<p>What are the challenges you are facing when teaching environmental impact topics in your classroom?</p>

CONTEXT	MECHANISMS (CODES)	OUTCOMES/CHARACTERISTICS/EPISTEMOLOGY
Pre-existing aspects	Related to the following emergent properties in an action context	Transformation, invariance or reproduction of those aspects of structure, culture, agency and relations
		<ul style="list-style-type: none"> ▪ Lack of resource and time. (Category T4) ▪ Like going out for excursions because we are teaching in disadvantaged school and finances are a challenge. (Category T4)
Culture	Mechanisms related to ideas or propositional formulations about structure (CS)	<p>How do you prepare a lesson for environmental impact topic?</p> <ul style="list-style-type: none"> ▪ The Curriculum Implementers (CI's) gives the templates, because we had a challenge, where we would prepare lessons plans and we are told that it is not correct, so they ended up giving us templates. (Category T1) ▪ Instead of going out we have posters about environment (Category T2) ▪ I look at the concept and identify key words and I will check the terminology so I check the activities and tell them what I will be doing, and check learner activities and teacher activities and also I check assessment so I know how I will test them if they understood me. (Category T1) <p>How often you use past examination question papers?</p> <ul style="list-style-type: none"> ▪ Before I used that more, but now we used them often because we encourage the students to use them, so that they get used to style of how the exams are set. (Category C3) ▪ I used them a lot, because we prefer that learners get used to the standard of how exams are set, simply because I sometime set test according to how you think and believe the learners have understood the lesson, and the examination comes and it's totally different. (Category C3)
	Mechanisms related to ideas or propositional formulations about culture (CC)	<p>Did your teaching of the content improve after the Fundisa training?</p> <ul style="list-style-type: none"> ▪ The change is when I prepare my lessons, because at the training, we had time to be outside and it actually made merealise that, there are things we can use

CONTEXT	MECHANISMS (CODES)	OUTCOMES/CHARACTERISTICS/EPISTEMOLOGY
Pre-existing aspects	Related to the following emergent properties in an action context	Transformation, invariance or reproduction of those aspects of structure, culture, agency and relations
		<p>from the school and make the lesson interesting and practical within the school yard and not concentrate only on the textbook (Category F2)</p> <ul style="list-style-type: none"> Very much, it improved such that I applied what I felt, because of the confidence we gained from training and hence we started the nature conservative group. I did not even care or know how to take care for it. (Category F2)
	Mechanisms related to ideas or propositional formulations about agency (CA)	<p>Do you take your learners for environmental fieldwork or excursions?</p> <ul style="list-style-type: none"> Yes, I do when we deal with that particular topic and also when the department plan trips to botanical garden and Kruger national park. They actually tell us well in time, that on a particular period we will take all learners for an excursion. (Category T1)
	Mechanisms related to ideas or propositional formulations about relations (CR)	<p>What support materials do your learners have at your school</p> <ul style="list-style-type: none"> The school has a library and computer lab that support learners in their studies. (Category T2)
	Mechanisms related to values and rules (CV)	<p>What is your understanding of environmental education?</p> <ul style="list-style-type: none"> In general, to me it means to have knowledge about the nature and school, because at home they tell us if something like this is means that, and science says something else. We also get indigenous knowledge. (Category T1)
Agency	Mechanisms related to beliefs (AB)	<p>Do you use the internet to search current issues on environmental education? If yes, what current issues are debated about environment locally and globally?</p> <ul style="list-style-type: none"> I use it every day, learners they use their phones. Some learners have not learnt how to use the internet because they just take the information as it is. (Category T2)

CONTEXT	MECHANISMS (CODES)	OUTCOMES/CHARACTERISTICS/EPISTEMOLOGY
Pre-existing aspects	Related to the following emergent properties in an action context	Transformation, invariance or reproduction of those aspects of structure, culture, agency and relations
		<p>current issues</p> <ul style="list-style-type: none"> Water shortage. Water pollution (we do not drink water at Witbank; we buy, due to mines around).
	Mechanisms related to reasons for action or non-action (AA)	<p>How is the response of learners towards environmental impact topics lessons?</p> <ul style="list-style-type: none"> The response is positive and good; you find sometimes it's what they know and do, according to the response to the topics. (Category T2) We have mixed responses, we have those who value the environment, and we have those who do not have an idea and they tend to be negative, because of lack of knowledge but they change in the long run after they have learnt. (Category T4)
Relations	Mechanisms related to duties/responsibility (RD)	<p>How do you find teaching environmental impact topics in the CAPS curriculum?</p> <ul style="list-style-type: none"> Yes, I think what we have in that document, even after one has used the documents, it was quite interesting in terms of it made us aware, how we should teach and make it interesting to the learners (Category T1) I enjoy it, I enjoy it because when you teach them it is something they can relate to nature. (Category T3)
	Mechanisms related to power (RP)	<p>Does your school have an environmental organisation for learners?</p> <ul style="list-style-type: none"> We had an enviro-club, however we had challenges financially. We planted lot of trees. (Category T1) <p>What went wrong?</p> <ul style="list-style-type: none"> Politics, everyone wanted to be in charge. (Category T1)

The analysis of the configuration of contexts, mechanisms and outcomes resulted in the emergence of categories that also formed the basic themes of this study. The themes that emerged from this study were teacher’s collaboration and orientation towards environmental impact topics in CAPS; coverage of environmental impact topics in the curriculum; influence of the Fundisa for Change programme and effects of changes of the curriculum. Table 6.3 below shows the categories that emerged from the codes and the description of each RST category that was coded to elicit the outcomes that depict either transformation, invariance or reproduction of those aspects of structure, culture, agency and relations. These themes that emerged from documents data have already been presented and discussed in Chapter 5 in the results on analysis of documents.

Table 6.3: Categories and themes emanating from documents and interviews’ results and analysis

THEMES	CATEGORY
Coverage of environmental impact topics in the curriculum	Exploration of environmental impact topics in the CAPS policy documents and selected textbooks used by agents in the classroom. (Category C1)
	Exploration of environmental impact topics in the past examination question papers (Category C2)
	Alignment between CAPS policy projections with past examination question papers (Category C3)
	Teachers’ perceptions of the role played by documents in the successful teaching of environmental impact topics in the school. (Category C4)
Teachers collaboration and orientation towards environmental impact topics in CAPS	Influence of structure, culture, agency and relations towards teacher knowledge of environmental impact topics (Category T1)
	Roles and practices of teachers towards successful implementation of environmental impact topics in the curriculum (Category T2)
	Processes and resources enabling implementation of environmental impact topics in the curriculum (Category T3)
	Challenges faced by teachers (agents) in the implementation of environmental impact topics in the curriculum (Category T4)

THEMES	CATEGORY
Effects of changes of the curriculum	Teachers' perceptions of curriculum changes in policy and examinations (Category E1)
	Availability of resources before and after curriculum shifts (Category E2)
	Teachers' views on the positive impact brought by the shifts of the curriculum (Category E3)
	Teachers' views on the threats brought by curriculum changes (Category E4)

6.3 THEMATIC ANALYSIS

Data analysis is an integral part of qualitative research and constitutes an essential stepping-stone towards both gathering data and linking one's results with higher order concepts (Given, 2012:2). In this study, analysis of qualitative data involved simultaneous data collection and analysis, use of codes to sort data, development of concepts and the connection of the data analysis to relevant literature. Given (2012) contends that the gathering analysis of data are iterative processes. Early data analysis provides sufficient insight to shape the gathering of further data. In this research, piloting the interview guide was done to check for similarities and upgrade the interview guide to suit the intended participants. The analysis of this study in this Chapter is based on interviews.

In the analysis of face-to-face interviews, Gubrium and Holstein (2001) note that qualitative interviews are based on conversations, with the researchers asking questions and the participants answering, and the interpretations tend to take the direction of interpretivism. Interview participants are more likely to be viewed as meaning-makers. Gubrium and Holstein (2001) further point out that qualitative interviewing and fieldwork are often classified together, along with documentary analysis (as was done in Chapter 5 of this thesis). According to Mills, Durepos and Wiebe (2012), in education, interviews in case study research not only create knowledge and understanding but also set a standard for good teaching practices through aspects such as development, implementation of policy and gaining experience through exposure to a particular phenomenon. I conducted face-to-face interviews with teachers to solicit their lived experiences on the implementation of CAPS, particularly in the teaching of environmental impact topics.

Mills et al. (2012) point out that educational policies set a standard for good teaching practices that contribute to a better overall level of education. Sometimes a policy is created to solve a problem and works in theory but does not necessarily work in practice (Mills et al., 2012). This is already seen in the document analysis in Chapter 5, where the policy will stipulate environmental impact topics or themes to be taught in the classroom and the results show that in practice those topics are not even covered by the examinations in some subject disciplines. In education research, the case study design can be effective when monitoring policy. In this study, CAPS subject documents were analysed to verify if there was alignment between the policy and what was being practised at schools through the examination of environmental impact topics in the curriculum. This analysis enabled the researcher to confirm whether the implemented policy is effective throughout the entire scope of its use in the school. During monitoring of teaching policy, subjects can be chosen for analysis (Mills et al., 2012). In this study, core subjects were chosen for analysis. In the document analysis of material culture, which can be written texts, a challenge is posed for interpretative approaches that requires interviews and critical comments from teachers in order for the text to be understood (Hodder, 2013). Therefore, the data and the interpreter are brought together in a dialectical manner.

The participating teachers had an experience of more than five years. Some of the characteristics of the participants are outlined in Table 6.4 below.

Table 6.4: The age, area, qualifications and subjects taught of participants

TEACHER	AGE AND GENDER	AREA OF SCHOOL (MPUMALANGA)	TEACHING EXPERIENCE (YEARS)	QUALIFICATION	SUBJECT TAUGHT IN GRADE 12
Transcript 1	43 Years (Male)	Elukwatini	14	Bachelor's Degree in Education	Geography
Transcript 2	49 Years (Male)	Elukwatini	22	Bachelor's Degree in Education	Geography
Transcript 3	40 Years (Male)	Nkomazi	7	Bachelor's Degree in Education	Agricultural Sciences

TEACHER	AGE AND GENDER	AREA OF SCHOOL (MPUMALANGA)	TEACHING EXPERIENCE (YEARS)	QUALIFICATION	SUBJECT TAUGHT IN GRADE 12
Transcript 4	46 Years (Female)	Emalahleni	7	Higher Diploma in Education	Life Sciences
Transcript 5	45 Years (Female)	Secunda	18	Honours Degree in Education	Geography
Transcript 6	26 Years (Female)	Emalahleni	5	Honours Degree in Education	Life Sciences

Table 6.4 above shows that most of the participants were adults with an experience of more than five years in teaching the subjects that include environmental impact topics. Five of the six participants were above the age of 40 years. Their experience also assisted me in soliciting adequate information about teachers' orientation towards environmental impact topics in CAPS. Two of the teachers had acquired their Honours degrees in education and three had bachelor's degrees in education.

The higher level of education that characterised the participants assisted me to get valuable information pertaining to the coverage of environmental impact topics in the curriculum and the alignment of examination questions to the policy document (CAPS). The participants taught the subjects that were investigated in this study, namely Life Sciences, Geography and Agricultural Sciences. Nine participants were contacted for face-to-face interviews. This number was bigger than the proposed sample of six participants described in Chapter 4 because I anticipated that some participants might withdraw from the study. During the course of the interviews, three out of the nine participants withdrew from the study citing reasons such as unavailability because of family responsibility and attending meetings at the Circuit Office. I was then able to interview six participants face-to-face, conforming to the sample size proposed in Chapter 4 of this study.

Figure 6.2 below shows a schematic presentation of the themes and categories in this section.

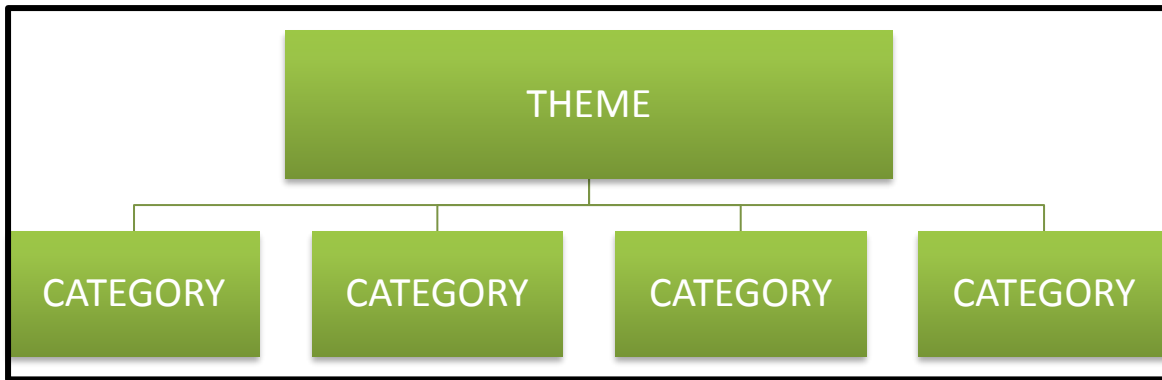


Figure 6.2: Diagram presenting interviews analysis.

6.3.1 Theme: Teachers collaboration and orientation towards environmental impact topics in CAPS

As mentioned in section 6.1 one of the four themes that emerged from the study was teacher's collaboration and orientation towards environmental impact topics in CAPS. This section focuses on teachers' face-to-face interviews that were conducted in order to answer the main question about the coverage, teaching and examination of environmental impact topics in the CAPS curriculum. This theme is comprised of four categories, which emerged from the data collected in this study. These categories are:

1. **T1-** Influence of structure, culture, agency and relations on teacher knowledge of environmental impact topics;
2. **T2-** Roles and practices of teachers in implementation of environmental impact topics in the curriculum;
3. **T3-** Processes and resources enabling implementation of environmental impact topics in the curriculum; and
4. **T4-** Challenges faced by teachers (agents) in the implementation of environmental impact topics in the curriculum.

6.3.1.1 T1- Influence of structure, culture, agency and relations on teacher knowledge of environmental impact topics

De Souza (2013) mentions that in a school situation a structure can be educational training programmes that aim to transform existing school structures by redefining roles, training to adopt new practices, supplying new resources and aligning assessment to suit a new generation of learners. Culture refers to ideas, theories,

values and arguments that affect an agent's transactions and operations within an institution. Therefore, the operation can be communicated to schools using documents and representations. In the context of South African schools, the study discovered that teachers (agents) and learners (agents) were greatly influenced by the different operational cultures practised in the school. The study revealed that operations of the social structures investigated are subject to agency. In the results of this study, it appears that the operational structures such as the management of the school affects the way in which teachers engage with learners on environmental impact topics. Moreover, it is emerging that some participants rely on subject advisors to acquire knowledge of environmental impact topics. In the same way, the social structures of curriculum advisors play an important role in influencing teacher knowledge of environmental impact topics in the school. Significantly, when participants, who are agents in this study, were asked about how they prepare a lesson for environmental impact topics for learners, one of the teachers noted that,

“The subject advisors gives the templates, because we had a challenge, how we would prepare lessons plans for environmental impact topics and we are told that it is not correct when we prepare for ours, so they ended up giving us templates” (Transcript 3).

The response above shows that teachers had developed a culture of relying on external structures to impart knowledge on environmental impact topics. The implication of relying on external social structures for assistance shows that teachers are dependent on these support structures to exercise their responsibility. I agree with the emerging culture of the agents to adopt strategies such as collaboration in order to gain the necessary content knowledge about EE and subsequently having the capability to teach in the classroom without doubts or challenges. From the response of the participant above, it can also be noted that teachers need to collaborate with all of the social structures available to solicit assistance in order to impart valuable knowledge to learners in the school environment. It can be noted that sustained transformation and assistance provided by the subject advisors can lead to shifts not only in structural, material and physical aspects of the action of teachers but also in ideational aspects, as mentioned by De Souza (2013). The changes of the ideas lead to changes in the culture of the teachers, learners and the school as a whole in the utilisation of documents from other important structures such as the subject advisors

in the education system. However, I would have a different view if the subject advisors were to be the only source of environmental knowledge. I suggest that the subject advisors should only provide exemplary templates to teachers so that teachers can be able to develop their own lessons without being assisted in future. The results of this study seem to suggest that teachers relied upon different structures when teaching EE as in the case of subject advisors' prepared lesson plans.

When teachers were asked, "*How do you prepare a lesson for environmental impact topics?*", one teacher revealed that,

"I look at the concept and identify key words and I will check the terminology so I check the activities and tell them what I will be doing, and check learner activities and teacher activities and also I check assessment so I know how I will test them if they understood me" (Transcript 5).

From this response, it is important to realise that teachers who understand their duties, responsibilities, power and rights adequately address the relational component described in RST. The success of teachers is guided by their willingness to carry out their duties in the classroom. This is seen in the response of the teacher above in that she checks learner's activities and provides tests for learners on environmental impact topics. Relations may depend on how confident learners feel in their corresponding duties on the assessment provided by the teacher, although the learners' aspect does not form the scope of this research.

Gwekwerere (2014:199), who mentions that "If teachers lack proficiency in their environmental knowledge, skills and commitment, it is unlikely they will be able to effectively lead environmental change in schools", supports this conclusion. This is also supported by the 2016 National Senior certificate diagnostic report which highlighted that environmental topics analysis revealed that learners performed poorly in environmental impact topics due to teachers' deficiency in understanding specific subject content (DBE, 2017:11). The results of this research revealed that structures were important in closing the knowledge gap with practice, belief and the sharing of ideas that emanate from the dynamics of outcomes that result in social reality. This social reality illustrates Archer's (2013) morphogenetic approach to social change.

6.3.1.2 T2- Roles and practices of teachers towards successful teaching of environmental impact topics in the curriculum

The roles and practices of teachers in successful implementation of environmental topics in this study hinge upon aspects such as dedication, knowledge of environmental impact topics, the ability to use appropriate teaching methods and a willingness from learners to participate in the learning process. Furthermore, this research has found that general interaction between structure in the schooling system, culture of teaching and learning among agents, and relations that exist also played a significant role in the successful implementation of environmental impact topics in the curriculum.

To illustrate the dedication of some teachers in successful implementation of environmental impact topics, one teacher interviewed revealed that apart from participating in the classroom, they go out and do field work in the natural environment. The teacher was asked, *“How do you find the teaching environmental impact topics in the CAPS curriculum?”* The teacher explained that;

“Most of the time I do field trips, or I just personify the items in the topic, maybe take the learners outside and dig holes and explain to them about soil erosion and also show them pictures of the community environmental situation. Let’s give an example of pollution caused by Sasol and as we are close to Sasol and it contributes to our air and water pollution” (Transcript 5).

The assertion of this teacher shows that she is dedicated to her work in the effort to successfully implement environmental impact topics in the curriculum. The participant also highlighted that she had five learners who had formed an environmental club at the school. When I reviewed the school committee documents presented by the teacher during the face-to-face interviews, I found that the document has an environmental policy. The school environmental committee undertook the following activities that are done at school: research and presentation on environmental impact topics, environmental audit, greening, waste management, sustainable resource utilisation, environmental action projects, acknowledging the environmental calendar, health issue and taking photos of environmental activities in the school environment. It was gratifying to find that some participants were fully involved in ensuring that EE is not only taught in the classroom but also practiced outside the classroom

environment. Having environmental committees in schools not only improves learners' knowledge towards EE but also ensures that their behaviour changes. This initiative by teachers in forming environmental committees in schools concurs with the purpose of the Department of Education where according to the DBE (2014), the National Curriculum Statement Grades R-12 serves the purposes:

- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education for an example knowledge of the environment;
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with a sufficient profile of a learner's competences.

The dedication of the participants in ensuring that environmental impact topics were successfully implemented in the curriculum is also seen in Appendix H, which shows the environmental policy developed by teachers and learners at the school level. The interactions of structure, culture, agency and relations are seen in the dedication of teachers in the implementation of environmental impact topics. The implication of this initiative in this study is that learners develop a culture of learning about environmental impact topics because of the structures that are available in the school system.

On the aspect of knowledge about environmental impact topics, teachers in this research exhibited the capability and responsibility for successful teaching of environmental impact topics. In practice, one teacher when asked, "*What are the teaching methods you use when teaching environmental impact topics?*" The teacher replied by saying that,

"One that is interesting, in environment I give the learner topics to go and research about certain topics (global warming, changing patterns of weather, erosion, ozone layer depletion); however, some learners are not keen on doing research and come and do presentation"(**Transcript 1**).

This shows that teachers have knowledge of other methods such as case studies, projects, demonstrations and role-plays that can be interesting to learners when being taught environmental impact topics. Gwekwerere (2014) believes that in teaching students about the environment, teachers should place experiences before narration

and concrete examples should be used in their teaching environment. However, it was revealed that not all learners were keen on activities provided by teachers in the classroom. In this case, although teachers encouraged learners to use other methods of studying environmental impact topics, some learners were afraid to do presentations. The implication of learners not being fond of taking part in presentations poses a significant threat to the accumulation of necessary skills and knowledge. Consequently, this research suggests that learners must be exposed to presentational activities in the school environment. This will ensure that learners are able to develop certain skills that will be essential in not only the present time but also in future studies as illustrated in one of the purposes of the CAPS policy shown above. The results of this study are supported by similar results in Norway of what characterises schools that have experienced little success in implementing the national curriculum. A common feature among schools that have experienced little success was an individualistic learning culture among learners (Ramberg, 2014:49). I strongly believe that as a teacher you have the ability to persuade learners to take part in all of the activities that you have presented in the classroom. I disagree with the notion that the teacher should succumb to the pressure of learners when they choose whether or not to present on environmental related research activities taking place in the school. I suggest that teachers should develop a common culture in the learning space that will be followed by all learners.

The results above confirm the results of Gwekwerere (2014) that teachers felt compelled to engage learners in environmental initiatives in school since they were captive agents while they are at school. Gwekwerere (2014) also supports my view that teachers should be the role models for their learners and that that could make a huge impact on motivating learners to participate and develop pro-environmental behaviour. In support of roles and practices of teachers, Gwekwerere (2014:201) goes on to comment that in order to develop an enduring understanding about the environment, students need to be given opportunities to develop ownership of the environmental knowledge they learn from the curriculum. They should also engage in concrete experiences as an integral part of environmental education and work on action projects dealing with environmental issues in their communities. Furthermore, Stanasic and Marksic (2014) emphasise that teachers of EE should become role models who value life and practice healthy lifestyles in order to be successful at school.

They further acknowledge that teachers should not only transfer relevant information about environmental issues but must also evoke learners' personal interest and care for environmental issues, as well as their readiness for involvement in the process of solving environmental problems.

I found that teachers' role and practices in successful implementing of environmental impact topics in the curriculum are evident in the structures of the school. This will lead to an improvement in the culture of learning about the environment by learners because they are exposed to actual practices of good environmentally sustainable behaviour. The improvement of teachers' practices and roles culminates in outcomes or characteristics of social change. Similar to the results of this study, Hill et al. (2006) point out that EE should not just blindly reproduce the current realities of living with nature, but it should allow people to explore alternate realities. This will enable learners to critically evaluate these realities and make informed decisions as to what the appropriate interaction with nature should be in their local context.

6.3.1.3 T3- Processes and resources enabling implementation of environmental impact topics in the curriculum

In this study, teaching processes were interventions that teachers were using in the planning and implementation of instructional activities and teaching experiences to meet learner needs. In the RST theoretical framework based on the CMOc, structure is comprised of mechanisms that are related to the emergent properties that are processes and resources. These mechanisms result in social reality that according to Archer (2013) illustrates morphogenetic approaches to social change. In this section, a descriptive analysis and interpretation of processes and resources enabling implementation of environmental impact topics in the curriculum was provided.

The process of ensuring that learners understand environmental impact topics involves several aspects. One teacher noted when asked: "*how do you find the teaching environmental impact topics in the CAPS curriculum?*" The teachers replied,

"I enjoy it; I enjoy it because when you teach them it is something they can relate to nature" (Transcript 6).

The process of teaching environmental impact topics involved the feelings of the teacher during lesson preparation and execution. Teachers revealed that learners

related to and enjoyed lessons that involved the natural environment and with the provision of examples, learners were able to relate to nature. The implication of learners being able to relate to nature concurs with views of Taylor et al. (2009) about EE's aim, which is supported by Di Chiro (2014:9) who points out that "EE is a social practice that aims to bring about changes and improvements in its field of action and the education for an environmentally aware and active citizenry".

One of the teachers also identified that the processes involved in teaching environmental impact topics also aroused interest, especially in the accumulation of new knowledge about nature and the world around us. I agree with the teachers that teaching learners about EE leads to behavioural changes that enhance knowledge to foster environmentally aware and active citizenry. These processes of using natural surroundings in teaching environmental impact topics make teaching easier. Rioux and Pasquier (2013:695) recognise that, "the aim of teaching about the environment is to foster the acquisition of environmental behaviour in order to ensure long-term environmental protection".

When asked about the processes involved in the preparation of a lesson for environmental impact topics. One teacher replied:

"Yes, these the only ones, but when you feel that there's a topic that you think learner might be interested in or learn from them you include it in your lesson plan, like we talk about soil degradation where we take the learners to see"(**Transcript 3**).

The use of templates provided by subject advisors was not the only way that teachers conducted their lessons. Teachers revealed that while they used a lesson plan to prepare for a lesson, in the process of delivering the lesson they could incorporate other interesting activities into the lesson plan. This was important, as teachers were able to investigate new ideas and new trends in the field of environmental education and were able to incorporate these in the lesson as part of the learning process. The results of teacher's interviews shown in Table 6.5 included the use of planning, implementation approaches, evaluation and various resources. This conforms to Palmer (1998) who reveals the following principles of teaching and learning of EE:

- being a body of knowledge essential to our understanding of sustainable solutions to environmental problems; and

- the skills and knowledge of EE are applicable to everyday life.

Learning processes cannot function without the availability of resources to enable implementation of environmental impact topics in the curriculum. In the learning process, resources play an important role in ensuring that teachers are able to impart appropriate knowledge to learners. One participant stated how they got the required knowledge as follows:

“Through research, because we need to teach them current issues, like we use charts and go for excursion” (Transcript 1).

The teacher included the process of research as a tool in presentation of environmental impact topics in the curriculum. The results of this research revealed that teachers used charts as one of the resources in the implementation of environmental impact topics in the school. Teachers also reported that they took their learners for excursions to places where there were resources that could help in the presentation of environmental impact lessons. Some teachers mentioned that in their lessons they allowed learners to use gadgets such as tablets to facilitate the learning of environmental impact topics in the curriculum.

Teachers also mentioned other resources that enabled the implementation of environmental impact topics in the curriculum. Most of the interviewed participants used textbooks to facilitate the learning process in the schools. The use of textbooks as one of the resources to teach in the curriculum had problems as some schools had large numbers of learners and few textbooks. Teachers mentioned that the inadequate availability of textbooks affected lesson presentation. Learners who did not have textbooks ended up writing classwork later or even failing to complete tasks given in the classroom. One of the solutions provided by teachers regarding lack of textbooks was that they allowed learners to share textbooks while in the classroom, but a problem arose when they were supposed to do homework. Participants also revealed that, as solution, they compiled notes for learners who did not have textbooks so that they will be able to write the homework given on environmental impact topics. In response to the question: *“How do you support learners without necessary learning support materials such as textbooks?”*, one teacher mentioned that:

“We make copies for them of all the important aspects, and we make copies for those that could not afford to buy study guides... and our parents they are hands-on; they would come and tell us if they cannot afford and the school together with SGB, they assist in making those copies” (Transcript 1).

The above teacher mentioned study guides as one of the resources they use to enable successful implementation of environmental impact topics in the curriculum. With the help of the parents, the learners bought study guides to study those important topics and those learners who could not afford to buy study guides were assisted by the SGB. One teacher explained that:

“They have textbooks and [where] we lack textbooks ... we request them to buy study guides which we buy as bulk. We encourage them to use the internet as well” (Transcript 1).

In this case, parents as agents in RST played an important role in ensuring that their children got the necessary resources for success in the learning process. The SGB also played an important role in ensuring social change through **buying teaching** and learning support resources.

When questioned about availability of resources in the school, one teacher was asked, what support materials do your learners have at your school? The participant replied:

“The school has a library and computer lab that support learners in their studies” (Transcript 6).

In this study, it was found that at some schools, libraries and computer laboratories were fully equipped with resources that assisted teachers in the dissemination of valuable information to learners. Teachers also mentioned that they downloaded past examination question papers for both teaching and learning. The coverage of environmental impact topics in the past examination question papers was discussed in Chapter 5. When asked about the resources they are using to enable implementation of environmental impact topics in the curriculum, one teacher replied:

“They use textbooks, and we use Google search. We have a WhatsApp group where we text some examples, all information is shared to all other groups” (Transcript 5).

The above quote reveals that some teachers use technology to communicate with learners. The use of the internet to search for information is vital in the current age

because of the ever-improving technological systems in education and in this Fourth Industrial Revolution. The implications of the use of technology by teachers is that it enables them to gain valuable information about environmental impact topics on the internet through using search engines such as Google and Yahoo. The use of modern social media applications like WhatsApp to share information was seen as a useful innovation by teachers for disseminating information to learners. The use of social media applications like WhatsApp enabled teachers to save on resources such as ink and bond paper for photocopying materials for learners in the learning process. Within the RST theoretical framework, these processes and resources are important in ensuring that teachers, who are agents of social change, are able to impart knowledge to learners during and after school hours.

The results from the teaching processes used by teachers in teaching environmental impact topics revealed evidence of planning, implementation and evaluation aspects by the teachers. It was evident that most of the teachers used templates provided by subject advisors for their lesson plan. However, it was also deduced from the interviews that some teachers were able to improvise resources that were needed during lessons. Some teachers use outdoor activities to successfully implement environmental impact topics. Teachers employed different teaching strategies, which included collaborative work, lectures, question and answer, group discussions and research-oriented methods in their lessons. These different teaching strategies accommodated learners with different learning styles as shown in Table 6.5 below.

Table 6.5: Summary of the teaching processes used by teachers who were interviewed

ENVIRONMENTAL IMPACT TOPICS TEACHING PROCESS			
PLANNING	IMPLEMENTATION APPROACHES	EVALUATION	RESOURCES USED
Policy documents, textbooks, lesson plan, Curriculum Implementers, Social structures (Teachers, School Management Team, SGB, Parents)	Collaborative work, lectures, question and answer, research projects, co-operative learning, excursions, practicals, case studies, games, role-playing, hands on activities,	Formative and Summative assessment, oral presentations	Textbooks, past examination questions papers, websites (Google, Yahoo), social media (WhatsApp), study guides, charts and smartboard

	demonstrations and group discussion		
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During analysis of the teaching processes in this study, it emerged that teachers used different teaching approaches when teaching environmental impact topics. This implies that teaching EE requires multiple approaches. This conforms to UNESCO's (2005) emphasis that the approach to ESD and EE should be interdisciplinary and holistic, where ESD should be embedded in the entire science and technology curriculum and not merely presented as a separate topic.

6.3.1.4 T4- Challenges faced by teachers (agents) in the implementation of environmental impact topics in the curriculum

During the face-to-face interviews with teachers, they raised several challenges that had an effect on the teaching process and affected teachers (agents) in the teaching of environmental impact topics in the curriculum. These challenges included **lack of** teaching and learning resources and lack of adequate time to complete the intended content for environmental impact topics. Some teachers complained about the high rate of crime in the schools, where teaching and learning resources were vandalised and stolen by people from the community. Teachers gave examples of well-equipped laboratories being broken into and people stealing equipment.

One participant was asked how the response of learners towards environmental impact topics lessons is. Sh/e replied that:

“We have mixed responses, we have those who value the environment, and we have those who do not have an idea and they tend to be negative” (Transcript 4).

From the teacher's response, it was noted that there were some learners who valued the environmental impact lessons and there were some who were not interested. The challenge that faced the teacher was lack of motivation from learners when they were taught environmental impact topics. The fact that some learners tend to be negative poses a significant challenge in knowledge acquisition.

Similarly, when another teacher was asked the same question, his reply was:

“They taking care of it, they have recycling bins at school. Sometime they even teach other learners, it’s very important to recycle; unfortunately, it is not the same for everyone at the school” (Transcript 6).

The teacher highlighted that although learners were making efforts to take care of the environment, some learners still did not practise what they had learnt in the classroom.

I argue that teachers need to provide all necessary assistance to learners who seem not interested in the lessons. Instead of neglecting learners who are not participating in the classroom, teachers should always find a common solution in order to help all learners. I also contend that if learners are not interested in the EE lessons, it will be difficult for them to exhibit acceptable environmental behaviour in the outside world. This concurs with Olvitt’s (2013) study, which revealed that when learners were making decisions affecting the environment they were guided by social concerns, self-interest, cultural influences, religion and past experiences. In relation to learners who have challenges in applying what they have been taught, Stanasic and Marksic (2014:124) indicate that one of the challenges of incorporating environmental education in the classroom is that “some topics are repeated in different subjects without horizontal and vertical connections which results in an inefficient learning process”. Stanasic and Marksic (2014:124) further state that learners are expected to apply knowledge and be proactive in relation to ecological problems in both local and global surroundings, only to find that they are unable to apply the necessary environmental concepts in their natural environment.

One teacher when asked *“what are the challenges you are facing when teaching environmental impact topics in your classroom?”*, replied that:

“The challenge that I had is the question of time, especially I was teaching Grade 12. Because they need extra hours to catch up. One also lacks time to debate to make it practical” (Transcript 2).

The response of the teacher reveals that the content was loaded with information that required more time to be explained in the learning process. Most of the teachers interviewed revealed that the amount of time allocated to environmental impact topics was limited and that they struggled to finish the curriculum at the appropriate time. To support this finding, Stanasic and Marksic (2014:124) also discovered that the prescribed ecological topics in the curriculum were numerous and frequently

overlapped. This overlap could lead to learners being unable to grasp all of the necessary skills and knowledge required in environmental education. Teachers also pointed out that if they could be allocated adequate time for the lessons, where learners would be given enough time to complete formative assessments, they would not experience learners who lacked basic knowledge of environmental issues. I concur with the results that time allocation for all the topics was not adequate to complete the intended curricula as I also experienced the same phenomenon during my time as a Secondary School educator teaching Agricultural Sciences in Grade 12. I found it difficult to fully complete a particular topic using the time allocated in the policy documents and thus I had to make extra time for my learners either in the morning or afternoon so that all aspects of the topics could be achieved. Therefore, it is important to realise that the normal teaching and learning hours stipulated by policy are not enough for the curriculum that is examination-oriented as discussed in Chapter 5. Olvitt (2013) supports this research finding in her study on exploring and contextualising the potential of EE, where she found that teachers' efforts to take responsibility for the environment were impeded by factors such as financial instability, time allocation, social conformity, the value attached to the subject and lack of alternatives to current practices.

In addition to not having enough time to teach particular topics, one teacher when interviewed and asked "what are the challenges you are facing when teaching environmental impact topics in your classroom?" replied that:

"Resources are also a challenge; we could not make enough copies and also find that there's only one data projector and it's being used by another teacher" (Transcript 2).

Teachers were of the opinion that a lack of resources had a negative impact on the implementation of environmental topics in the CAPS curriculum. They lacked resources such as copies of teaching and learning materials that should be distributed to learners to ensure that lesson presentation was a success in the classroom. All of the teachers interviewed in this study mentioned a lack of teaching and learning resources as one of the problems they faced in the delivery of environmental impact topics in the schools. They mentioned resources such as textbooks, printers, photocopying machines and computers. They attributed the lack of resources to financial challenges

that the schools and parents of learners are facing within their respective communities. One teacher responded to the question of challenges they face in the school by saying:

“Like going out for excursions, because we are teaching in disadvantaged school and financially challenged” (Transcript 4).

The above response reveals that some teachers wanted their learners to be exposed to areas of environmental interest, however the obstacle was a lack of funds to go for excursions. During excursions, learners would have been able to relate what they had learnt in the classroom to what was happening in the outside world. One teacher complained that:

“The challenge we have, is that there are certain learners who reach certain Grade without being exposed to certain things and it makes it difficult to teach, because we assume that, at that level they should have been exposed” (Transcript 3).

The above teacher complained that some learners were not supposed to be in Grade 12, but the Department of Education condoned learners who had failed in Grade 11 and allowed them to proceed to Grade 12 without grasping the basic knowledge of environmental impact topics. This posed difficulties where learners were not able to handle the large and conceptually difficult amount of content, they were exposed to in Grade 12. This led to teachers having to spend more time on topics that should have been covered in Grade 11. This could be one reason why the allocated time for Grade 12 lessons was not adequate for completing the curricula. Less time being allocated to environmental topics resulted in teachers not being able to impart necessary knowledge to learners.

Stanisic and Marksic (2014:123) point out that in other countries environmental issues in the curriculum place more emphasis on the acquisition of information at the expense of developing the cognitive abilities of learners. They further noted a gap between environmental knowledge and environmental action and therefore argued that the teacher plays an important role in developing environmental attitudes, knowledge and habits of learners and in bridging the knowledge gap that might be experienced.

From the analysis of this category, I concluded that teachers encountered several challenges when teaching environmental impact topics. Some challenges that emerged in this study were a lack of motivation from learners, congested content, lack

of teaching and learning resources, less time allocated for lessons, lack of financial support from parents and the inability of progressed learners to cope with the demand of the new content.

6.3.2 Theme: Effects of Changes of the Curriculum

This study also investigated the effects of changes in the curriculum on the teaching of environmental impact topics. The perception of teachers as agents of curriculum implementation is interpreted in this section. This section also presents results with regards to the availability of resources before and after curriculum shifts; teachers' views on the impact brought by the shifts in the curriculum. The emerged categories are;

- 1) E1- Teachers' perceptions of curriculum changes in policy and examinations
- 2) E2- Availability of resources before and after curriculum shifts
- 3) E3- Teachers' views on the positive impact brought by the shifts of the curriculum
- 4) E4- Teachers' views on the threats brought by curriculum changes

6.3.2.1 E1- Teachers' perceptions about curriculum changes in policy and examinations.

Participating teachers in this study revealed understanding of the curriculum changes in South Africa from the old NCS (Grade 10-12) to CAPS. CAPS built on the old NCS (Grade 10-12) but also updated it and provided specifications on what was to be taught and learnt on a term-by-term basis (DBE, 2017). The perceptions of teachers about the changes that occurred in the year 2012 when CAPS was implemented were analysed in this study and most of the teachers interviewed were optimistic about the new curriculum. Only one teacher with five years' experience did not have teaching knowledge about the old NCS (Grade 10-12), as she was not yet a teacher in the year 2012 when CAPS was implemented. The remaining five teachers interviewed had experience of more than seven years, which helped the researcher to gain information about their experience of the old NCS (Grade 10-12) and the new CAPS. This study, being conducted five years after the curriculum shift, will provide valuable insights on the effects of the curriculum change as teachers are now able to distinguish between the old and new curricula because most of them have experienced both.

One participant when questioned, “**How is the coverage of environmental impact topics in the new CAPS curriculum compared with the previous curriculum?**” replied,

“In terms of topics they link, from Grade 10-12, we often complained that there is no link. CAPS have added more relevant content that the previous curriculum failed to do, and it is good” (Transcript 1).

Another teacher when asked about the comparison between the new curriculum and the old curriculum, explained that,

“The new curriculum, it covers more aspects than the previous one and it is more detailed and it has lot of work but it has more information and detail compared to previous curriculum” (Transcript 3).

In support of this teacher, another teacher replied:

“The new curriculum, it covers more aspects than the previous one and it is more detailed and it has lot of work but it has more information and detailed compared to previous curriculum. They provide relevant books that are provided and if we look at the pace setter compare to the book you would use, they are related. Paper work is confusing because it says you must have prepared lessons and we spent more time preparing administrative work than teaching” (Transcript 2).

This revealed that teachers considered the new curriculum to provide better **links** between the related topics across Grades 10 to 12, which made it easier for them to teach in the classroom. Their perception was also that the CAPS curriculum had more relevant content, which the old curriculum failed to include. Teachers also mentioned that, in terms of the level of difficulty compared to the old curriculum, CAPS was simpler to teach and more easily understood by learners. These results show similar results to the document analysis results in Chapter 5, where it was revealed that the CAPS policy was user-friendly. These perceptions by teachers imply that they understood the new curriculum better than the old curriculum.

Teachers mentioned that the new curriculum covered more aspects and was more detailed. However, it provided teachers with more work and sometimes they found it difficult to complete the teaching schedule in the given time. Teachers perceived that the new curriculum, being more detailed, made it simpler and easier to understand

and teach to learners. They also mentioned that the teaching of environmental impact topics in the new curriculum was now easier and they were encouraged by that. It is evident that the CAPS curriculum is an easier document to comprehend and teachers are finding teaching less difficult. I agree with them that it is more accessible. However, challenges such as lack of motivation from learners, lack of resources and less time allocated for lessons pose a threat to both teaching and learning processes. These challenges are mentioned in Sections 6.3.1.4 and 6.3.2.4.

In relation to teachers' arguments about the importance of the new curriculum, Khan and Law (2015:75) mention that structures such as public schools tend to be less receptive to external influences in the implementation of new curricula. According to the DBE (2014), complaints were raised on the following hindrances where stakeholder's realised changes were necessary to revamp the education system in South Africa by introducing CAPS. In this study, teachers complained about hindrances such as implementation problems and being overworked due to additional administration requirements such as the preparation of weekly lesson plans. This implies that, even though CAPS had been structured in a way that teachers began to understand what was to be taught and when, there were still challenges in the implementation of the curriculum.

Apart from teachers' comparisons of the two curricula, the document analysis in Chapter 5 (Table 5.2, Table 5.3, Table 5.4 and Table 5.5) revealed that before 2012 the coverage of environmental topics in the curriculum was less than in the CAPS coverage. From this comparison, it can be deduced that teachers might have more influence in ensuring that learners are taught education for sustainable development and have greater confidence that those topics are likely to be examined at the end of the year in the new curriculum.

I concur with the complaint of teachers and am of the opinion that the changes in structure and assessment weighting for some subjects will further limit coverage of some important themes or topics in the curriculum. I noted that some of the topics in the subjects that are currently overlooked are the ones with environmental themes such as environmental impact topics.

In support of the above statement, one teacher when asked, “Does the depth of content coverage in the curriculum affect the way you prepare your learners for examinations?” stated that:

“I think exam preparation for this topic is easier compared to other topics. Because this one when you teach environmental studies in class like the one learners also can get involved, it’s not just teacher-centred it is a very interesting topic. When it comes to exam preparation is to give them previous question papers, you don’t have to go back and revise that much” (Transcript 6).

The consistent coverage of environmental impact topics in the examination stated by the teacher above affects the way teachers prepare for future examination of the learners. I agree with the teacher that teaching environmental impact topics in the curriculum also provides opportunities for learners to learn about the environment in a practical way. This can be illustrated in examples where learners can be taught about land degradation and air pollution that is being experienced in their natural surroundings. This agrees with the RST framework which claims that dimensions of structure have the capacity to inform actions that influence individuals (teachers). It is evident from this research that teachers use past examination question papers for practicing for the forthcoming examinations. The culture of using past examination to prepare final year learners was evident in this study. Teachers relied mostly on past examination papers to prepare learners and this was transferred to learners who are also important agents in the school system.

In support of this finding, a teacher participating in this study who had been teaching Geography for 22 years was asked; “How the shifts or changes of the curriculum affected the examination of environmental impact topics?” and replied that:

“I would say that, I think the coverage was sufficient than the previous curriculum. We saw some topics which were not part of the curriculum are now included, according to my observation, CAPS has more coverage on environment topics” (Transcript 2).

From the comment of this participant, it is clear that teachers were aware that the coverage of environmental impact topics in the CAPS had improved compared to the old old NCS (Grade 10-12) curriculum. Teachers also used past examination question papers to gauge the standard of forthcoming examinations. In support of this

statement one teacher was asked, “*How often do you use past examination question papers in your teaching activities?*” and replied:

“I use them a lot, because we prefer that learners get used to the standard of how exams are set, simply because I sometimes set test according to how you think and believe the learners have understood the lesson, and the examination come and it’s totally different” (Transcript 4).

All of the participating teachers mentioned the importance of past examination papers in their preparation of learners for the Grade 12 exit level examinations. Some teachers used them in the beginning of the year and some used them every time they prepared a lesson for Grade 12 learners. Teachers mentioned that when they used past examination question papers, they did not need more time to go back and revise certain topics. Teachers also realised that in the examinations under CAPS, coverage of environmental impact topics had improved compared to old NCS (Grade 10-12). It has been observed in this study that past examination question papers were essential in learning and they helped teachers and learners to know the standard of the examinations. It was noted that teachers had vivid recollections of the changes emerging from the shift from old NCS (Grade 10-12) to CAPS. Some of these changes seen by teachers were that in CAPS the topics were now linked to each other, it was easier to understand, covered more content than before and the content was now relevant.

6.3.2.2 E2- Availability of resources before and after the curriculum shifts

According to the RST, resources are part of the structural component that influence teaching and learning of environmental impact topics in the CAPS curriculum. Teachers highlighted the benefits of the CAPS curriculum when teaching environmental impact topics, but at the same time, they mentioned the lack of availability of resources to facilitate teaching and learning in the classroom. According to teachers, the issue of a lack of resources had the same negative impact in the old curriculum as it had in the new curriculum. One of the participants mentioned the lack of resources that impeded teaching in the classroom, as follows:

“I think the only challenge is shortage of resources, in some lessons, one need to use ICT gadgets but we do not have, because they assist in terms of learners need to get what they want in terms of teaching. You find that lesson needs, but it becomes a

challenge if you want to demonstrate, because in the book it's only pictures and also we have shortage of textbooks as well" (Transcript 2).

Although resources were limited, some teachers mentioned that in their schools the use of textbooks was not that problematic because of the fortunate circumstance of having smart boards. They mentioned that in the old curriculum they had to conduct all of their lessons on the chalkboard. However, now the teachers were using smartboards and that made it easier to demonstrate a lesson in the classroom. Some teachers mentioned that they used compact discs loaded with past examination question papers and that each learner was able to download the study material and could learn on their own at home. From the views of teachers in this study, it can be deduced that although teachers mentioned inadequate resources for teaching environmental impact topics, the teaching and learning resources had improved due to technology since we are now in the Fourth Industrial Revolution. In one of the rural schools, a teacher stated that they used tablets that were donated by a telecommunications company. However, the challenge they had was that the internet connection was slow and that only a few learners could take part in a lesson due to the classrooms being overcrowded.

6.3.2.3 E3- Teachers' views on the positive impact brought by the shifts of the curriculum

Positive impacts brought about by the shifts of the curriculum were not limited to environmental impact topics. The shifts in the curriculum not only **improved** the content coverage of environmental impact topics in some subjects but also improved the usage of technological gadgets in the classroom as seen in the section above. The complexity of the content being taught in the school required more resources and teachers were able to devise some strategies to ensure that their lessons were successful, and learners were able to benefit even though the classes were overcrowded. This study revealed that teachers had become more innovative and were keeping up with the ever-changing technologies in the education system.

Teachers mentioned the improvement in the results of subjects such as Geography and Life Sciences since the new curriculum was introduced in the year 2012. However, this study found that, although the results of learners in these subjects have improved, the examinations pass rate on environmental impact topics had decreased.

The demarcation of the topics to be taught per term in the new CAPS curriculum made the preparation of lessons by teachers easier as they now knew what content needed to be covered per week. This caused teachers to better keep up with the expected pace of the work schedule and to even work overtime, if necessary, to cover the content. This benefit of the new CAPS curriculum was not limited to environmental impact topics as they also form part of the content to be taught in the. Apart from conducting lessons in the classroom, the new curriculum allowed environmental impact topics to be conducted outdoors in the form of excursions as alluded to by teachers during the face-to-face interviews. When asked about the benefit of teaching environmental impact topics in CAPS, one teacher commented:

“Yes, I think what we have in that document, even after one has used the documents, it was quite interesting in terms of it made us aware, how we should teach and make it interesting to the learners”(**Transcript 2**).

Teachers realised that all the CAPS documents used in the teaching and learning of environmental impact topics made teaching interesting because they were aware of which sections should be taught and how they were supposed to teach those sections in the classroom. On the other hand, when one participant was asked *“How do you find teaching environmental impact topics in the CAPS curriculum?”*, he replied that:

“The teaching is easy, but only if you have all the information for that particular topic. Because everything starts with the educator, if the educator has resources then it’s easier to also transfer to the learners” (**Transcript 3**).

As seen in the narration above, the issue of resources is one of the major concerns that emerged repeatedly in this study. Teachers’ work was impeded by a lack of teaching and learning materials. I agree with the teacher that everything in teaching the new curriculum starts with teachers and that if teachers are not prepared then the lesson will be unsuccessful. It seems that the lack of necessary resources was a major problem in teaching environmental topics in the new curriculum. I observed in this study that the shifts in the curriculum did not take into consideration the provision of necessary resources to be used by teachers in their subjects. In spite of this, teachers found the teaching of environmental impact topics in the CAPS to be interesting. For example, when asked, *“How do you find teaching environmental impact topics in the CAPS curriculum?”*, one teacher stated:

“I enjoy it; I enjoy it because when you teach them it is something they can relate to nature. Because they can easily relate to, because it is something they live with every day, taking care of nature, taking of various organisms that we have. And the issue of extinction” (Transcript 6)

Some teachers indicated that teaching environmental impact topics in the new curriculum was interesting to learners because they could relate to their natural surroundings. I agree with the teachers that when teaching environmental impact topics most examples must be formulated in relation to the learners’ natural surroundings so that they can be able to relate what they have learnt in the classroom to their natural world. This implies that learners will be in a better position to be agents of behavioural change towards environmental sustainability. This is supported by William (2010:75), who contends that “sustainability is seen as the miracle-cure for all the ailments of contemporary education and through the prism of sustainability, educationalists can once again envisage changing the world, not by creating knowledge but by an objectified generation” of knowledge. Similarly, Rioux and Pasquier (2013) indicate that acquiring responsible environmental behaviour is the aim of EE, where there will be a development of sustainable environmental behaviour that becomes a habit, which can be applied to all aspects of daily life.

In conclusion, teachers noted that the new CAPS curriculum had brought several positive impacts. Some improvements that were identified by teachers were increased content coverage, improved examination results of learners in subjects such as Life Sciences and Geography. CAPS also allowed teachers to be innovative in their lesson preparation. The demarcation of the topics to be taught in a term enabled teachers to follow a common schedule. In contrast to the improvements that were brought by CAPS, the lack of teaching and learning resources was a **major setback** to CAPS. This leads to the following category that discusses teacher’s views on the threats brought by curriculum changes.

6.3.2.4 E4- Teachers’ views on the threats brought by curriculum changes

Apart from the numerous benefits of the shifts of the curriculum in the teaching of environmental impact topics, there were some concerns enshrined in the teaching and learning process. As mentioned in the sections above, teachers indicated that there were concerns in teaching environmental impact topics in CAPS because the learning

process was learner-centred, which made it difficult to teach in overcrowded classrooms. One teacher mentioned that it was a challenge to complete the content in the time specified by CAPS. The teacher was asked, “*How is the coverage of the new CAPS curriculum compared with the previous curriculum?*” and replied:

“Although it is a bit difficult for us, who have been around, but the fact that it gives the learners opportunities to show case their abilities. It is not teacher focus, though it wastes our time. It is time consuming most of the time it is difficult to cover the syllabus, because you need to have enough time to give to each learner attention and that’s the only challenge we have and we learn a lot from the learners to improve ourselves as well” (Transcript 4).

The issue of time in teaching environmental impact topics was one of the concerns most teachers alluded to when comparing CAPS to the old NCS (Grade 10-12). One participant noted that:

“I think we were expecting that CAPS to have less admin, but it is the same as previous curriculum” (Transcript 1).

From this response, it can be concluded that teachers were expecting less administration work for CAPS. They revealed that teaching environmental impact topics requires a lot of paperwork to be done by teachers in terms of marking and setting of questions for learner’s formative and summative assessment. In subjects such as Life Sciences and Geography that carry considerable environmental impact topics content, teachers complained about too much filing that had to be done by the teacher. Teachers mentioned that filing emanated from the evidence that they had to produce when subject advisors come to evaluate their work at school. The filing was in the form of item analysis, subject improvement plans and schedules of learners’ performance in the formative and summative tasks. One teacher indicated this in saying:

“We have lot of filing to do, they talk about item analysis, subject improvement plan, and performance, it’s good but it has lot of work” (Transcript 1).

This is supported by the National Senior Certificate Diagnostic Report of 2016 (DBE, 2017), which stated that environmental impact topics do not get enough revision time from teachers in Grade 12, which resulted in the poor performance of learners in the

past examinations as mentioned in Chapter 5 section 5.8.4.4. The following section discusses results emerged from the theme coverage of environmental impact topics, teachers perspectives. It is important to mention that this theme was succinctly analysed under the document results Chapter 5. This chapter only presents the views of teachers about document coverage of environmental impact topics.

6.3.3 Theme: Coverage of Environmental Impact Topics in the Curriculum

6.3.3.1 C4-Teachers' perceptions on the role-played by documents in the successful teaching of environmental impact topics in the school.

According to De Souza (2013), the RST theoretical framework, structure, in the concept of Context-Mechanism-Outcome configuration (CMOc), comprises of components, which are roles, positions, practices, resources and processes. Documents such as textbooks and past examination question papers were used by teachers (agents) during the learning process. These documents were used by teachers in the successful teaching of environmental impact topics in the school. This section analyses and interprets the perceptions of teachers as agents in the role played by documents in the successful teaching of environmental impact topics in the school. One teacher was asked, *“What is the extent of previous question papers affecting your emphasis of a particular topic in the classroom?”* and replied that:

“Because we need to look at the CAPS document and exam guidelines, because the textbook has lot of things. Not everything needs to be done. So, when you look at exam guidelines you have to look at the previous question papers and it will save a lot of time in class and that is where I am with the Grade 12 because I have been teaching them for 5 years. I now have experience with the question papers. I know the topics they set” (Transcript 6).

From this narration of the teacher, it is important to realise that teachers, as agents of change in the classroom, were not only using past examination question papers and textbooks in the learning process but they also used examinations guidelines as one of the documents that influenced the successful teaching and learning of environmental impact topics in the school. This study also revealed that teachers, with the teaching experience they had accumulated in the school environment, knew which topics were going to be set for examinations and more emphasis was focused on those

topics. Another teacher emphasised the importance of documents such as examination papers by saying:

“I check how often they ask some topics and then I emphasis on those in class”
(Transcript 5).

This shows that documents played an important role in the teaching and learning structure of the learning process. However, in contrast to other participants, one teacher mentioned a different approach to the use of documents in the learning of environmental impact topics in the curriculum by saying:

“I normally set to teach the whole curriculum, because I am doing what I am expected to, so it does not affect me” **(Transcript 4).**

In this case, it can be seen that some teachers begin by teaching their learners everything that is stipulated in the CAPS policy document and were not affected by the extent of examination coverage of environmental impact topics in the curriculum. Only one teacher mentioned that she made limited use of examination questions, while the other five teachers made use of past examination question papers frequently. One teacher noted:

“There’s no way one can ignore the diagnostic report” **(Transcript 2).**

Teachers also mentioned that reports were made available at the beginning of the year by the Department of Education on how learners were able to answer examinations questions were important documents that play a role in the successful implementation of environmental impact topics in the learning process. These reports were called diagnostic reports and were available for all subjects in Grade 12. These reports, according to the teachers, helped them to focus on content that was difficult for learners and provided ways on how those difficult topics could be taught in the classroom by teachers. The report also provided teachers with clear common mistakes made by learners when attempting particular questions during examinations. Teachers also elaborated that apart from the documents such as CAPS policies, past examination question papers, handouts from the internet, diagnostic reports and handouts from CI’s, textbooks also played an important role. They revealed that CAPS textbooks had enough information that could be used by the learners during the

learning process. I agree with the assertion of teachers using all documents to the best of their ability to inculcate knowledge to learners.

Mustam and Daniel (2016) indicate that integration of environmental impact topics in Malaysia was done in subjects such as Geography, English, Bahasa Malaysia (national language) and Science. Studies on integration of those subjects revealed that knowledge among learners was high and the major shortfall was the teachers' weak implementation of an EE curriculum as their approaches did not live up to expectations as the focus was on preparing students for national examinations. In contrast to the results of Mustam and Daniel (2016), this study found that the CAPS curriculum was loaded with content that needed to be completed before learners sat for the examinations. Therefore, teachers revealed that it was important to assist learners to pass the examinations, as the CAPS curriculum was examination-oriented. In conclusion, teachers in this study emphasised that their performance was evaluated according to the results of the learners at the end of the year by the DBE and not by how much content they were able to impart to learners over the course of the year. The section below provides conclusions based on the structural, cultural and agential dimension of teachers in the teaching of environmental impact topics.

6.4 CONCLUSION ON THE STRUCTURAL, CULTURAL AND AGENTIAL DIMENSIONS OF TEACHERS

The realist social framework used in this study comprises of aspects of structure, culture and agency, which according to Archer (1996a) interact to shape and re-shape the conditions people have for engaging in action. This section discusses the structural, cultural and agential dimensions of teachers' perceptions of changes in the school curriculum.

6.4.1 Structural Dimension of Teachers

This study alleges that teaching environmental impact topics in the CAPS curriculum is affected by several structures such as the DBE, the school governance system, teaching and learning resources and the social community. The interaction of all these structures results in teachers being able to provide necessary services to learners in terms of imparting knowledge to learners. It can also be seen in this study that agents such as parent's involvement in learners' school needs improved their ability to

perform well in examinations. Teachers' work in schools was impeded by a lack of teaching and learning resources and that inhibited the action of teachers to explore more teaching strategies in EE lessons. Consequently, social structures are activity-dependent, requiring agents (like teachers and policy makers) to engage in social activities in order to sustain or transform them (De Souza, 2017). Therefore, the structural dimension assists agents with contexts within which to pursue activities and interests. These activities and interests pertain to institutional, physical, material and human resources and relations. It can be mentioned that the new structure of the curriculum was favourable to agents (teachers and learners) in ensuring that environmental impact topics' teaching and learning were being positively transformed in the education sector. This study has revealed that the shifts in the curriculum transformed the teaching, content coverage and examination of environmental impact topics. Agents such as teachers, also agreed with the results that a structure such as the CAPS curriculum was more detailed compared to the old curriculum. This resulted in lessons being more effective in the classroom but concerns of resources were still a major threat to teaching and learning.

6.4.2 Cultural Dimension of Teachers

Cultural dimension entails understanding the ideological beliefs and commitments the teachers have towards education. These prevailing beliefs and commitments would guide decision-making and place the direction of changes along certain trajectories more than others (De Souza, 2017). The results of this study recognised that, in the CAPS curriculum, teachers had developed skills that enabled them to utilise different teaching strategies in order to teach environmental topics. For example, some teachers had developed a culture of using technology to teach their learners. They were able to use smart boards and form WhatsApp groups with learners so that they could be assisted with homework while they were in the comfort of their own homes at night. This demonstrates the power and culture of utilising different strategies to ensure that learners were well equipped in their studies. Teachers were convinced that the new CAPS curriculum was better than the old old NCS (Grade 10-12) curriculum and revealed that they were now committed to embrace new technology in teaching environmental impact topics. The culture of using technology not only improved the cognitive skills of learners but also ensured that the future generations'

behaviour towards sustainable development was positively transformed (such as less use of paper and toner).

6.4.3 Agential Dimension of Teachers

Curriculum changes in South Africa affected teaching context and these changes enabled teachers to make pedagogical improvements in the classroom. This study revealed that teachers transformed their teaching strategies to suit to the current generation of learners. The ability of the teachers to transform to the changes in technology shows that teachers exercised the kind of agency that enabled them to meet the requirements of environmental impact topics content knowledge. This implies that the way education has been relationally organised in the past had conditioning effects that exerted causal influences, which differently constrained and/or enabled present-day activities and the changes that can be made (De Souza, 2017). In this study it can be indicated that the negative effects of old curriculum enabled changes in the CAPS to be effective. In other words, it is important to realise that CAPS was an extension of the old old NCS (Grade 10-12) and teachers in the study were agents of change who could either take action or not depending on their beliefs, values and experiences. For example, in this study teachers took actions in the learning process shown in Table 6.5, which involved, planning, implementation and evaluating environmental impact topics.

6.5 SYNTHESIS OF RESULTS ON TEACHERS VIEWS ABOUT TEACHING ENVIRONMENTAL IMPACT TOPICS

The conclusion that can be drawn from the three themes emerging from this study are structured according to the two research questions and RST framework on aspects such as structure, culture and agency. One of the research questions that the study provides answers for is: *“What changes have been brought about in the new curriculum (CAPS) in the coverage of environmental impact topics?”* In response to this research question, the study’s results from teachers’ face-to-face interviews revealed that there were several changes that were experienced and seen by teachers. The teachers interviewed had been teaching the new CAPS curriculum since its inception and the experience they had was important in knowing exactly what these changes were. These changes were the school’s operational structure, use of different teaching strategies, enhanced collaboration, formation of environmental committees

and changes in teachers and learners' behaviour. These changes were comparable to RST mechanism where Archer's (1995) views reality as complex and recognises the role played by structure, culture and agency to foster relations through mechanisms that influences human behaviour. In the case of this study teachers and learners behaviours are influenced by outcome of interactions of structure, culture and agency.

In this study, it emerged that teachers had experienced challenges in the implementation of environmental impact topics, and they associated these difficulties to changes that had happened in the curriculum. Firstly, teachers observed that the operational structure in CAPS was different from the previous curriculum where teachers had to rely upon external structures such as the subject advisors to implement lessons in the classroom. In the results of this study, was evident that the operational structures, such as the management of the school, affected the way teachers engaged with learners on environmental impact topics. The study analyses revealed that the interactions of teachers with external structures result in or affect change in the social context of interest, that Archer in the RST classify it as emergent properties that are called mechanisms (Archer, 1995). These mechanisms in this study are the outcomes (See Table 6.2) which are perspective of teachers in teaching environmental impact topics. The study revealed that teachers had to use textbooks, past examination papers and policy documents to ensure that lessons were well structured for environmental impact topics and the availability of these resources depended upon the structures that are there at school level. The use of templates provided by subject advisors was not the only way they conducted the lessons. CAPS enabled teachers to incorporate other interesting practical activities into their lesson plans and this led to some learners being more interested in participating in the lesson, although it should be mentioned that some learners were not co-operative during these activities.

Secondly, teachers indicated that the CAPS curriculum allowed them to use different teaching strategies in the teaching of environmental impact topics. The teachers developed a culture of collaboration in accessing the necessary resources and skills to impart environmental knowledge to learners both inside and outside of the classroom. Some teachers had developed a culture of forming an environmental committee, where the lessons learnt in the classroom were practiced in the outside

world. Teachers developing a culture of collaboration is an indication that these outcomes have transformed due to invariance or reproduction of those aspects of culture related to proportional formulations about structure, culture, agency and relations (See Table 2.7) which Archer (1995) refers to as outcomes of cultural dimension. Teachers believed that CAPS had widened the scope of teaching strategies that could be incorporated when teaching environmental topics. Some teachers taught environmental impact topics in the form of excursions, as research projects or as classroom presentations. This implied that teachers were innovative and CAPS enabled them to explore other relevant teaching strategies during the teaching of environmental impact topics.

Consequently, I concur with the emerging culture of the agents to adopt strategies such as collaboration in order to gain necessary content knowledge about EE and subsequently having the capability to teach in the classroom without doubts or challenges. It was found that although teachers encouraged learners to use other methods studying environmental impact topics, some learners were afraid to do presentations. The implication of learners being afraid of taking part in the presentations poses a significant threat to the accumulation of necessary skills and knowledge. The results also revealed that teachers used charts as one of the resources in the teaching of environmental impact topics in the school. In summary, teachers used the following teaching strategies for environmental impact topics: collaborative learning, lectures, question and answer, research projects, co-operative learning, excursions, practical work and group discussions. The teaching strategies enhanced changes in the way teachers presented lessons in CAPS and this was also beneficial to learners who later exhibited positive behavioural changes towards the environment.

Thirdly, results on teachers' views and perceptions about teaching environmental impact topics in CAPS curriculum revealed benefits that had been brought by the curriculum change. However, teachers also revealed some challenges that emanated from teaching environmental impact topics in the CAPS curriculum. Some of the challenges that emerged were lack of motivation from learners, congested content, lack of teaching and learning resources, limited time allocated for lessons, lack of financial support from parents and inability of progressed learners to cope with the demand of the new content. Most of the teachers interviewed used textbooks to

facilitate learning processes in the schools. The use of textbooks as one of the resources to teach in the curriculum had problems as some schools had large numbers of learners and few textbooks. It can be deduced that schools as structures, and teachers and learners as agents, still lacked the necessary resources to ensure that the learning processes were implemented without hindrance and concerns.

Lastly, the study also contends that teachers should not only transfer relevant information about environmental issues but must also evoke learners' personal interest and care for environmental issues, as well as their readiness for involvement in the process of solving environmental problems. The process of teaching environmental impact topics involves the feelings of the teacher during lesson preparation and execution. I agree with the teachers that teaching learners about EE leads to behavioural changes that enhance knowledge to foster environmentally aware and active citizenry. Although teaching of environmental impact topics in the CAPS curriculum had some challenges, teachers claimed that it was better than the past curriculum in terms of the structure of the curriculum. In addition, this research revealed that teachers used past examination question papers most of the time when preparing learners for the examinations in Grade 12. This implies that the culture of using past examination papers was common to most teachers and learners. However, there were contradictions as to when teachers used past examination papers, with some teachers using them at the beginning of the year and some using them every time they prepared a lesson for Grade 12 learners. The common practice was that most teachers use past examinations towards the end of the year, during preparations for actual exit level examinations.

As mentioned earlier, teachers relied on documents such as past examination questions to know how they should structure their lessons. Only one teacher mentioned that she made limited use of examination questions, while the other five teachers made use of past examination question papers frequently. This supports the notion that teachers can be influenced by the extent of coverage in the examinations. Teachers also revealed that the CAPS curriculum was loaded with content that needed to be completed before learners sat for the examinations. Therefore, teachers revealed that in order to impart knowledge to learners for them to be tested in examinations, it was important to assist learners to pass the examinations as the CAPS curriculum was examination-oriented compared to old NCS (Grade 10-12).

The second research sub-question of the chapter was: “*How do teachers find the teaching of environmental impacts topics in the curriculum under CAPS (FET phase) compared with the old curriculum?*” In addressing this question, teachers were interviewed, and they indicated several comparisons based on their experience of teaching in both the CAPS and the old NCS (Grade 10-12) curricula. Teachers interviewed in this study revealed understanding of the changes from the old NCS (Grade 10-12) to CAPS. CAPS built upon the old NCS (Grade 10-12) but also updated it and provided specifications on what was to be taught and learnt on a term-by-term basis (DBE, 2017). According to teachers, teaching environmental impact topics in CAPS appeared to not be as challenging when compared with the old old NCS (Grade 10-12) curriculum. They mentioned that environmental impact topics in CAPS linked similar content that had to be taught. Teachers further mentioned that teaching environmental impact topics in CAPS was simpler; it was easier for learners to understand the content, which was more relevant to the local issues. The new curriculum covered more content, provided more opportunity to use technology in classrooms and as such, examination results of some subjects such as Life Sciences and Geography improved in Grade 12. Teachers highlighted the unavailability of adequate teaching and learning resources as a major challenge in CAPS in comparison to the old curriculum. The provision of more content coverage in these subjects illustrated Archer (1995) RST that culture allows researchers to analyse how dominant ideas or prevailing cultural conditions affect individuals’ perceptions of what can or cannot be done in a social context. In the context of this study, these perceptions will lead teachers teaching more environment content in the classroom.

In contrast to teachers perceptions that the CAPS curriculum was easier to teach compared to the old curriculum, Ramatlapana & Makonye (2012), indicated that prescriptive nature of the curriculum as espoused by CAPS at times compromised educator autonomy in effecting quality education. This is highlighted by the diagnostic report for 2016 examinations that environmental impact topics in CAPS were done poorly in the Grade 12 examinations. This implied that it was easier to teach and think that learners understood than it was to teach so that learners pass the examinations. The focus of this study was to explore how teachers found the teaching environmental impact topics in CAPS compared to old NCS (Grade 10-12). These perceptions by teachers implies that they understood the new curriculum better than the old

curriculum. However, whether learners were passing or not can be part of another study that can be investigated in future.

Secondly, teachers believed that the CAPS curriculum had more relevant content than the old curriculum. The teachers' perceptions were that the new curriculum covered more topics on environmental issues than the old curriculum. In addition, teachers claimed that the new curriculum covered more aspects and was more detailed than the previous curriculum. However, the wider the scope of coverage also provided teachers with more work and sometimes they found it difficult to complete the schedule in the given time. Thirdly, teaching environmental impact topics under CAPS provided more opportunities to use technology in classroom. Participants acknowledged that in the old curriculum, they had to conduct all of their lessons on the chalkboard whereas now it is becoming more common for teachers to use smart boards, which made it easier to demonstrate a lesson in the classroom. Despite limited resources, some teachers mentioned that in their schools, the scarcity of textbooks was not that problematic because of the fortunate circumstance of having smart board technology in the schools. Teachers were now able to present lessons through videos and templates that could be projected onto the smartboard screen where all learners would be in a position to view. In addition, teachers were also able to use compact discs for examination paper storage, cellular phones for communication (WhatsApp) and tablets for research purposes. Although technology had improved access for teachers and learners to get information, the unavailability of some teaching and learning resources was a major challenge in comparison to the old curriculum. It is evident that the CAPS curriculum was an easier document to comprehend and teachers found teaching less difficult. I agree that it is more accessible, but challenges such as a lack of motivation from learners, lack of resources and less time allocated for lessons poses a threat to both teaching and learning in CAPS.

In sum, this section shows that teachers were able to differentiate the effects of the new curriculum when compared to the old curriculum. They were able to realise that CAPS was better in terms of structure of lessons and activities to be done in the classroom. They further realised that time constraints were still a problem because of the loaded content to be taught within a limited period of time and thus affecting learners' performance in subjects such as Life Sciences. This is supported by the National Senior Certificate Diagnostic Report of 2016 (DBE, 2017), which revealed

that environmental impact topics did not get enough revision time from teachers in Grade 12, resulting in poor performance of learners in the past examinations as mentioned in Chapter 5, section 5.8.4.4.

The synthesis of this study also points out if the results conform to UNESCO’s (2005) approach to ESD and EE that it should;

- Be interdisciplinary and holistic: ESD should be embedded in the entire science and technology curriculum and not merely be presented as a separate topic;
- Become value-driven: The ethical values and principles underpinning sustainable development should be accepted as the guiding principle of science and technology education;
- Promote critical thinking and problem-solving: Addressing and understanding the dilemmas and challenges of sustainable development requires skills in critical thinking and problem-solving;
- Be based on multi-dimensional methods: Art, drama, debate, experience, etc., should be used to construct a multi-faceted pedagogy which can cope with the multi-dimensional character of ESD;
- Involve participatory decision-making: Learners should be given the chance to participate in decisions and learn how they are to be made;
- Focus on applicability: Learning should be integrated into day-to-day personal and professional contexts; and
- Achieve local relevance: Teaching should address global as well as local issues, including use of the language(s), which the learners most commonly use.

Table 6.6: Synthesis of the interview results based on UNESCO approaches to EE/ESD

UNESCO APPROACHES	SELECTED ALIGNMENT OF UNESCO APPROACH IN THIS STUDY’S RESULTS
Be interdisciplinary and holistic	CAPS curriculum allowed teachers to use different teaching strategies in the teaching of environmental impact topics. ESD in the curriculum is embedded throughout the entire science and technology curriculum using equipment such as smartboards, compact discs for examination paper storage, cellular phones for communication (WhatsApp) and tablets for research purposes. This

UNESCO APPROACHES	SELECTED ALIGNMENT OF UNESCO APPROACH IN THIS STUDY'S RESULTS
	approach was affected by a lack of the necessary resources in some schools and the scourge of theft of some equipment by the community.
Become value-driven:	Forming of environmental committees by some schools in the province showed teachers played an important role in ensuring that learners practiced ethical values and principles underpinning sustainable development. These values were not practiced by other schools that based their concern on availability of time, resources and support from social structures such as school management.
Promote critical thinking and problem-solving	The use of different teaching methods as shown in Table 6.5 suggests that some teachers promoted understanding of sustainable development through methods that allowed learners to be problem solvers and critical thinkers. However, some learners were not co-operative during these activities. The study revealed that the CAPS curriculum was loaded with content to be taught within a limited time. This could be a hindrance to slow learners who will then require more time to develop problem solving and critical skills.
Be based on multi-dimensional methods	Teachers developed a culture of collaboration in accessing necessary resources and skills to impart environmental knowledge to learners both inside and outside of the classroom. Teachers used multi-dimensional methods more in CAPS than in old NCS (Grade 10-12). This resulted in lessons becoming easier to present and more learners becoming interested in different approaches to environmental impact topics lessons.
Involve participatory decision-making	In some schools, learners were not given the privilege to participate in decision-making processes. This was due to a number of factors such as lack of motivation from learners, congested content, lack of teaching and learning resources, less time allocated for lessons, lack of financial support from parents, etcetera.
Focus on applicability	Relevance of the CAPS curriculum to adapt to different teaching methods had enabled teachers to integrate learning into day-to-day personal and professional contexts as seen in Chapter 5 on document analysis. In some schools, the focus on applicability was hindered by the unavailability of some teaching and learning resources.
Achieve local relevance	The CAPS curriculum could be ideal to achieve local relevance when teaching some environmental impact topics. Teachers revealed that it was still a challenge to entirely teach environmental impact topics

UNESCO APPROACHES	SELECTED ALIGNMENT OF UNESCO APPROACH IN THIS STUDY'S RESULTS
	in their local languages. However some teachers stated that code switching was done during their lessons and the use of local examples was a common practice in the classroom.

6.6 CHAPTER SUMMARY

This chapter provided results from interviews with the six teachers who took part in the study. Furthermore, this study presented RST components based on the CMO'c, which were used in this study as a lens to evaluate the interviews from teachers on how the shifts of the curriculum affected the coverage, teaching and examination of environmental impact topics in the curriculum. This chapter further provided an analysis and interpretation of the data based on three of the four emergent themes, namely: teacher's collaboration and orientation towards environmental impact topics in CAPS; effects of changes of the curriculum; coverage of environmental impact topics in the curriculum. These themes were used in the interpretation of the results of this study. Chapter 7, which follows, presents teachers' views about the importance and influence of the Fundisa for Change programme to the teaching of environmental impact topics in CAPS.

CHAPTER 7

RESULTS ON ANALYSIS OF THE FUNDISA FOR CHANGE PROGRAMME

7.1 INTRODUCTION

This chapter presents data based on interviews with teachers who attended the Fundisa for Change Programme's training workshops that were aimed at improving teacher's knowledge on how to teach environmental topics in the curriculum. It responds to the main research question that focuses on how the shift in the curriculum has affected coverage, teaching and examination of environmental impact topics in South Africa's Further Education and Training (FET) phase. The sub-question answered in this chapter is:

What was the impact of teacher support for teaching environmental impacts topics provided through the Fundisa for Change Environmental Teacher Training Programme?

The Diagnostic Report of 2016 (DBE, 2017) noted that learners performed poorly on environmental topics when analysing the Grade 12 final year results for the whole country. This chapter evaluates the relevance of the Fundisa for Change programme in improving the teaching of environmental impact topics in the South African FET curriculum. Teachers from selected schools in Mpumalanga were chosen on the basis of their taking part in the Fundisa for Change Teacher Training Programme as mentioned in Chapter 1. The results of the face-to-face interviews in this Chapter are structured as shown in Figure 7.1 in the schematic diagram below.

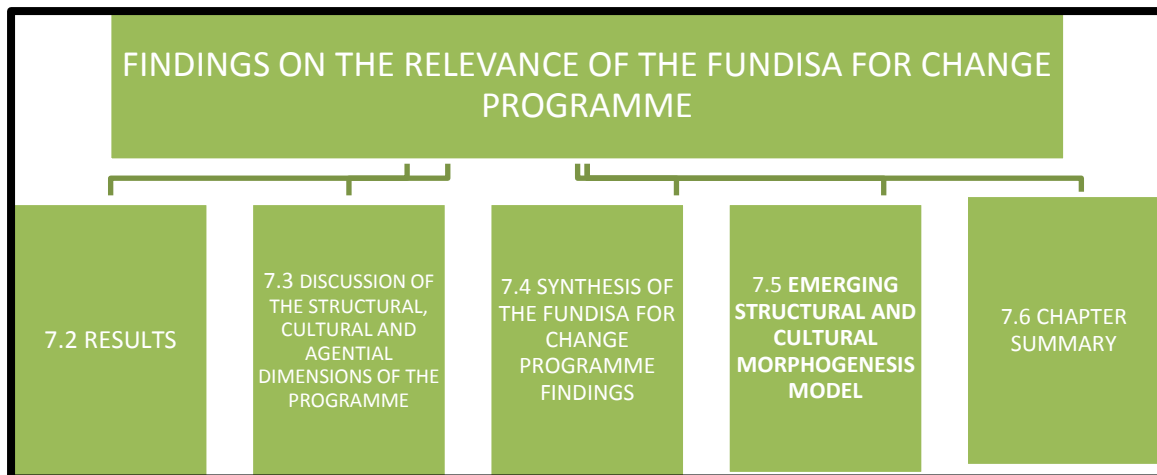


Figure 7.1: Chapter outline

The following section provides analysis of the influence of the Fundisa for Change programme in the teaching of environmental impact topics, which is an emergent theme of this Chapter as seen in Chapter 6 Section 6.2.2 in Table 6.3. Table 7.1 below shows the presentation of the selected analysis of interviews based on the RST framework.

Table 7.1: Presentation of selected participant's data based on the context, mechanisms and outcomes configuration

CONTEXT	MECHANISMS (CODES as seen in Chapter 6 Table 6.1)	OUTCOMES/CHARACTERISTICS /EPISTEMOLOGY
Pre-existing aspects	Related to the following emergent properties in an action context	Transformation, invariance or reproduction of those aspects of structure, culture, agency and relations
Structure	Mechanisms related to processes (SPR)	<p>How did the training provided by Fundisa for Change programme assist you in delivering your lessons on environmental impact topics in your subject?</p> <p>(Response from a teacher who was teaching Climate Change in Geography)</p> <ul style="list-style-type: none"> ▪ It helped a lot, we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources. You can use carbon footprint; you do not need resources and those are in use now or it is practical. (Category F1) <p>(Response from a teacher who was teaching Biodiversity in Life Sciences)</p> <ul style="list-style-type: none"> ▪ Yes, I got the idea, regarding the excursions from this training, became they took us to the Nelspruit botanical garden. They took us there we are adults and we are teachers but we enjoyed it like we were learners. That is where I got my teaching ideas, I started implementing the following year till today. And you can't teach about the environment in the classroom; something you just can't teach while in class, they need practical experience (Category F2)

CONTEXT	MECHANISMS (CODES as seen in Chapter 6 Table 6.1)	OUTCOMES/CHARACTERISTICS /EPISTEMOLOGY
Culture and agency	Mechanisms related to ideas or propositional formulations about culture (CC)	<p>Did your teaching of the content improve after the Fundisa training? (Response from a teacher who was teaching Biodiversity in Life Sciences)</p> <ul style="list-style-type: none"> ▪ The change is when I prepare my lessons, because at the training, we had time to be outside and it actually made me realise that, there are things we can use from the school and make the lesson interesting and practical within the school yard and not concentrate only on the textbook (Category F2) <p>(Response from a teacher who was teaching Climate Change in geography)</p> <ul style="list-style-type: none"> ▪ Very much, it improved such that I applied what I felt, because of the confidence we gained from training and hence we started the nature conservative group. I did not even care or know how to take care for it. (Category F2)
Relations	Mechanisms related to rights (RR)	<p>What needs to be done in future to improve the training provided by Fundisa for Change? (Response from a teacher who attended Climate Change module in the training)</p> <ul style="list-style-type: none"> ▪ We felt that the time set and scheduled for the workshops was not enough because we were excited and we were anticipating more information sharing. (Category F3) <p>How long did it take?</p> <ul style="list-style-type: none"> ▪ If I am not mistaken, it was a week or two not sure but I think it was a week. (Category F3)

7.2 RESULTS

Teachers' perceptions about the Fundisa for Change programme are structured based on the theme that emerged from the study and three categories as shown in Figure 7.2 below:

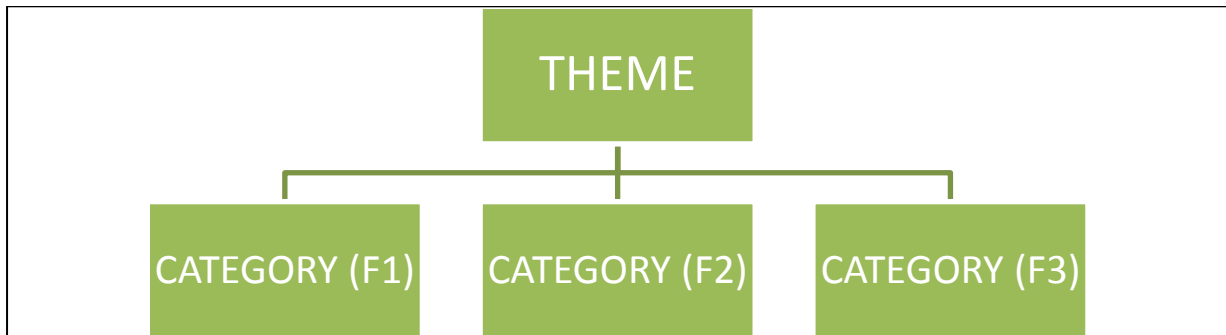


Figure 7.2: Presentation of theme and categories

7.2.1 Theme: Influence of Fundisa for Change Programme in the Teaching of Environmental Impact Topics

In this research, teachers who took part in the Fundisa for Change programme were asked about the following aspects: their understanding of the importance and role of the programme; effects of the programme on teaching and learning; and improvements that can be adopted by the programme in future. Based on these three questions posed to teachers during interviews, the following categories emerged from this study:

- 1) **F1**-Teachers' perceptions on the contribution and role of the programme
- 2) **F2**-Effects of the programme on teaching and learning
- 3) **F3**-Improvements that can be adopted by the programme in future

7.2.1.1 F1-Teachers' perceptions on the contribution and role of the programme

Teachers were asked about the training provided by Fundisa for Change in terms of improvement in delivering lessons in the classroom, the question was, "*How did the training provided by Fundisa for Change programme assist you in delivering your lessons on environmental impact topics?*", one teacher replied,

“It helped a lot; we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources.”(Transcript 1).

The above statement revealed that teachers benefitted from the programme and were now able to conduct lessons on environmental impact topics based on the content knowledge they acquired from the Fundisa for Change programme. One participant also mentioned that after attending the programme, it assisted him through learning about other teaching methods that helped him to teach environmental impact topics. The teaching methods learnt by the teachers were classified into information and transfer, experiential, investigative, learning by doing and deliberative methods. As a result, the learners in his Geography class passed well at the end of the year. With regards to the training, another participant mentioned that;

“It was very informative, I used to be like my learner where I was also blaming others and I learnt that they are many things that I do, which I was not aware I am contributing to climate change. You become conscious of what is going on around you don’t just litter and I don’t misuse the resources. How CAPS is interrelated. Other concepts for climate change that I learnt which we normally say these you will learn in science and we did not know about them. It gave us confidence.” (Transcript 5)

Teachers also pointed out that the programme assisted them with practical ways of teaching in the classroom and that made their lessons more interesting for learners, coupled with a better understanding of environmental impact topics. The programme gave teachers confidence to teach environmental topics in the classroom. This is anchored by the RST where educational training programmes transform existing school structures by redefining roles, providing in-service training to adopt new practices, supplying new resources and aligning assessment to suit new generations of students (De Souza, 2013). Another participant when asked: *“How has the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?”* replied that:

“Definitely how can I dispute that one, it really assisted our school and results improvement and my subject was part of that. The learner got 100% and the learner was recognised in the province.” (Transcript 2).

I do not believe the teacher's assertion that by attending the programme he was able to get 100% pass rate for Geography. Rather, the programme may have assisted in the improvement of the results, but that could not be solely due to the contribution of the programme initiative. I am of the notion that other factors may have contributed to learners passing well at the end of the year. The improvement of learners' results in the examinations could also be a result of proper planning, the discipline of learners, the culture of the school, among other things. It cannot be disputed that results improved after attending the Fundisa for Change programme, but it is likely not the only contributing factor.

Teachers' views and appreciation of the programme also revealed that, before attending the programme, they lacked adequate knowledge on how they could teach their learners environmental impact topics to ensure that learners understood the work. Stanisic and Marksic (2014:124) remark that, "some studies reveal EE delivery in the classroom has some challenges which include, teachers who are expected to teach new information in a different way without any appropriate education or training". This situation is similar to South Africa where the diagnostic reports in subjects such as Agricultural Sciences, Life Sciences and Geography revealed that learners were still struggling with environmental impact terms used in the examinations (DBE, 2017). In support of programmes such as the Fundisa for Change initiative, Iqbal and Arif (2011:100) state that, "for education to improve, all the teachers must have a global perspective, be well prepared and provided with ongoing professional development and appropriate support". This is also echoed by UNESCO's (2005) approaches to EE and ESD that state that teachers should have the necessary skills and must become value driven to be able use local knowledge and contextual relevance when teaching environmental impact topics.

This research considers teachers' voices on how changes in the curriculum have affected the teaching of environmental impact topics and how programmes such as Fundisa for Change have helped in improving their practices in the classroom. Ramberg (2014) mentions that "teacher studies on educational change have applied the quantitative method." Consequently, teachers' voices have rarely been included in the analysis about what changes are needed in education and how to implement such curriculum changes. An alternative research focus should therefore be advocated to spearhead the idea of teachers as agents of change.

7.2.1.2 F2- Effects of the programme on teaching and learning

When one teacher was asked, “*How has the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?*” he responded,

“Yes, I got the idea, regarding the excursions from this training, because they took us to the Nelspruit botanical garden. They took us there. We are adults and we are teachers but we enjoyed it like we were learners. That is where I got my teaching ideas, I started implementing the following year till today. And you can’t teach about the environment in the classroom, some things you just can’t teach while in class, they need practical experience” (Transcript 6).

This response from the participant revealed the positive effect of the programme on both teaching and learning in the schooling structure. The implication is that the programme not only imparted content knowledge and skills to teachers, but it also provided ways with which teachers could deliver the environmental impact topics such as using ideas which factor the socio-cultural aspects of learners into the learning system. Teachers mentioned excursions as one of the ideas sourced from the programme and some were now implementing those ideas in their daily teaching activities. The adoption of the programme ideas is also illustrated by the RST where components of culture involve ideas about roles, positions, practices, resources and processes within a structure. Changes then lead to shifts not only in the structural, material, and physical aspects of the action but also in ideas (Archer, 1995 & De Souza, 2013). A study conducted by Irwin (2010) showed that several participants maintained that EE teachers in particular were deprived by the lack of scope applied to EE in the context of outdoor education that enabled a stronger and more critically focused content to be learnt in schools. In relation to the above, UNESCO (2005) emphasised that teachers should use multi-dimensional methods in teaching environmental impact topics.

When participants were asked, “*Did your teaching of the content improve after the training?*” one teacher responded that:

“The change is when I prepare my lesson, because at the training, we had time to be outside and it actually made me realise that, there are things we can use from the

school and make the lesson interesting and practical within the school yard and not concentrate only on the textbook.” (Transcript 4)

The positive contribution of the programme was therefore evident in their lesson preparation. In response to the same question, one teacher mentioned that:

“Yes, it did. In terms of lesson planning the objective is practical, like pollution you don’t have to refer them to the industries, because we also contribute” (Transcript 1).

In the above instance, the teacher revealed that previously he was teaching environmental impact topics such as pollution by only referring to industries as the main polluters, thereby neglecting the fact that as individual human beings we also contribute to pollution. I agree with the teachers that if you are able to gain more knowledge on how to teach in different contexts, that can be transferred to learners. Knowing how to integrate different teaching strategies in teaching environmental impact topics improved confidence in teachers and learners benefited by doing better in examinations, which will enable them to become good citizens whose behaviours enhance environmental sustainability. This showed that the programme improved the content knowledge, pedagogical approaches and assessment strategies for teachers. This conforms to UNESCO’s (2005) suggestion for a teaching approach that focuses on applicability, where learning is integrated into the day-to-day personal and professional context.

Teachers mentioned that the programme not only improved their content knowledge but also improved their strategic questioning, classroom presentations and report writing due to resources such as copies of the modules that they were trained on. These modules for Biodiversity and Climate Change have different assessment methods and tools, a range of possible teaching methods that helped them during environmental impact topics lessons. One teacher said, as also seen in the section 7.2.1.1 above,

“It helped a lot, we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources. You can use carbon footprint, you do not need resources and those are in use now or it is practical” (Transcript 1).

In response to the impact of the programme, one teacher indicated that he was still using the resources that were given in the training programme for teaching and learning in the in the classroom and outdoors. I noted the importance of the programme to teachers in the manner that one teacher was inspired by the Fundisa for Change programme in that she managed to form an environmental committee in the school in the aftermath of the training. This was a practical initiative that enabled teachers to practically implement education for sustainable development (ESD), which was being cascaded to learners and members of the communities where the learners lived. This was the response of the teacher when she was asked about the benefits of the programme:

“Very much, it improved such that I applied what I felt, because of the confidence we gained from training and hence we started the nature conservation group. I did not even care or know how to take care for it” (Transcript 5).

7.2.1.3 F3- Improvements that can be adopted by the programme in future

Although participants mentioned that the programme was beneficial to their teaching practice, they also suggested improvements that could be made to future programmes of Fundisa for Change. This section analyses and interprets some of the ideas from teachers on what they thought could be done in future to improve the training which could benefit their teaching and learning in the classroom. Firstly, one teacher mentioned that:

“We felt that the time set and scheduled for the workshops was not enough because we were excited and we were anticipating more information sharing” (Transcript 2).

It is important to mention that all of the teachers believed that the time for such programmes should be increased and they were still anticipating a lot of information on how they could change their teaching approaches. They were of the opinion that more weeks should be set aside for such informative training instead of just one week. On a different note, one participant when asked, *“What needs to be done in future to improve the training provided by Fundisa for Change?”* suggested:

“I think they need to come with a method of teaching large classes, because that is our challenge and how to discipline learners without losing contact time with them.”(Transcript 1).

This response revealed that teachers are still having challenges with teaching in overcrowded classrooms, particularly in township schools, and that they need appropriate methods to conduct lessons on environmental impact topics under such circumstances. Contrary to most teachers, one teacher mentioned that the Fundisa for Change programme helped her to be able to conduct environmental lessons outside of the classroom using large numbers of learners. This showed that teachers still have a problem with overcrowded classrooms and find it easier for classroom presentations if done outdoors. This is the teacher said:

“It helped me, that I was able to take a large group of learners to the ground. I can now manage a group of learners” (Transcript 4).

Teachers believed that the programme could play an important role in providing strategies on how to deliver a lesson in large, congested classes. In this case, teachers expected more examples of activities that would be appropriate to teach large classes.

One teacher put forward that:

“I think it was informative and more educators need to be invited, because we were expected to transfer the information, but it would not be sufficient because we might forget other things” (Transcript 5).

In this research, all of the participants mentioned that although the training workshop was informative, and the expectation was that the trained teachers would cascade the information from the training to other teachers who did not attend the workshop. However, teachers found it challenging to convey the information to other teachers exactly the way it was presented in the programme. On this note, teachers suggested that the Fundisa for Change programme should include more teachers so that they could benefit from the resources, knowledge and skills that could be included in their teaching activities in the curriculum. When one of the teachers was asked what needs to be done in future to improve the training provided by Fundisa for Change, the response was:

“I think they need to add more teachers we were few. More outdoor activities (We spent a lot of time indoors listening to presentations, we only went out once, life science its practical subject” (Transcript 6).

It can be concluded that during this study teachers appreciated the initiative of the Fundisa for Change programme. However, they suggested that in future, if such programmes were held in the province in Mpumalanga Province, more teachers needed to be invited; the programme organisers should also provide activities that can be used in large classes as government has not addressed the issue of overcrowding; and more time needs to be allocated for such programmes in future. They appreciated the time given for outdoor activities, but it was not enough for them to be acquainted with more interesting activities provided by the programme in the training.

Teachers in this study believe that training programmes such as the one provided by Fundisa for Change should be centralised in the province so that more teachers will be in a position to attend without having to travel long distances. They further mentioned that the Department of Education does not fund them for the training and many teachers are then discouraged to take part. They believed that the closer the venue is to most teachers, the more it will encourage teachers to participate in the training if they are invited again. This is what one teacher responded concerning the training venue:

“I think it must be done again and the invitation should be open to more teachers. The venue should be close because teachers tend to run away because the department doesn’t fund them” (Transcript 3).

7.3 CONCLUSION OF THE STRUCTURAL, CULTURAL AND AGENTIAL DIMENSIONS OF THE PROGRAMME

According to the Realist social theory (RST), social structures are comprised of aspects of structure, culture and agency, which interact to shape and re-shape the conditions people have for engaging in action (Archer; 1996). This section discusses conclusions based on the structural, cultural and agential dimensions of the Fundisa for Change programme.

7.3.1 Structural Dimension of the Programme

In this chapter, the focus was on evaluating the Fundisa for Change programme’s aim of improving and strengthening environmental learning in schools. There were different structures aimed at improving teaching of environmental impact topics in this study. These structures were the Fundisa for Change programmes environmental

teacher training workshops, resources used during the training, schools and resources used by teachers in schools. The interaction of these structures brought change in the way teachers (agents) were being empowered and strengthened in their content knowledge, pedagogic and assessment of environmental topics. The structure of the programme in terms of workshop presentations, activities and resources brought transformation to teachers. According to De Souza (2017), the structural dimension provides agents with contexts within which to pursue activities and interests. She further indicates that structural dimensions pertain to institutional, physical, material and human resources and relations.

7.3.2 Cultural Dimension of the Programme

It was noted in this research that the Fundisa for Change programme played an important role in ensuring that participants were able to share different ideas on how they could teach environmental impact topics in the classroom. The different teaching strategies helped teachers to develop a socio-cultural dimension where teachers' prior knowledge and experiences, language, culture, histories of learners and the societal context of learners were taken into consideration when preparing for teaching in the schools. I conclude that after attending the teacher-training programme, teachers developed a culture of using multiple teaching methods and strategies to enhance learners' understanding of environmental impact topics. Teachers mentioned that the resources and content knowledge accumulated in the programme were helpful. Dolphin and Tillotson (2015) support this view of the role that teachers' beliefs play in their decision-making in the school environment.

7.3.3 Agential Dimension of the Programme

The agential dimension of the programme involved imparting skills and content knowledge in teaching environmental topics. The results of this study provide evidence that the programme improved teachers' (agents) content knowledge and skills in teaching environmental topics. The implication of the programme is that it improved teacher's practices inside and outside the classroom. The actions of the teachers to accommodate teaching strategies learnt from the programme revealed that they had been transformed and this had a positive influence on learners' academic achievement.

7.4 SYNTHESIS OF THE FUNDISA FOR CHANGE PROGRAMME RESULTS

One of the objectives of this study was to evaluate whether the Fundisa for Change programme had an impact on the teaching of environmental impact topics in the CAPS FET phase. Teachers who were interviewed all participated in the Fundisa for Change Environmental Teacher Training Programme. As mentioned earlier, Fundisa for Change is a collaboration between a range of teacher education partners working with teachers across South Africa to improve and strengthen environmental learning in schools (Fundisa for Change, 2014). This study's results revealed that teachers who participated in the programme benefited and their teaching of environmental impact topics improved. Participants mentioned that the programme provided different options that can be used in the teaching of environmental impact topics in the classroom. Certainly, most teachers were of the view that teaching methods such as excursions and practical work assisted them in ensuring that they were able to better prepare and deliver the lessons on environment impact topics in subjects such as Geography and Life Sciences without much challenge. In addition, teachers, as agents of change, indicated that being exposed to the Fundisa for Change programme helped them to develop relevant teaching strategies in teaching environmental impact topics outside the confines of the classroom context through fieldwork. In line with this, Oguz (2004) indicated that some studies on teachers' perceptions about EE have shown that teachers show a desire to integrate environmental concepts into their teaching. It is against these results that I agree with the participants that all teachers should be afforded the opportunity to attend such programmes. In this way, the high failure rate on environmental impact topics in Grade 12 examinations could be reduced. I argue that the high failure rate on environmental impact topics in Grade 12 exit examinations will continue to rise if teachers are not exposed to programmes such as Fundisa for Change.

Apart from new teaching methods that the teachers were able to learn from the programme, teachers admitted that they also acquired insights and skills that they can use for effective assessment practices. Teachers were of the view that the programme assisted them to gain new content knowledge on current issues pertaining to the impacts of human activities on biodiversity and climate change. They believed that they were now able to use different effective assessment practices such as strategic questioning, classroom presentations, report writing and observation while on

excursions. Above all, the participating teachers arrived at the similar conclusion that the programme allowed them to share new ideas on teaching environmental impact topics and that they were now using the different ideas that emerged from the programme. For example, one teacher mentioned that in teaching biodiversity, they were given an example of using learner's shoes that could be sorted according to size, colour, make, and so forth. This helped teachers to identify differences and this can be used in the classroom to teach species diversity when teaching and learning resources are limited. The teachers gained teaching skills and knowledge on teaching environmental impact topics in and outside of the classroom. The acquired critical decision-making skills and knowledge not only assisted in teaching but also improved the understanding of the content for both teachers and learners, which can contribute to environmental sustainability. This supports UNESCO's (2005) view of the teaching approach for environmental impact topics, namely that it should be interdisciplinary and holistic.

Besides how the programme assisted teachers in delivering lessons in and outside the classrooms, teachers were asked if their teaching of the teaching strategy improved after the training. Most participants indicated that they implemented positive changes in their lesson presentation after attending the programme. The results of this study revealed that environmental impact topics lessons became more interesting to learners because of alternative learning strategies that were now being used by the teachers after the training. Teachers indicated that they now used the schoolyard more often when teaching environmental impact topics and learners became interested and fully participated in outdoor activities when compared to being confined in the classroom as was the norm before attending the programme. Integrating the programmes ideas into the classroom confirms Archers (1995) RST relations dimension which exist within structure, culture and agency. It can be seen in this study that success of a school programme may depend on how teachers feel in carrying out their duties in terms of the curriculum, which acts as a guide for their teaching. The theory also affirms the results of this study that success may also depend on how confident students feel in their corresponding duties of learning, studying and meeting the outcomes. As a results, teachers recognised that their content knowledge improved and that they were able to bring new teaching materials that they were still using even today in their schools. One participant, in contrast to others, mentioned

that she was now able to manage larger groups of learners through doing outdoor activities. Most teachers indicated that they would need more workshops on how they could handle large groups of learners when teaching environmental impact topics since government could not provide adequate classes to curb overcrowding. I agree with most teachers that teaching large classes poses a barrier to learning because teachers are not able to focus and assist individual learners who are having challenges in the lesson.

Some participants reported that after attending the programme, they established environmental committees within the schools, which fascinated me. The aim of the environmental committees formed in some schools in Secunda was to ensure that environmental days were celebrated in the schools and that the school were kept litter free by the learners.

The achievements of the Fundisa for Change programme are supported by Gwekwerere (2014:201), who states that

in order to develop an enduring understanding about the environment, teachers should ensure that learners are given opportunities to:

- develop ownership of the environmental knowledge they learn from the curriculum;
- engage in concrete experiences as an integral part of EE courses;
- work on action projects dealing with environmental issues in their communities; and
- participate in policy and decision-making processes.

Teachers were of the opinion that the Fundisa for Change programme could provide more assistance to the education sector. Firstly, teachers noted that the training was conducted in a short period, hence they did not have adequate time to share teaching ideas. Secondly, the study's results revealed that teachers still needed assistance with strategies to teach large classes. As mentioned above, teaching in overcrowded classrooms inhibits effective teaching and learning. Thirdly, teachers were of the opinion that in future the venue of the programme should be centralised so that it can attract more teachers to take part in the programme. They suggest that all teachers need to attend the programme because it was difficult for them to cascade the new information to others due to time constraints. Lastly, teachers appreciated the importance of the programme and proposed that the Fundisa for Change workshops

should be held periodically in order to enhance their content knowledge and teaching strategies not only for environmental impact topics but also for all the other topics for different subjects. In support of this, Iqbal and Arif (2011:106) emphasise that “there is an urgent need to recognise teachers’ work as complex and demanding, and improvement in teacher quality requires a re-conceptualisation of how we prepare a new generation of teachers”.

Finally, I noticed the willingness and happiness in the way that the participants expressed their appreciation of the Fundisa for Change programme. This implies that the programme materials and the different teaching and assessment strategies have empowered teachers with confidence in teaching environmental impact topics and EE in the classroom. This might be beneficial to learners and the social community they live in by promoting environmental sustainability for future generations. The Fundisa for Change programme’s aim of improving and strengthening environmental learning in schools is supported by Markaki (2014:87), who argues that “innovation that should be adopted by some programmes with the sole aim of bringing together the latest trends in EE, well-tested and documented inquiry-based learning practices and cutting-edge technology used for educational purposes”. To achieve these objectives, Markaki claims that programmes should embrace the following:

- Successfully and permanently link EE to career contexts, by properly training the next generation to respond to major issues such as sustainable development and climate change and make sound decisions for their future careers.
- Create an inventory of the most outstanding educational scenarios connecting the curricula of various countries to professions related to sustainable development, thus rendering students more active and personally and professionally responsible.
- Establish a constantly expanding network of teachers and school communities informed on the necessity of ‘green living and teaching’ and trained in the effective use of digital resources in science teaching.

7.5 CHAPTER SUMMARY

This chapter provided an analysis and results of the data based on the evaluation of the influence of the Fundisa for Change Programme in the teaching of environmental impact topics. This chapter discussed three categories that emerged from the participant’s face-to-face interviews, which were teachers’ perceptions on the

contribution and role of the programme; effects of the programme on teaching and learning; and improvements that can be adopted by the programme in future. Chapter 8, which follows, presents a summary of all of the chapters in terms of coverage, teaching and examination of environmental impact topics in the FET phase. Chapter 8 summarises the results based on the research questions and objectives, and proposes recommendations and conclusions.

CHAPTER 8

CONCLUSION, RECOMMENDATIONS AND REFLECTIONS

8.1 INTRODUCTION

Chapters 5, 6 and 7 of this study presented findings on the **coverage, teaching and examination** of environmental impact topics in the Further Education and Training (FET) phase. This chapter presents summary, conclusion, recommendations and reflections.

8.2 SUMMARY OF THE STUDY

Chapter 1 provided an introduction and background to the study. The chapter further outlined the rationale for the study, the statement of the problem, research questions, aims and objectives, preliminary literature review, research methodology, limitations and delimitations, definition of terms and an outline of the thesis.

Chapter 2 presented key environmental impacts from a global, regional and local perspective. It was noted in this chapter that human activities are the major cause of environmental impacts, such as the effects of climate change, deforestation, biodiversity loss, depletion of ecosystems, land degradation and (air and water) pollution. Such activities include the effects of population growth, poverty, urbanisation, industrialisation and a consumer culture. Chapter 2 also presented literature on environmental impact assessment, citing examples signed by the International community, the African region and South Africa.

Chapter 3 discussed environmental education as a key response to addressing the global environmental crisis. The chapter provided an overview of EE from a Global, African, Southern Africa and South African perspective. Challenges facing the implementation of EE and the role of teachers in the dissemination of EE were discussed in this chapter. Chapter 3 also outlined some examples of Global and SADC approaches to EE implementation in the school curriculum. This chapter concluded with an outline of the discourse on sustainability and the influence of the UN Sustainable Development Goals on EE.

Chapter 4 focused on the research methodology employed in this study, where the research design and research methods were explained. A qualitative case study research design informed by Critical Realism formed the basis of this study.

Chapter 5 presented and analysed formal education guiding policy documents, examination documents and analytical reports, and supporting educational resources for the FET phase. The emphasis was on the effects of curriculum change on the **coverage** (documents) of environmental impact topics.

Chapter 6 provided the findings on the effect of the curriculum change drawing from interviews with the six teachers who took part in the study. The emphasis was on the effects of curriculum change on the **teaching** of environmental impact topics.

Chapter 7 provided findings on the influence of the Fundisa for Change Programme in the **teaching** of environmental impact topics.

Based on the findings of the document analysis in Chapter 5 and the face-to-face interviews with teachers in Chapter 6 and 7, a model is proposed by this study. This study proposes a change of structural, cultural and agency (CSCA) model that shows how the shifts in the curriculum have an effect, which can be negative or positive on the structure, culture, and agents. This model conforms to the premises of Margaret Archer's structural and cultural morphogenesis theory and is discussed in section 8.11.

8.3 SUMMARY OF FINDINGS BASED ON THE RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

The findings on the coverage, teaching and examination of environmental impact topics were guided by the study's research objectives. As mentioned in Chapter 4, Realist Social Theory (RST) framework using the concept of context, mechanism and outcomes configuration (CMOc) shown in Chapter 6 was the analytical lens employed this study. The findings of this study confirm RST aspects that view reality as complex and recognise the role played by **structure**, **culture** and **agency** to foster relations through mechanisms that influence human behaviour. The summary of findings in relation to RST are further summarised according to the objectives and critical research questions. This section summarises the four objectives and sub-questions that were used to address the research questions and the aim of this study.

8.3.1 Objective 1: To determine how the changes in the South African FET curriculum affect teaching of environmental impact topics in the schools

This objective responds to the research question: “What changes have been brought by the new curriculum (CAPS) in the coverage of environmental impact topics?”

As a result, the change of old NCS (Grade 10-12) to CAPS curriculum revealed that some teachers relied upon certain educational structures to perform their duties at school. These structures are the subject advisors who should provide **extra resources** for teachers in the teaching of environmental impact topics. Therefore, the **subject advisors** play a pivotal role in **knowledge acquisition** for teachers as they prepare their learners for environmental lessons. Emphasising the RST framework of this research (that comprises of the aspects of structure, culture, agency and relations), this study has revealed that teachers, as agents, gained **content knowledge** from different educational structures such as subject advisors, school management teams and the Fundisa for Change programme. The **collaboration** of teachers with other agents such as subject advisors, and structures such as resources, also had an effect on the culture that was developed, where teachers could request resources that were essential in the school for the benefit of both teachers and learners. It can therefore be noted that the reliance upon external social structures by teachers for teaching environmental impact topics could lead to **sustained transformation**, which culminates in shifts not only in structural, material and physical aspects of the actions of teachers but also in ideational aspects. These ideational aspects result in teachers developing a **culture of self-reliance** and in them developing relevant study resources for learners in future.

In this study, the aspect of relations embedded in the CMOc of the RST is adequately addressed by teachers who exhibit mechanisms of **duty, responsibility, power** and **rights** in providing learners with numerous activities on environmental impact topics in the classroom. The findings of this study also revealed that structural factors such as policy documents, teaching resources and availability of textbooks are important in the closing of the knowledge gap between practice, beliefs and the sharing of ideas that result in outcomes that exhibit social reality.

Furthermore, the interviews showed that teachers were not only teaching environmental impact topics in the classroom but they also formed **environmental**

clubs in the school so that even those learners who were not exposed to EE could also benefit from good whole-school initiatives such as responding to improper solid waste disposal in the school environment through recycling. This initiative by teachers also influenced the culture of learning such as using the local natural surroundings and the development of environmental **sustainability practices** that contribute to environmental content knowledge accumulation by teachers and learners in the school. The benefits of these types of school-based environmental sustainability initiatives are supported by a study conducted by Gwekwerere (2014) that found that teachers felt compelled to engage learners in **environmental initiatives** in the school since they were captive agents while they were still at school. Teachers in this study also pointed out that they used several **teaching methods** for environmental impact topics, such as giving learners environmental impact topics to research. These topics provided teachers with opportunities to explore diverse teaching strategies on how they could improve their lessons in future and also evoked learners' interest in environmental impact topics, which led to environmental knowledge accumulation.

8.3.2 Objective 2: To investigate how teachers carried out their duties and responsibilities in the new CAPS curriculum

This objective responds to the research question: "How do teachers find the teaching of environmental impacts topics in the curriculum under CAPS (FET phase) compared with the old old NCS (Grade 10-12) curriculum?"

Teachers expressed that they enjoyed teaching the content on environmental impact topics in the CAPS curriculum and they indicated that learners related to and enjoyed lessons that involved the natural environment because they could **easily relate** that to the local context. Teachers also revealed that the processes involved in teaching environmental impact topics **aroused interest** among them, especially in the accumulation of **new knowledge** about nature and the world around them. This study also found that through CAPS, teachers were increasingly able to investigate new **ideas and trends** in the field of EE and incorporated these ideas into the lesson plan.

Findings of this study also revealed that **resources**, which are one of the key aspects of the RST framework, are essential if teachers are expected to efficiently execute their duties in the school. It was noted from this study that teachers used a variety of resources to enhance the efficiency of teaching environmental impact topics in the

CAPS curriculum. Teachers allowed their learners to use modern resources such as **tablets and smart phones** to search for vital information, which is helpful in the Fourth Industrial Revolution era. In relation to this, teachers also indicated that they now used smartboards and social media platforms, technologies that were not available previously. Teachers mentioned that the CAPS curriculum was embedded in the technological era where learners were exposed to gadgets such as tablets and smart phones that they could use to source valuable information online.

The findings also revealed that the **demarcation** of topics to be taught per term in CAPS made lesson preparation easier to handle. However, the study found that the **lack of adequate learning resources** for all learners is still prevalent despite the introduction of CAPS. Teachers also stated that they anticipated that the CAPS curriculum would involve less administration work, but it requires **more** record-keeping than the old NCS (Grade 10-12) did. They further mentioned that they are not allocated enough time in the new curriculum to complete the environmental impact topics according to the work schedule. I can argue that though the CAPS curriculum is replete with topics to be covered in daily lessons, teachers still find it challenging to demarcate appropriate EE topics in subjects such as English, Mathematics, Mathematical Literacy and Accounting. Documents such as subject policies for these subjects **do not** mention EE topics to be covered but appear to expect teachers to “thumb-suck” which EE topics could be relevant for each subject.

The overall findings of this study are that the CAPS curriculum is beneficial in the provision of **quality teaching and learning** opportunities for environmental impact topics. Teachers were able to relate positively to the new curriculum when teaching environmental impact topics, although there were still challenges, which include a **shortage of resources** and **time allocation**. The findings also revealed that the coverage of environmental impact topics in the policy was **not** the same in all the subjects investigated. In my view, this shows that environmental impact topics would not necessarily be regarded as important by teachers if coverage is **low** and this implies that learners would be deprived of **environmental content knowledge** that is important in their daily lives. The study also found that there was some **misalignment** between policy requirements and actual content coverage in both textbooks and examination question papers. However, the quality of teaching of environmental impact topics **improved** after teachers were trained through workshops on teaching

environmental topics by the Fundisa for Change programme. The results also indicated that teachers' general orientation towards change was positively related to the degree of perceived reform in their teaching.

The structural factors used by teachers in the teaching of environmental impact topics were not just limited to the traditional textbook resource usage but included a variety of resources, relevant learning materials and contextual conditions. However, teachers mentioned that CAPS textbooks were **better** than the old NCS (Grade 10-12) textbooks. The major difference highlighted by teachers was that the new curriculum textbooks related to the policy in terms of what was covered per term and the depth of content on environmental impact topics per level was clearly stipulated. Above all, the CAPS textbooks were **user-friendly** for learners and the activities addressed the content that was stipulated in the policy documents. The study also found that teachers made use of study guides that could be bought by learners to supplement the textbooks that they use in Grade 12. However, although teachers used study guides and textbooks as teaching and learning resource materials in the teaching of environmental impact topics, a challenge they faced was a shortage of adequate teaching and learning resources to cater for all learners, which made lesson presentation difficult. This was due to some classes being **overcrowded** and **few textbooks** being available to all learners. Also, few learners could afford to buy the study guides due to financial constraints. Inadequate teaching and learning resources had a negative effect on the presentation of lessons.

To address the challenge of shortage of resources, teachers indicated that they sought help from internal structures at school such as the SGBs to provide the necessary financial assistance. They also stated that they received financial help from external structures, such as cellphone companies like Cell C, which provided tablets and programmes to study environmental impact topics. This implies that the practice by teachers of soliciting help from diverse sources enabled the effective teaching of environmental impact topics in the new curriculum in some of the investigated schools. Libraries and computer laboratories were also indicated by some teachers as resources that they were able to use in the teaching of environmental impact topics in the curriculum. Some teachers in this study stated that they encouraged their learners to use **WhatsApp** groups to share valuable information about environmental impact topics. These groups enabled learners to share vital information about school-related

work and helped them when they were alone at home struggling with content while writing homework. It can therefore be deduced that improvements in technology assisted learners in places where network coverage was not a problem. However, despite the use of information technology in teaching and learning, in some schools learners that came from disadvantaged backgrounds could **not afford the data bundles** required for searching and downloading information from gadgets such as smart phones and tablets. This had a negative effect on learning in the current 21st century and Fourth Industrial Revolution era.

In sum, the study found that teachers faced challenges in the teaching of environmental impact topics in the new curriculum. These challenges were: a **lack of time** to complete the **heavily loaded content** for CAPS; a lack of adequate **teaching and learning resources**; and a **high rate of crime** in the community where laboratory equipment such as computers were often **stolen** after school hours. Teachers also faced the challenge of a lack of **motivation** among some learners to complete the tasks given and, because of **large and overcrowded** classes, it was challenging to follow learners' daily activities. This implies that teachers were faced with a variety of challenges and teaching of environmental impact topics was therefore affected. In my view, these challenges not only demotivate teachers but have an effect on learners who are the products of the education system. These challenges will not only retard teachers' **content knowledge** of environmental impact knowledge but will have negative repercussions in the community where the economic gap was widening when compared to communities who were not facing these challenges in their schools. In this regard, they requested the Fundisa for Change programme to assist them with a workshop on how to deal with **overcrowded classrooms** when teaching environmental impact topics in the new curriculum since government is slow in building new schools in the areas.

8.3.3 Objective 3: To establish how the shifts in curriculum affect the examination of environmental impacts content

This objective responds to the research question: "*To what extent are environmental impact topics being examined in the Grade 12 (Matric) exit examinations?*"

As shown in Table 5.2, the shifts in the curriculum **improved** coverage of environmental impact topics in examination question papers for Life Sciences. The

implication is that the increase in the coverage of environmental impact topics in the examinations for new curriculum is likely to influence teachers and learners to have **greater in-depth content knowledge** of environmental impact topics. This was supported by the statements from teachers that they used past examination question papers to prepare their learners for final-year examinations. It appears that the increase of coverage in the examination had positive effects on agents (teachers), as they were able to put more emphasis on those environmental impact topics during lessons.

In Geography, similar to Life Sciences, document analysis revealed that examination of environmental impact topics in CAPS was **greater** than the coverage in the previous old NCS (Grade 10-12). It was noted that the teachers interviewed in this study shared the same opinion that the new curriculum covered the environmental impact topics better than the previous curriculum. Likewise, the analysis of CAPS documents for Agricultural Sciences and Economics revealed **an increase** in the coverage of the environmental impact topics in the examinations compared to the former old NCS (Grade 10-12) curriculum. The findings of this study also revealed that Economics had the **highest** coverage of environmental impact topics in the Grade 12 examination followed by Geography when comparing examination question papers that fell within the UNDESD. The significance of the UNDESD was to integrate the principles, values and practices of sustainable development into all aspects of education and learning. This educational effort encouraged changes in behaviour that would create a more sustainable future in terms of environmental integrity, economic viability and a just society for present and future generations (UN, 2016).

This study also investigated the alignment between CAPS policy content coverage and the actual coverage of the content in the past examination question papers from the year 2012 to the year 2015. The study revealed that in Life Sciences, there was a difference of 0.1%, which showed that there was **good alignment** between the CAPS policy coverage and the examination papers. In Geography, the analysis revealed a difference of about 4.6%, which showed a **slight misalignment** between the policy requirements and the examination of environmental impact topics. For Agricultural Sciences, it was observed that there was alignment between the examinations and the required content coverage. Lastly, in Economics, there was **a slight misalignment** between policy requirements and actual coverage of environmental content in the

examinations where the difference was 3.1%. The implication of alignment is that good alignment **positively affects** the way teachers prepare learners in terms of acquiring of content knowledge while misalignment has detrimental effects on both teachers and learners in the teaching and learning of environmental impact topics. A good correlation between the curriculum content specification and coverage in examination papers, as revealed in the above subjects, indicates that the examinations are adhering to the **required coverage** of environmental impact topics.

This study also found that, apart from using past examination question papers, teachers also use other official Department of Basic Education documents such as **examination diagnostic reports** on how learners answered environmental impact topics in the Grade 12 examinations. These reports assisted teachers to understand the types of challenges faced by learners in the examinations, and they used the reports to improve teaching and learning practices and processes in order to enhance performance of learners on environmental impact topics in future. The findings in this study showed that documents (curriculum policy and diagnostic reports) played an important role in both teaching and learning as part of the school structure.

It is apparent that teachers had adequate knowledge on how the shifts in the curriculum affected their teaching of environmental impact topics because of their experience in the teaching of subjects such as Life Sciences, Geography and Agricultural Sciences under both the old and new curricula. It was also found that teachers in this study were optimistic about the benefits of the CAPS curriculum. They revealed that the new curriculum had topics which built upon the content of previous grades and that made it **easier** to teach. They also mentioned that the CAPS system covered **many** aspects and provided details of what to teach in each term.

In sum, I am of the view that the shift in the curriculum positively influenced the coverage, teaching and examination of environmental impact topics in South Africa's FET phase. This implies that in the CAPS curriculum, specifically where there was evidence of environmental impact topics coverage in the subject policies, teachers were able to include the content in their teaching. I believe that learners are **benefiting** more in CAPS than in old NCS (Grade 10-12) in terms of learning about sustaining the biophysical, economic, political and social environment. This resulted in an emergence

of structural and cultural morphogenesis model in the teaching of environmental content in the FET phase, which was discussed in section 8.11.

8.3.4 Objective 4: To analyse the impact of Fundisa for Change Environmental Teachers Training Programmes in the teaching of environmental impact topics in the CAPS FET phase

This objective responds to the research question: *“What is the impact of teacher support for teaching environmental impacts topics provided through the Fundisa for Change programme?”*

This study used a case study of teachers who were trained by the Fundisa for Change programme as mentioned in Chapter 4. Teachers’ opinions of the programme were **highly** positive. Teachers stated that the programme was **helpful** in their preparation and execution of ideas and **new teaching methods** on environmental content. Teachers benefited from the programme and they were able to conduct environmental impact topics lessons based on the **content knowledge, teaching approaches and assessment methods** they had acquired from the Fundisa for Change programme. Teachers also claimed that, since attending the workshops, learners’ performance in Grade 12 examinations had **improved**. They stated that this improvement was based on the different teaching methods they were exposed to in the programme that were applicable not only to environmental impact topics but to other subject areas as well. They also mentioned that they were able to incorporate **practical teaching methods** in their lessons, which contributed to the lessons being more enjoyable for learners and positively influenced their understanding of environmental impact topics.

Teachers revealed that before they attended the Fundisa for Change professional development programme, they **lacked knowledge** on how they could teach their learners environmental impact topics in order to ensure that they understood the content in the classroom. Iqbal and Arif (2011) point out that for teachers to improve their teaching, they must be prepared and provided with professional development and appropriate support. This kind of support was seen in this study from the work done by the Fundisa for Change programme. Apart from improving the skills of the teachers, the programme also assisted teachers with **resources** that contributed immensely to the provision of environmental content knowledge and the effective teaching and assessment practices for use with learners. Teachers also mentioned

that they learnt new ideas about how they could improve their lessons on environmental impact topics in the subjects they were teaching.

The programme, as mentioned above, not only fostered **positive changes** in the acquisition of knowledge and skills by teachers, but it further provided ways in which teachers could deliver the environmental impact topics by using ideas which factor **socio-cultural** environmental aspects into the learning system. Teachers gave the example that while pollution of the environment is mainly caused by industries, individual human beings also contribute to air pollution in various ways.

Teachers mentioned that, although there were tangible benefits from attending the programme, there were also improvements that could be adopted by the programme in future. For instance, teachers felt that the **time** allocated for Fundisa for Change training was not enough for them to be able to fully grasp all of the content knowledge and different skills provided by the programme. They mentioned that they were still anticipating **more activities** from the programme that could be used in the classroom to teach environmental impact topics. Teachers were also of the view that the training should include strategies to teach environmental impact topics to **large, overcrowded classes** in communities where most learners do not have adequate learning support materials. I am of the view that training should not only provide strategies of teaching in large classes but also provide strategies on how teachers can improvise during a lesson when teaching under such conditions. Teachers also mentioned that they were required by the programme to cascade the information they had obtained to other teachers who had not attended the training. However, they felt that it was difficult for teachers to cascade this information when they had to cover all the content before learners wrote their final examinations at the end of the year in Grade 12. I argue against the notion that teachers do not have enough time to cascade environmental impact topics to fellow teachers, because they can use **after-school hours** and Saturdays to cascade this information to their colleagues. I believe that in this technology era, teachers can easily share information via social media platforms such as WhatsApp, Instagram, Telegram, Facebook, Twitter, and emails.

Teachers recommended that the Fundisa for Change training should be **opened** to a wider range of teachers from different schools so that information about the teaching of environmental impact topics can be shared throughout the Mpumalanga province

and not just centred in selected schools. Teachers also revealed that the inclusion of a larger number of teachers in the training would also help schools to gain necessary teaching skills and knowledge on how to teach environmental impact topics in the CAPS curriculum.

8.4 KEY FINDINGS OF THE STUDY

Key findings of this study are summarised in terms of coverage, Alignment of environmental impact topics between documents, Effects of the shifts of the curriculum, teaching of environmental impact topics and impact of Fundisa for Change.

Coverage

- It has emerged that CAPS documents require coverage of environmental impact topics in all subjects, although policy documents for subjects such Accounting, Mathematical Literacy and English First Additional Language **did not contain** environmental impact topics in their teaching programme. I believe that the **non-inclusion** of environmental impact topics in the subjects influences agents who are teachers to develop a culture of **neglecting** teaching content that promotes ESD.
- In Life Sciences, Economics, Agricultural Sciences and Geography, it was noted that they all recorded an **increased** percentage of coverage in CAPS compared to old NCS (Grade 10-12). Hence, teachers will now be exposed to **more content** on environmental education
- Results of the study revealed that environmental impact topics in the curriculum constitutes an average of about **6.3%** across all subject disciplines.
- The inclusion of environmental impact topics in Life Sciences is to be **commended** in that the policy developers and implementers ensure that teaching and learning of environmental impact topics is given **more** attention compared to all the other subjects analysed. I am of the view that the subject policy guideline for Life Sciences should be adopted as an **example** by other subjects.

- The results showed that the breath of coverage of environmental impact topics was not consistent in all of the subjects that were analysed which can be attributed to different subject policy makers who do not adhere to the principle of inclusion of environmental education in all subjects.

Alignment of environmental impact topics between documents

- There was some **alignment** between the coverage of environmental impact topics in the textbooks and policies when compared to the examination papers. For example, in Life Sciences, Geography, Economics and Agricultural Sciences textbooks the coverage was 3%, 15%, 7% and 5% respectively, while in the examination it was 8.8%, 12%, 2.5% and 10.8%. I believe that the alignment could have a **positive** effect on the teaching and learning of environmental impact topics in the classroom where teachers would be compelled to focus on topics which are frequently examined.

Effects of the shifts of the curriculum

- Shifts in the curriculum positively contributed to increased coverage of the environmental impact topics in the CAPS curriculum in both the textbooks and in Grade 12 examinations analysed. The shift from old NCS (Grade 10-12) to the CAPS curriculum was beneficial to teachers as they were able to engage in reflecting on and assessing their own efforts to **promote inquiry, reasoning, problem-solving** and **communication** of environmental impact topics in the classroom.
- Effects of the shift led to an increase in the coverage of environmental impact topics was found in these subjects (Life Sciences, Economics, Agricultural Sciences and Geography) but most of the other subjects did **not cover** these topics in the policy and in the examinations. These subjects are Accounting, Mathematical Literacy and English First Additional Language.
- This study also found that through CAPS, teachers were increasingly able to investigate new **ideas and trends** in the field of EE and incorporated these ideas into the lesson plan.

- In sum, the structural dimension of documents which comprised of the CAPS policy documents, past examination question papers and selected textbooks seemed to influencing agents on the content that can be taught to learners. These lead to cultural practices of teachers to teach environmental topics that have high probability of being examinable at the end of the year. This cultural practice tend to deprive learners to know about environmental content that are essential for environmental values and principles.

Teaching of environmental impact topics

- The collaboration of teachers with other social structures such as subject advisors has a positive effect on the culture that can be developed where reliance on external structures by teachers leads to **sustained transformation** which culminates in shifts not only in the **physical** aspects of action of teachers but also in **ideational** aspects.
- The study found that teachers are more likely to produce students who are more environmentally literate if they are **more knowledgeable, have positive attitudes** towards the environment, and show concern for **environmental problems**.
- Findings further revealed that teaching environmental impact topics in CAPS was simpler; it was easier for learners to understand the content, which was more relevant to the local issues. The new curriculum covered more content, provided more opportunity to use technology in classrooms
- In teaching environmental impact topics, teachers still face challenges such as **inadequate infrastructure** such as improperly built classrooms, **vandalism** of school property by community, **overcrowding** of classes and **inadequate resources** for teaching of environmental impact topics. Teachers revealed that CAPS has a lot of work to be taught to learners yet less time is allocated for each period.

Impact of Fundisa for Change

- Programmes such as Fundisa for Change equip teachers with necessary professional development and encourage usage of different **teaching**

strategies in the teaching of environmental impact topics outside the confines of the classroom context through fieldwork.

- Teachers were of the view that the programme assisted them to gain new content knowledge on current issues pertaining to the impacts of human activities on biodiversity and climate change.
- The acquired critical decision-making skills and knowledge not only assisted in teaching but also improved the understanding of the content for both teachers and learners, which can contribute to environmental sustainability.

8.5 CONCISE SUMMARY OF THE STUDY

The concise summary of this study is characterised into coverage, teaching and examination of environmental impact topics. The study found that:

8.5.1 Coverage of Environmental Impact Topics

It has emerged that CAPS documents require coverage of environmental impact topics in all subjects, although policy documents for subjects such Accounting, Mathematical Literacy and English First Additional Language **did not contain** environmental impact topics in their teaching programme. I believe that the **non-inclusion** of environmental impact topics in the subjects influences agents who are teachers to develop a culture of **neglecting** teaching content that promotes ESD. This will have a **negative** effect on learners who are products of the education system not to adhere to sustainability issues. I argue that policy implementers in these subjects tend to neglect some of the policies that perpetuate inclusion of environmental impact topics in practice; for example, the policy statement from the White Paper on Education and Training Notice 196 of 1995 which states that;

Environmental education, involving an inter-disciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and active citizens and ensure that all South Africans, present and future, enjoy a decent quality of life through the sustainable use of resources (DBE, 2018)

However, in subjects such as Life Sciences, Economics, Agricultural Sciences and Geography, it was noted that they all recorded an **increased** percentage of coverage

in CAPS compared to old NCS (Grade 10-12). In my view, the increased coverage of environmental impact topics in the CAPS is one of the **positive impacts** of curriculum change in terms of ESD. In these subjects, teachers will now be exposed to **more content** on environmental education. I believe that this is a good indication that although some subjects did not infuse environmental impact topics coverage into the curriculum, other subjects do adhere to the policies. My concern is that the subjects that comply with the policy are very **few** when compared to those subjects that do not. Significantly, the White Paper on Environmental Management Policy published in 1997, states that establishing good governance in South Africa can only be guaranteed if it is based on a sound socio-economic framework that is **environmentally sustainable** (DBE, 2017).

The coverage of environmental impact topics in the curriculum constitutes an average of about **6.3%** across all subject disciplines. The coverage of environmental impact topics in CAPS for Life Sciences, Geography, Agricultural Sciences and Economics was 9%, 7%, 3% and 8% respectively. The inclusion of environmental impact topics in Life Sciences is to be **commended** in that the policy developers and implementers ensure that teaching and learning of environmental impact topics is given **more** attention compared than all the other subjects analysed. I am of the view that the subject policy guideline for Life Sciences should be used as an **example** by other subjects. This implies that teachers and learners are exposed to teach and learn about environmental impact topics knowing which topics must be covered and to what extent in the documents. Payne (2006:25) argued;

Recent reviews of environmental education (EE) research converge with pedagogical trends in the education literature to situated and constructivist learning and the need for greater researcher reflexivity about the assumptions and conduct of research. These trends also elaborate the need in EE and education for sustainable development and related fields of curriculum inquiry and theory for learners to critically examine their own and others' experiences of the various places they regularly encounter

This argument by Payne (2006) is important in support of the findings of this study on the coverage of environmental impact topics in the curriculum that it should empower or provide spaces for teachers to enable learners to critically examine their own experiences with regards to ESD and related fields. Hence, the policy developers and

implementers as social structures have a responsibility to elaborate the need for EE in the education space.

I argue that if all the subjects' structures and agents can **mirror** what Life Sciences has done concerning environmental impact topics coverage, the biophysical, socio-economic and political environment could be sustained through education. I am of the opinion that extensive environmental impact topics coverage in the curriculum could ensure that younger generations develop appropriate skills, knowledge and principles for sustainable living.

8.5.2 Alignment of Environmental Impact Topics in the Documents

There was some **alignment** between the coverage of environmental impact topics in the textbooks when compared to the examination papers. For example, in Life Sciences, Geography, Economics and Agricultural Sciences textbooks the coverage was 3%,15%, 7% and 5% respectively, while in the examination it was 8.8%, 12%, 2.5% and 10.8%. I believe that the alignment could have a **positive** effect on the teaching and learning of environmental impact topics in the classroom where teachers would be compelled to focus on topics which are frequently examined. In case where there is **misalignment** between policy and practice, I am of the view that teachers will tend to neglect these environmental impact topics to be taught in the classroom as it could be seen as a waste of time since they are not going to be included in the examinations. This implies that learners will be **deprived** of the teaching and understanding of ESD they need to sustain the biophysical, socio-economic and political environment in the future. I am of the view that this neglect is creating a **knowledge gap** in the learners in terms of ESD. Payne (2006:29) stated that;

Limited progress in the ability of social theory, environmental philosophy, and geography to inform curriculum developers of how to bridge the dualisms of agency–structure, identity–spatiality, and local–global that, effectively, denied the possibility of plausible empirical insights into the nature of human–environment relations and, therefore, satisfactory explanations of socioecological life needed for the planning of meaningful curricula experiences.

Again, Payne (2006) statement signifies the importance and role of curriculum developers to ensure that educational policies infusing EE/ESD into the curriculum are interpreted and applied correctly (put into practice) to enhance progress in the ability

of social theory, environmental philosophy and all subject to inform relevant stakeholders on how to bridge the agency-structure relationship that exist. I strongly believe that examinations, which are summative assessments should carry the **same** weight as formative assessments in the end of year results. This will allow teachers and learners to have more time to concentrate on other topics such as environmental impact topics in all the subjects.

8.5.3 Effects of the Shifts of the Curriculum

Shifts in the curriculum positively contributed to increased coverage of the environmental impact topics in the new curriculum in both the textbooks and in Grade 12 examinations. The shift from old NCS (Grade 10-12) to the CAPS curriculum was beneficial to teachers as they were able to engage in reflecting on and assessing their own efforts to **promote inquiry, reasoning, problem-solving and communication** in the classroom. I am of the view that social problems such as the drought experienced by South Africa in 2016 could be alleviated by adhering to **sustainable practices** that are environmentally friendly. An increase in the coverage of environmental impact topics was found in a few subjects (Life Sciences, Economics, Agricultural Sciences and Geography) but most of the other subjects did **not cover** these topics in the policy and practice or in the examinations. I concur with the findings of this study that integration of environmental impact topics in the curriculum documents as well as in practice should be encouraged and it is the responsibility of all structures involved in the education sector. In support of this finding, Gough (2013) pointed out that the inclusion of EE in the curriculum allows for the construction of trans-cultural spaces in which scholars from different localities collaborate in reframing and disseminating their own knowledge traditions. He further states that much needs to be done in terms of research as EE continues to evolve and transform.

In the short term, I am of the view that the constant changes in the South African curriculum affects teaching and learning because teachers have to keep on learning new ways of teaching instead of adapting and improving the new curriculum. Ball 2008 cited in Priestley (2011:1) argues that;

As a result of curriculum changes, practitioners' work has intensified, paperwork and bureaucracy have increased, and teachers have felt increasingly disempowered and professionally marginalized.

Ball (2008) assertion about curriculum changes is seen in Chapter 6 of this study where teachers mentioned that amending of the South African school curriculum from old NCS (Grade 10-12) to CAPS did not alleviate workload but it intensified paperwork. Teachers felt threatened by CAPS with the amount of **workload** required which is coupled with understanding of the EE/ESD integration in the curriculum. I argue with the notion presented by Ball (2008) that these teachers felt disempowered and professionally marginalised, I believe that with the CAPS curriculum teachers are empowered due to the **changes** brought by curriculum shifts. Priestley (2011:2) is of the view that;

Teachers have become recently positioned in policy as agents of change, as the standard bearers of professional models of transformational change.

The effects of the constant changes of the curriculum has led to teachers becoming the the **agents of change** as seen in this study where teachers have to quickly adapt to new teaching strategies that are introduced by the CAPS curriculum. I am of the view that if teachers are standard bearers of professional models of transformation, this leads learners to be **environmentally responsible** citizens.

8.5.4 Teaching of Environmental Impact Topics

The collaboration of teachers with other social structures such as subject advisors has a positive effect on the culture that can be developed where reliance on external structures by teachers leads to **sustained transformation** which culminates in shifts not only in the **physical** aspects of action of teachers but also in **ideational** aspects. The ideational aspects then lead to **self-reliance** and the ability to **develop** strategies to teach environmental impact topics in the school system. This leads teachers to be compelled to engage learners in environmental initiatives at school since they are captive agents. In support of this finding, Tuncer et al. (2009) state that teachers are more likely to produce students who are more environmentally literate if they are **more knowledgeable, have positive attitudes** towards the environment, and show concern for **environmental problems**. Ko and Lee (2003) indicated that;

Teachers tended to teach more environmental education if they held more favorable attitudes toward environmental education, had more skills in teaching environmental education.

I agree with the notion that **motivated** teachers in the classroom will bring out the best in terms of knowledge transfer to learners. I argue that the teachers' fully reliance on subject advisors for lesson plans is **unnecessary**. I believe that teachers can be given a template for a lesson once by the subject advisors and then develop skills to prepare their own environmental impact topics lesson plans. This will ensure that teachers develop critical learning skills and are in a position to keep up with the changes in the social environment. To support my views on this issue, Good and Lavigne (2015) indicate that good teaching involves more than increasing learners' scores on standardised achievements tests; it entails **assisting learners** to become better **problem-finders** and **problem-solvers** as well as encouraging student **civility** and **social responsibility**.

8.5.5 Impact of Fundisa for Change

Programmes such as Fundisa for Change equip teachers with necessary professional development and encourage usage of different **teaching strategies** in the teaching of environmental impact topics in the curriculum. In support of this, Johnson-Pynn, Kityo and Lugumya (2014) argue that environmental education programmes are a major conduit in making learners aware of **threats** to the environment, and it is through EE programmes that youth can learn to make informed decisions to conserve and improve their surroundings. I concur with the finding that teacher professional **development** programmes are essential especially if they are content-specific. I believe that in the current policy dispensation where EE is **not** regarded as a stand-alone subject in the CAPS curriculum but the content is spread across all subjects as policy stipulates, it is important that programmes such as Fundisa for Change are **held timeously** probably once in every six months to ensure that teachers are developed in teaching environmental impact topics.

8.5.6 Challenges faced by Teachers

Teachers still face challenges such as **overcrowding** of classes and inadequate resources for teaching of environmental impact topics. Iqbal and Arif (2011) suggest that teachers should be aware of the actual complexities of classroom processes and student activities, as well as how they can be organised. I agree that teachers should be aware of the complexities of teaching environmental impact topics in congested classes. However, I am of the view that this challenge could bring the best out of a

teacher where **critical thinking** can be used to develop lesson plans that will suit any situation. I believe that teachers can always take learners for **outdoor activities** and **excursions** in dealing with overcrowded classes. This study findings concurred with Ko and Lee (2003) who discovered that some teachers promoted environmental education in extracurricular activities. Learners are interested when they are exposed to the outside environment while they are learning environmental content as they could easily relate to environmental impact topics such as improper solid waste, effects of climate change, air pollution and water pollution. From what the teachers perceive as **lack of resources**, I am of the view that these is one of the common concerns with teachers and it is not only affecting current teaching and learning but will also have an effect on the environmental knowledge **acquisition** by the future generation of learners. Ko and Lee (2003:198) noted that;

Some of them thought that inadequate environmental education knowledge and training for teachers as well as lack of readily usable materials were also problems.

The findings of this study in Chapter 6 and 7 pointed to some challenges that are faced by teachers in ensuring that EE/ESD is correctly disseminated in the classroom. Challenges such as lack of **teaching and learning resources** retards the learning process. These findings on the lack of resources concurred with Ko and Lee (2003) who mentioned that lack of readily usable materials were a problem for teachers.

8.6 LIMITATIONS OF THE STUDY

The participants in the study were all based in Mpumalanga and teaching in schools which fell under the Mpumalanga Department of Education. Therefore, the teachers' perceptions about the challenges brought about by the shifts in the curriculum cannot be **generalised beyond** the Mpumalanga province because other provinces might be in a position to provide necessary resources needed for teaching and learning. However, the **content coverage** of environmental impact topics can be generalised to all provinces as policy documents and examinations analysed are nationally based. This brings another limitation of the study to light, in that the examination analysis cannot be **generalised** for all of the grades in the education sector but is limited to the FET phase, specifically Grade 12 examinations.

8.7 CONTRIBUTIONS TO THE BODY OF KNOWLEDGE

The findings of this study appear to contribute the following to the body of knowledge;

- This study reveals that CAPS documents for subjects such as Accounting, Mathematical Literacy and English First Additional Language **do not** contain environmental impact topics in the programme despite the aim and principles mentioning the inclusion of environmental topics in the curriculum. I deduce that this **non-inclusion** of EE components in the subjects' policy documents brings about a negative culture among teachers **not** to teach EE. This can have a negative influence on agents such as learners and teachers as they would not be able to inculcate positive environmental behaviour. Thus, leading to a society that is despondent and morphostasis in terms of structure, culture and agency on environmental issues.
- The breadth of coverage of environmental impact topics appears to **be inconsistent** across all the subjects that are being analysed. This inconsistency can be attributed to different subject policy makers **not** adhering to the principle of inclusion of environmental education in all subjects. As mentioned earlier, I am of the view that the subject policy guideline for Life Sciences should be used as an **example** by other subjects. This will result in teachers and learners are being exposed to teach and learn about environmental impact topics knowing which topics must be covered and to what extent are those topics going to be examinable.
- The shifts in the curriculum **improved** the breadth of content coverage of environmental impact topics in some subjects. This significant improvement in the coverage is likely to influence teachers and learners to have in-depth knowledge of environmental impact topics and **promote environmental sustainability** in their livelihoods, specifically for those subjects such as Life Sciences, Geography and Economics.
- Teachers indicated that CAPS enabled them to use different **teaching strategies** in the teaching of environmental impact topics. It was found that teachers developed a **culture of collaboration** in accessing necessary resources and skills to impart environmental knowledge to learners both inside and outside of the

classroom. This confirms Archer's (1996), RST proposition that social structures influence culture and agency.

- The study also revealed some **challenges** that arise during the teaching environmental impact topics in the CAPS curriculum. These include lack of **motivation from learners, congested content, lack of teaching and learning resources, limited time allocated for lessons, lack of financial support** from parents and **inability** of progressed learners to cope with the demand of the **new content**.
- Apart from different **teaching methods** that the teachers were able to learn from the Fundisa for Change programme, teachers admitted that they also acquired **new insights** and **skills** that they can use for effective assessment practices. They believed that they were now able to use **different** and **effective** assessment practices such as **strategic questioning, classroom presentations, report writing** and **observation** while on excursions. Teachers mentioned that they were able to benefit from the three key components of the programme, which were subject **content knowledge, teaching practice** and **assessment practice** of environmental impact topics. It should be noted that programmes such as Fundisa for Change improve teachers' pedagogical approaches, assessment strategies and subject content knowledge by providing relevant resources and training for teachers for the teaching of environmental topics. However, the only shortfall of this was that few teachers and schools participate in such programmes due to funding limitations.
- The studies reviewed in the literature highlight issues of EE integration, teaching practice, content knowledge, different principles of teaching EE and approaches to EE implementation. However, none of the studies reviewed investigated alignment of curriculum policy and actual practice. This study contributes toward closing this knowledge gap between **policy** and **actual** practice in the coverage of environmental impact topics. Through the contribution of this study it is evident that the DBE can now have practical view on how ESD issues are enhanced or diminished through educational policy implementation at all different schooling structures.

- Teachers are important agents of change who can deliver the educational response to EE/ESD. Since teachers are influential change agents, it emerged in the study that there is a need for them to be supported with the requisite skills, knowledge, strategies, values, motivation and commitment to teach the curriculum content on sustainable development. Consequently, I am of the view that teachers can be supported to develop resources and to access resources on EE/ESD that have much to offer in the building of a relevant, quality education system, not only in South Africa but also across the globe, towards attaining the SDGs. I believe that this support will enhance UNESCO approaches to EE/ESD in terms of teachers becoming **value-driven, critical thinkers and problem solvers** when dealing with biophysical, social, economic and politics aspects of the environment.
- The aim of this study was to investigate the extent to which environmental impact topics have been integrated into the curriculum and the proportional alignment of content coverage in the examinations as well as policy projections in the FET phase. It was evident from this study's findings that there was both **alignment** and **misalignment** between policy and actual practice in some subjects. It was noted through findings that the only exception was in Life Sciences where analysis showed what was written in the policy was actually practiced. This implies that policy makers should stipulate the extent to which each topic must be covered in the summative assessments such as examinations. In the initial sampling of documents to be analysed, **eleven** core subjects that were taught in the FET phase in the South African education system were chosen because DBE policy stipulates that EE should be integrated in all subjects. I was surprised that some subject statements did **not include** environmental impact topics. This reduced the sample to be analysed to **four** subjects (Life Sciences, Geography, Agricultural Sciences and Economics). This implies that the policy developers for some subjects value environmental impact topics more than others do. This requires that policy developers in the Department of Education should ensure that environmental impact topics are integrated in the policy documents of **all** subjects instead of writing a generalised statement that teachers find challenging to put into practice. This calls for subjects such as Accounting, Mathematics, Mathematical Literacy and English to integrate the teaching of environmental impact topics using the **Life**

Sciences model where the policy clearly stipulates the breadth of coverage in the policy as well as in the examinations.

- Based on the outcome of the analysis of this study, a model is proposed as discussed in section 8.11. Basically the proposed **Change of Structure, Culture and Agency (CSCA) model** can be of use to the education fraternity as it can easily predict the end results of curriculum shifts where structural and cultural factors affects agents (teachers) in a positive or negative manner based on the changes of content coverage of EE/ESD topics, assessment, policies, educational programmes, roles, resources, processes and practices. Positive changes to agents that can be brought by the curriculum shifts can lead to individuals possessing the following UNESCO approaches to EE/ESD which are interdisciplinary and holistic, value-driven, critical thinking and problem solving and taking good decisions towards environmental issues.

8.8 CONCLUSIONS

The main research question of the study was how the shift in the curriculum has affected coverage, teaching and examination of the environmental impact topics in the FET phase. Although teachers mentioned that changes to the curriculum happen periodically, the analysis showed that the **shifts have brought positive effects** to the teaching of environmental impact topics. The coverage of the environmental impact topics in both the policy documents and in examinations **improved** as seen in subjects such as Life Sciences, Geography and Economics.

The analysis of the CAPS curriculum for **Life Sciences** revealed that it stipulated the number of marks to be allocated to environmental topics in the final examinations, but that was not evident for the other subjects. The other subjects had **varying degrees** of coverage of environmental impact topics. I believe that the DBE should use the subject policy for this subject as an example when reviewing the CAPS curriculum in terms of EE/ESD coverage. In addition, the examinations revealed an improvement in **the depth of coverage** compared to the old curriculum. The study also found that shifts in the curriculum influenced agents to use **additional resources** to facilitate teaching. This study revealed that to prepare learners for formative and summative assessment in the school structure, teachers used documents such as examination diagnostic reports.

On the **teaching practice** aspect, while the shifts in the curriculum improved the content to be taught in the classroom and teaching methods to be used, the amount of **time and lack of teaching and learning support materials** was still a challenge in the teaching of environmental impact topics. I propose that private industries and government departments could be encouraged to provide financial support to schools found in poverty-stricken, rural areas. The study also found that the initiative by Fundisa for Change to provide professional environmental teacher development support through providing necessary subject content knowledge, teaching and assessment approaches to teachers was a **success**. Teachers used ideas from the training provided by the programme to teach environmental impact topics in the classroom. I agree that supportive in-service teacher professional development programmes play an important role in closing the knowledge gap that teachers experience from curriculum changes. Zwelibanzi (2016) and Maluleke (2016) are of the view that the constant changing of the curriculum in a very short period **confuses teachers**. It is evident from the findings of this study that the **confusion** in this case can be alleviated by programmes such as Fundisa for Change.

Structure, culture and agency interactions were components of the RST framework used as a lens for this study. Firstly, with regard to structure, the participants revealed that in order to perform their practices efficiently, they need to be supported by social structures such as subject advisors, SGBs, the DBE and even the learners. In addition, the shifts in the curriculum not only affected the roles of teachers but they also had an effect on structure, where resources were needed in order to implement the new curriculum. Environmental education is shaped by the curriculum content, the assessment, and how teachers teach the content to learners. **Structure** also influenced the roles teachers and learners took in the classroom, the educational practices and processes they engaged in when they were teaching and learning environmental impact topics in the CAPS curriculum. This led to structural and cultural morphogenesis as proposed in the model shown in section 8.12. Secondly, with regard to **culture**, the findings revealed that the culture of the participants, which was made up of ideas and beliefs, was largely influenced by the professional development that they accumulated from training programmes and documents which they used during teaching and learning.

Lastly, with regard to **agency**, teachers as agents in this study were affected by the structure and culture of the education system. In this study, teachers played an important role in influencing positive implementation of environmental impact topics in the curriculum. However, they encountered some challenges, such as not having enough time to teach environmental impact topics, lack of material resources and lack financial resources to implement some of the teaching methods that require learners to be exposed to excursions. The shifts in the curriculum revealed the importance of developing new technology-facilitated teaching methods such as the use of tablets and smart phones to source information for both formative and summative tasks.

The overall contribution of the study to educational changes is that **different structures** play an important role in ensuring that the knowledge gap on environmental impact topics is closed. Based on the documents findings of this study, I am of the view that role players such as examiners also contribute to the teaching and learning of environmental impact topics and their interpretation of the policy requirements can be either beneficial or detrimental to learner's environmental knowledge acquisition.

I also propose that teachers need to **collaborate** and **use diverse teaching methods** that improve learners' knowledge of environmental topics. This finding concurs with Yang (2015) who argues that although elementary school learners do not experience substantial academic pressure, environmental awareness cannot be achieved solely by studying the written content of teaching materials. Hence, teachers need to fully participate in programmes aimed at improving their skills in teaching practice. The education system in South Africa is examination-driven; therefore, it is important that documents which assist teachers with preparation of learners for examinations be aligned to the curriculum policy framework of the DBE.

Furthermore, the study concludes that consistency in the proportional coverage of environmental impact topics in the curriculum, and alignment of the policy with actual practice in the examinations would encourage **pro-environment** teaching practices, thereby enabling positive change in the culture of teaching environmental impact topics. This is supported by Di Chiro (2014:9), who points out that EE is a social practice that aims to bring about changes and improvements in its field of action and the education for an environmentally aware and active citizenry.

From a **Realist Social Theory** perspective, the extent of the coverage of these topics in the examination papers may change the ways in which both teachers and learners focus on environmental topics in their teaching and learning inside and outside of the classroom. **Greater coverage** will enable learners to be empowered to solve and respond to environmental issues. It is important to have relevant documents that can be used by learners and teachers for teaching and learning environmental impact topics such as documents that are aligned to the policy projections of environmental impact topics in order to be able to foster **structures, cultures** (roles and ideas) and **agency** that encourage environmental sustainability. Therefore, consistent coverage of environmental impact topics in the curriculum and examinations can encourage the **agency** of teachers and learners in becoming more aware of environmental problems in their lives and acting positively to respond to these **environmental issues**.

8.9 RECOMMENDATIONS OF THE STUDY

Based on the above conclusions of this study I suggest the following recommendations to the Department of Education, policy makers, examiners, teachers and subject advisors;

- Due to the misalignment between formative and summative assessment of environmental impact topics in the CAPS, this study recommends that the DBE change the ratio of 25% case mark and 75% examination to 50% case mark and 50% examination respectively for final year results for learners.
- Teachers should use multiple structures to get necessary assistance in the teaching of environmental impact topics in the CAPS curriculum. Teachers in this study noted that they faced challenges such as inadequate resources to facilitate teaching and learning. The new curriculum is driven by advancing information technology and many learners in poor communities lack access to these new ways of learning. They can therefore benefit from assistance from both public and private sectors.
- Teachers who attended professional development training programmes should be assisted to form professional communities of practice (PCPs) in order to share ideas with those teachers who did not get an opportunity to attend training. The district officials responsible should be empowered to facilitate the process and encourage such collaborations, particularly in areas where this will benefit teachers

greatly. I am of the view that regular meetings of teachers should be held to enhance sharing of innovative ideas on how they could teach environmental impact topics in the new CAPS curriculum.

- Teachers and other related social structures such as the SGB, the school management team and the community can also improve the teaching of environmental impact topics by organising competitions for learners on environmental impact topics where learners can debate issues affecting their environment. Again, these stakeholders could be involved in advocacy campaigns to create awareness of the consequences of undermining environmental care.
- Education policy developers and subject advisors should evaluate the documents used by teachers for teaching purposes to ensure that the policy requirements are embedded in all the subject documents. This study discovered that some subjects have stipulated the coverage of environmental impact topics in the curriculum, but documents such as textbooks and examination question papers cover few if any of the environmental topics. Therefore, in most of the subjects analysed there was a misalignment between policy requirements and actual coverage in the textbooks and examinations. The implication of this misalignment is that teachers tend to focus on the topics that have frequently appeared in the examinations. This could lead to environmental impact topics not being taught to learners as teachers concentrate on topics that have a higher potential of being examined at the end of the year.
- Policy developers should provide enough time in the teaching plans for teachers to enable them to complete the stipulated environmental impact topics in the curriculum. This study proposes that each subject should have an equal weighting for both continuous assessment and exit-level summative assessment (Examinations) to ensure that all the content taught during the year is given the necessary attention by teachers instead of focusing only on possible examination topics.
- The Fundisa for Change programme should be better resourced financially, expanded and extended to provide more teaching strategies that can be used by teachers in under-resourced classrooms. The training could, in this instance, be made available to more teachers at provincial and national levels and not only to selected schools.

- The DBE examiners need to be consistent in the coverage of environmental impact topics in the examinations as teachers find it difficult to provide necessary support to learners if the coverage is not consistent. Life Sciences is a good example where policy projections stipulate the depth of environmental impact topics to be covered in the examination as shown in this study's analysis (Chapter 5), and ensure that there is an alignment between policy projections and actual coverage in the examinations in Grade 12.

8.10 REFLECTIONS

8.10.1 Reflection on Literature Review

Chapter 2 covered environmental impact topics from global, regional and national perspectives with more emphasis on the South African context. I did not have any real challenges in sourcing relevant literature. However, in Chapter 3, I encountered challenges when reviewing literature on the coverage of environmental impact topics from policy (curriculum) documents for the global perspective. I find that global countries integrate environmental impact topics differently compared to regional (African) countries. They use different approaches which are compulsory, interdisciplinary, intra-curricular and use of teachers' discretion.

8.10.2 Reflection on Methodology

The qualitative approach suited the data collection and analysis of this study. The study had to employ two data-collection tools in the form of document analysis and case study research. It can be noted that the predominant design was document analysis that was extensively analysed in Chapter 5. I used phrases, words and word count to source text that was relevant for this study as document analysis requires data selection, instead of data collection. I can attest that document analysis was time-consuming; however, as seen in Chapter 5, it comprised large amounts of data that were sourced from documents because they were readily available anytime when need arose with minimum cost. I can mention that while conducting document analysis the initial 11 core subjects that were analysed at the initial stage were reduced to four subjects (Life Sciences, Geography, Agricultural Sciences and Economics) due to non-inclusion of environmental impact topics in the respective policies (documents) and in practice (examinations).

8.10.3 Reflection on the Theory

The RST theory that underpinned this study helped in demarcating tenets of the data using the CMOs shown in Table 6.2 where the context comprised of pre-existing aspects of structure, culture, agency and relations. This demarcation was significant because data analysis of teachers' views clearly demonstrated these aspects in Chapter 6 and 7. The findings of the study conforms to Archer (1996) on the concept of morphogenesis that teachers as agents and documents as structures are affected by the cultures that is existing within the schooling fraternity.

8.11 RECOMMENDATIONS FOR FURTHER STUDY

Based on the findings of this study further studies are recommended as follows:

- A study to explore whether teachers delivering the lessons on environmental impact topics in the classroom are really practising what they have been taught in programmes, and whether the lived environment is fully utilised to facilitate learning;
- An investigation into how teachers facilitate connections between prior knowledge and new environmental learning;
- An investigation into learner engagement on environmental impact topics in the classroom; and
- An assessment of teachers' pedagogical content knowledge and planning in terms of environmental impact topics.

8.12 PROPOSED CHANGE OF STRUCTURE, CULTURE AND AGENCY MODEL

Based on the findings of the document analysis in Chapter 5 and the face-to-face interviews with teachers in Chapters 6 and 7, a model is proposed by this study. This study proposes a change of structural, cultural and agency model that shows how the shifts in the curriculum have an effect, which can be **negative or positive** on the structure, culture, and agents. The proposed model seems to conform to the premises of Margaret Archer structural and cultural morphogenesis concept. The findings of this study indicate that shifts in the curriculum contributed to several factors that culminated to the following;

- change of the way teachers presented lessons;

- changes in the resources used;
- changes in the content to be presented;
- changes to the assessment given to learners; and
- changes to the overall structure and culture of the school systems.

The changes seen in this study conform to Margaret Archer's theory of morphogenesis. Her theory stresses that there is an inter-relationship between social structures and human agency (Archer, 1995). Against this background, in this study there was an emergence of structural and cultural morphogenesis. The emergence of structural and cultural transformation in the school environment relates to the RST concept of the context-mechanism-outcome configuration (Archer, 2003; De Souza, 2013; Pawson & Tilley; 1997). As mentioned in Chapter 4 of this study, RST is an explanatory framework that focuses on the operations of programmes to evaluate their effectiveness and challenges. Apart from programme evaluation, "RST also focuses on the social theory about individuals in society, how individuals and society are related" (De Souza, 2013). Furthermore, RST also focuses on possible interactions between them that may result in or **affect change in the social context** of interest. I have noticed based on the findings in this study that the effects of the changes of old NCS (Grade 10-12) to CAPS resulted in changes in the environmental impact topics content that is taught to learners. For example teachers tend to be influenced by external agents such as subject advisors and structures such as documents (policies, textbooks, examination papers) in influencing teaching of environmental impact topics. The proposed change model in figure 8.1 is characterised by aspect of change that could be positive or negative in terms of structural and cultural context. The structural and cultural factors influence mechanisms related to ideas, roles, practices, resources and processes as shown in Figure 8.1 below. In this study it is important to emphasise that social structures had an influence in the culture of teaching of environmental impact topics. Human agency (of the teachers) in this study was seen transformed after being exposed to the Fundisa for Change capacity building workshops.

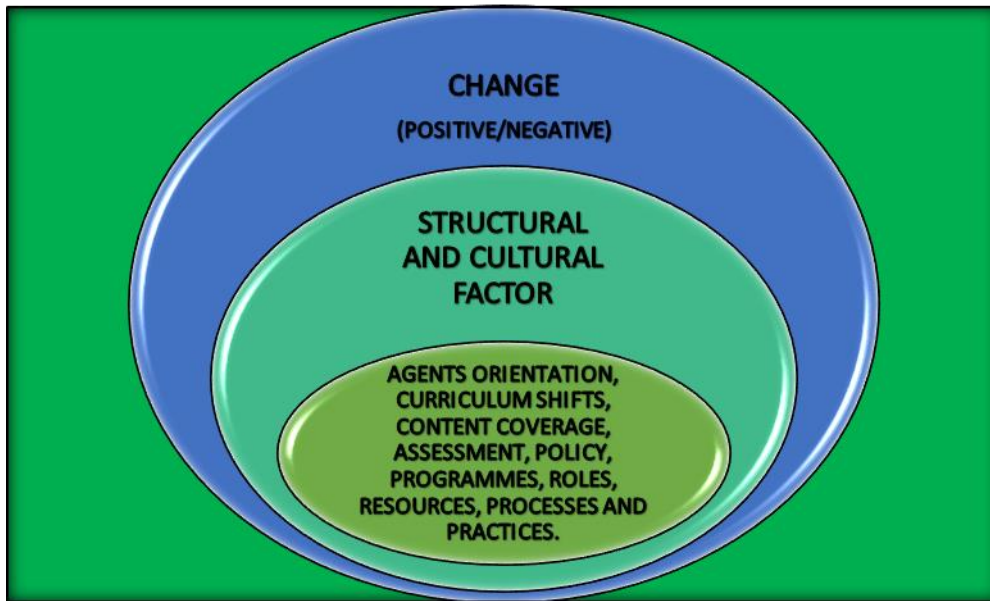


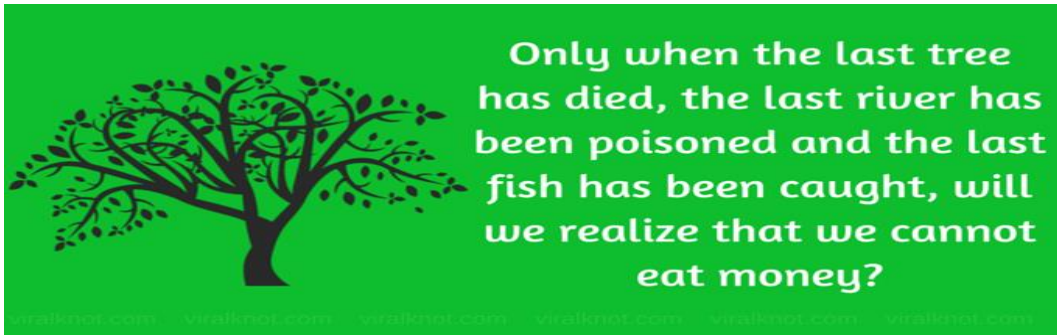
Figure 8.1: The proposed emerging change of structural, cultural and agency (CSCA) model

This study on the analysis of the coverage, teaching and examination of environmental impact topics in the FET phase revealed changes emanating from structural and cultural factor. This is in agreement with Margaret Archer, who believes in socio-cultural interaction that results in structural morphogenesis for example, structure is reproduced through agency which is simultaneously constrained and enabled by structure. In line with Archer, who argue that structure, culture and agency need to operate in unison for transformation to emerge. This conforms to human interactions which take place in a context that has been conditioned by effects of both structure and culture (Archer, 2003; Case, 2015). As seen in this study it was impossible to separate social structures such as rules, resources, powers, relations and practices from culture and agency as they operate in unison and can only be separated analytically as explained by Archer. The analysis section of this study revealed that shifts in the curriculum affected structures related to the roles of teachers as they deliver the lessons in the classroom, mechanisms related to teachers' orientation, content coverage, assessment, policy, programmes, resources and teachers' practices. This has led to these results being aligned to Archer's morphogenetic theory.

The model emerged in the way in which teachers use documents in the analysis of coverage of environmental impact topics in the new curriculum, as seen in Chapter 5,

shows the cultural factor that comprises of ideas on how to use documents like past examination question papers and the culture of teachers using ideas from the Fundisa for Change programme as seen in Chapter 7 to teach environmental impact topics. The proposed change model also shows the interaction between the factors and the mechanisms that result in the changes in the learning process. These changes can be **negative or positive** depending on whether there is transformation or reproduction after curriculum changes, programme training and the use of new teaching and learning materials by teachers. The proposed change of structural, cultural and agency (CSCA) model can be useful in the analysis of the operations of a programme that could lead to social change. It can also be used to evaluate the effectiveness and challenges brought about by shifts in the curriculum as seen in this study. The model in Figure 8.1 shows the relationship of change/transformation of structures, cultures and the emergent properties such as teacher orientation, curriculum shifts and content coverage.

In sum, the proposed CSCA model can be of use to the education fraternity as it can easily predict the end results of curriculum shifts where structural and cultural factors affects agents (teachers) in a positive or negative manner based on the changes of **content coverage, assessment, policies, educational programmes, roles, resources, processes and practices**. Positive changes to agents that can be brought by the curriculum shifts can lead to individuals possessing the following UNESCO approaches to EE/ESD which are **interdisciplinary and holistic, value-driven, critical thinking and problem solving** and taking good decisions towards environmental issues. The interplay of culture, structure, and agency through social interaction leads to social reproduction and transformation or, in Archer's (1995) terms, cultural and structural elaboration. This proposed model of the interplay of culture, social structure, and agency casts considerable light on the **educational change** in the schooling sector.



Source: Viralknot.com (2018)

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APPENDICES

APPENDIX A: LETTER REQUESTING PERMISSION TO CONDUCT STUDY IN MPUMALANGA PROVINCE

P.O. Box 1672

Piet Retief

2380

24 October 2016

Director, Private Bag X11341
Nelspruit
1200
Tel: (013) 766 5552/5349/5115

Dear Sir/Madam

Request permission to conduct research in your Province (Mpumalanga)

I humbly request permission to conduct research in your province Mpumalanga. I am a student at the University of South Africa enrolled for Doctoral Degree in Curriculum Studies. The studies research topic is **an analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education and Training phase**. The aim of my research is to investigate how environmental impact content teaching is affected by the shifts in the curriculum and extent of examinations content coverage in the FET phase. Your Province has been selected because of the districts who took part in environmental education training conducted under the Fundisa for Change programme between July to November 2013. Teachers who took part in the training mentioned above will be interviewed after school hours or during school holiday. Feedback will be made available to participants after all research processes have been finalised. The benefit of this study will help in equipping teachers on how they will improve teaching environmental impact topics in the new curriculum (CAPS). The research project will be carried out for a period of one week as mentioned above only teachers will be interviewed for only 1-2 hours each.

Teachers participation in this research project is voluntary and confidential and should the teacher be willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school and teachers.

Should any academic publication be made, pseudonyms will be used for the teachers in place of the actual names. Participants are free to withdraw from the study if they feel they do not want to continue. Detail in this letter is a document explaining the role of participants in this study, and teachers who are willing to participate may sign a declaration of consent. This would mean the teacher participates in this project willingly and that it may withdraw from the research project at any time.

Yours faithfully

Sikhulile B Msezane (msezanesb1@gmail.com / msezsb@unisa.ac.za)

APPENDIX B: LETTER REQUESTING PERMISSION FROM THE SCHOOL PRINCIPAL AND APPROVAL

P.O. Box 1672

Piet Retief

2380

24 October 2016

The Principal

Private Bag X11341

Nelspruit

1200

Tel: (013) 766 5552/5349/5115

Dear Sir/Madam

Request permission to conduct research in your school

I humbly request permission to conduct research in your school. I am a student at the University of South Africa enrolled for Doctoral Degree in Curriculum Studies. The studies research topic is an analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education Training phase. The aim of my research is to investigate how environmental impact content teaching is affected by the shifts in the curriculum and extent of examinations content coverage in the FET phase. Your school has been selected because of the districts who took part in environmental education training conducted under the Fundisa for Change programme between July to November 2013.

Teachers who took part in the training mentioned above will be interviewed after school hours or during school holiday. Feedback will be made available to participants after all research processes have been finalised. The benefit of this study will help in equipping teachers on how they will improve teaching environmental impact topics in the new curriculum (CAPS). The research project will be carried out for a period of one week as mentioned above only teachers will be interviewed for about 1-2 hours each.

Teachers participation in this research project is voluntary and confidential and should the teacher be willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school and teachers.

Should any academic publication be made, pseudonyms will be used for the teachers in place of the actual names. Participants are free to withdraw from the study if they feel they do not want to continue.

Detail in this letter is a document explaining the role of participants in this study, and teachers who are willing to participate may sign a declaration of consent. This would mean the teacher participates in this project willingly and that it may withdraw from the research project at any time.

Yours faithfully

Sikhulile B Msezane (msezanesb1@gmail.com / msezasb@unisa.ac.za)

APPENDIX C: LETTER REQUESTING TEACHER'S PARTICIPATION

P.O. Box 1672

Piet Retief

2380

24 October 2016

Dear Participant

I humbly request your participation in the research to be conducted in your school. I am a student at the University of South Africa enrolled for Doctoral Degree in Curriculum Studies. The studies topic is: **An analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education and Training phase**. The aim of the study is to investigate how environmental impact content teaching is affected by the shifts in the curriculum and extent of examinations content coverage in the FET phase. You have been selected because you took part in environmental education training conducted under Fundisa for Change programme between July to November 2013.

Teachers who took part in the training mentioned above will be interviewed after school hours or during school holidays. Feedback will be made available to participants after all research processes have been finalised. The benefit of this study will help with information that will equip teachers on how they will improve teaching environmental impact topics in the new curriculum (CAPS). The school and teacher's information will be kept confidential. Summary of findings will be available after the study has been completed. The results or data of this study will be used for other purposes such as a research report, journal articles and conference proceedings. Copies of data will be filled in a locked cupboard for a period of five years and electronic information will be stored on a password protected computer and memory sticks.

Your role in the research will be to give information about your teaching and an interview guide will be administered by the researcher. Unstructured questionnaire will guide the interview activities and the process will take an average of one hour. Participation in this study is voluntary and you are under no obligation to consent to

participation. If you do decide to take part, you will be given a consent form to sign although you are free to withdraw at any time without giving a reason.

I appreciate your sincere consideration to my request and thank you for taking time reading this information sheet.

Yours faithfully

Sikhulile B Msezane

msezanesb1@gmail.com / msezsb@unisa.ac.za

Cellphone No: 073 354 8165 / 012 481 2888

APPENDIX D: RESEARCH ETHICS APPROVAL LETTER



UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2017/02/15

Ref: **2017/02/15/44144156/9/MC**

Dear Mr Msezane,

Name: Mr SB Msezane

Student no: 44144156

Decision: Ethics Approval from
2017/02/15 to 2019/02/15

Researcher:

Name: Mr SB Msezane

Email: Msezanesb1@gmail.com

Telephone: 073 354 8165

Supervisor:

Name: Prof S Shava

Email: shavas@unisa.ac.za

Telephone: 012 429 4782

Title of research:

An analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education Training phase

Qualification: D Ed in Environmental Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2017/02/15 to 2019/02/15.

The low risk application was reviewed by the Ethics Review Committee on 2017/02/15 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:



University of South Africa
Pretter Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

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1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date 2019/02/15. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2017/02/15/44144156/9/MC** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

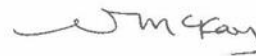
Kind regards,



Dr M Claassens

CHAIRPERSON: CEDU RERC

mcdtc@netactive.co.za



Prof V McKay

EXECUTIVE DEAN



Approved - decision template – updated 16 Feb 2017

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APPENDIX E: AN EXAMPLE OF AN APPROVAL LETTER FROM THE PRINCIPAL

APPENDIX D

P.O. Box 1672

Piet Retief

2380

6 MARCH 2017

Dear Sir/Madam

Request permission to conduct research in your school

I humbly request permission to conduct research in your school. I am a student at the University of South Africa enrolled for Doctoral Degree in Curriculum Studies. The studies research topic is an analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education Training phase. The aim of my research is to investigate how environmental impact content teaching is affected by the shifts in the curriculum and extent of examinations content coverage in the FET phase. Your school has been selected because of the districts who took part in environmental education training conducted under the Fundisa for Change programme between July to November 2013.

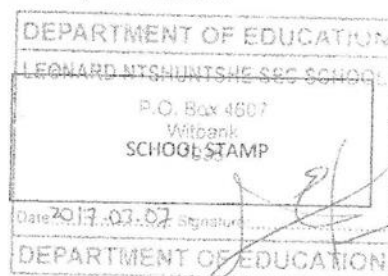
Feedback will be made available to participants after all research processes have been finalised. The benefit of this study will help in equipping teachers on how they will improve teaching environmental impact topics in the new curriculum (CAPS). The research project will be carried out for a period of one week as mentioned above only teachers will be interviewed for about 1-2 hours each.

Teacher's participation in this research project is voluntary and confidential and should the teacher be willing to participate in this study, none of the information obtained will be disseminated to the public in a manner that identifies the school and teachers. Should any academic publication be made, pseudonyms will be used for the teachers in place of the actual names. Participants are free to withdraw from the study if they feel they do not want to continue.

Detail in this letter is a document explaining the role of participants in this study, and teachers who are willing to participate may sign a declaration of consent. This would mean the teacher participates in this project willingly and that it may withdraw from the research project at any time.

Principal's signature.....

Date 2017.03.07




APPENDIX F: AN EXAMPLE OF A SIGNED CONSENT LETTER FROM A PARTICIPANT

CONSENT

I agree to participate in the study entitled: An analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education Training phase. The researcher asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation. I have read and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty. I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified. I agree to the recording of the face to face interviews. I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print) MABASO DAPHNEY


Participant Signature

07/03/2017
Date

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APPENDIX G: APPROVAL LETTER FROM MPUMALANGA PROVINCE DEPARTMENT OF EDUCATION



Building No. 5, Government Boulevard, Riverside Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel: 013 766 5552/5115, Toll Free Line: 0800 203 116

Litiko le Temfundvo, Umnyango we Fundo

Departement van Onderwys

Ndzawulo ya Dyondzo

Mr SB Msezane
P O Box 1672
Piet Retief
2380
Cell: 073 354 8165

RE: APPLICATION TO CONDUCT RESEARCH: MR SB MSEZANE – UNISA

Your application to conduct research study was received and is therefore acknowledged. The title of your research project reads: "An analysis of the coverage, teaching and examination of environmental impact topics in the South African Further Education Training phase". I trust that the aims and the objectives of the study will benefit the whole department especially the children who are the beneficiaries. Your request is approved subject to you observing the provisions of the departmental research policy which is available in the department website. You are requested to adhere to your university's research ethics as spelt out in your research ethics.

In terms of the research policy, data or any research activity can be conducted after school hours as per appointment with affected participants. You are also requested to share your findings with the relevant sections of the department so that we may consider implementing your findings if that will be in the best interest of the department. To this effect, your final approved research report (both soft and hard copy) should be submitted to the department so that your recommendations could be implemented. You may be required to prepare a presentation and present at the departments' annual research dialogue.

For more information kindly liaise with the department's research unit @ 013 766 5476/5148 Or a.balovi@education.mpu.gov.za

The department wishes you well in this important project and pledges to give you the necessary support you may need.

MRS MOC MHLABANE

HEAD EDUCATION

14, 9, 17

DATE

Open Rubric



APPENDIX H: QUESTION GUIDE AND TRANSCRIPTS FOR PARTICIPANTS

TRANSCRIPT 1, 2 AND 3

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 1	TRANSCRIPT 2	TRANSCRIPT 3
	<p>Age: 43 Subjects: Geography Grades: 12 only this year Number of classes: 3 Number of learners: 128 Experience: 14 Years Teaching Experience: 14 years Highest qualification: B.Pd. Location: Elukwatini Number of learners at the school: 1066 Home language: Siswati</p>	<p>Age: 49 Subjects: Geography Experience: 22 Years Teaching Experience: 22 years Highest qualification: Degree Location: Elukwatini Number of learners at the school: 562 Number of classes: None Home language: none Last year of teaching: Last year</p>	<p>Age: 40 Subjects: Agricultural science and life sciences Grades: 10 and 11 and grade 11-12 Experience: 2011 6 (7) Years Teaching Experience: life science 2 years and agriculture 5 years Highest qualification: B.Ed. in Agric University: University of Forte Location: Nkomazi Middle Plaas Number of learners at the school: 875 Number of classes: 182 Home language: siSwati</p>
<p>1. How is the coverage of the new CAPS curriculum compared with the previous curriculum?</p>	<p>In terms of topics they link, from grade 10-12, we often complained that there is no link. CAPS have added more relevant content that the previous curriculum, however it is good. SP There was not continuation but now it continues and the</p>	<p>I think this one is a little bit better, compared to the previous one, it has been simplified and straight to the point. SP, SPR Apart from CAPS being a better curriculum than the old one, are there any challenges?</p>	<p>The new curriculum, it covers more aspects than the previous one and it is more detailed and it has lot of work but it has more information and detailed compared to previous curriculum. SP, SPR They provide relevant books which are provided and if we look</p>

	<p>content is the same, for example we have four aspects: climatology, geomatology, people and place (rural and urban settlement) and economic geography, you find that these sections were not in grade 10 but now they're across the board. It makes it easy for us as educators when we discuss, we will all be teaching same sections throughout the senior and FET phase. SPR</p> <p>I think we were expecting that CAPS to have less admin, but it is the same as previous curriculum. CS</p> <p>We have a lot of filing to do, they talk about item analysis, subject improvement plan, and performance, it's good but it has a lot of work. SP</p>	<p>I think the only challenge is shortage of resources, in some lessons, one needs to use ICT gadgets but we do not have, because they assist in terms of learners need to get what they want in terms of teaching. You find that lesson needs, but it becomes a challenge if you want to demonstrate, because in the book it's only pictures and also we have shortage of textbooks as well. SP, AB</p>	<p>at the pace setter compare to the book you would use, they are related SR</p> <p>Paper work, is confusing because it says you must have prepared lessons and we spent more time preparing administrative work than teaching SP</p>
<p>2. What is your view of coverage of environmental impact topics in the CAPS curriculum</p>	<p>They are intensively covered particularly in the FET band. SP</p> <p>I am looking one topic in grade 10 which is global warming, the way it is covered in our textbook, it tells us of causes and how to avoid global warming. I am particularly</p>	<p>What is your view of coverage of environment Geography impact topics in the CAPS curriculum</p> <p>Yes, one can say, that it is extensively covered, compared to the old one because with new curriculum links topics. SP</p>	<p>In the CAPS curriculum, it is covered correctly however in practicality I don't think they understand some of the things might not be practical and possible in your environment, because to be honest lessons end in class. CC</p> <p>What is the problem:</p>

	<p>interested in this one, we had a misconception that people who actually cause global warming are the mining industries however we did not know that we ourselves also play a role, for example the way we use electricity, can minimize the impact global warming. SP, CC</p> <p>Who is supposed to teach us how to minimize global warming and where is lacking</p> <p>We have environmental department and environmental educators (Geography and life sciences). SPR</p> <p>However according to the study I am doing, I have discovered that environment is also covered in other subjects, like economics according to past exam question paper.</p> <p>I also think all school subjects must be taught in all, and those specific subjects can focus more on its intensive content. SR</p>		<p>The problem, it is educators are not involved, and one educator cannot do everything on his/her own. Learners are willing to do what they're told but educators are not coming on board. SRP, AA, RD</p>
<p>3. How do you find teaching environmental impact</p>	<p>It is so interesting, one way I was helped by the training we attended in 2013; they spoke of</p>	<p>Yes, I think what we have in that document, even after one has used the documents, it was</p>	<p>The teaching is easy, but only if you have all the information for that particular topic. Because</p>

<p>topics in the CAPS curriculum</p>	<p>carbon-footprint. Practical examples, us who use cars for close distance instead of walking, even when you explain to the learners, they in do understand. SRP, RD It is also interesting to me because some of the things are not even written; as we talk about them we find that we are not doing well. AA The eating of beef, it means more cattle must be slaughtered. Greenhouse gas. RP, CC</p>	<p>quite interesting in terms of it made us aware, how we should teach and make it interesting to the learners RD</p>	<p>everything starts with the educator, if the educator has resources then its easier to also transfer to the learners SR</p>
<p>4. What are the teaching methods you use when teaching environmental impact topics</p>	<p>One that is interesting, in environment I give the learner topics to go and research about certain topics (global warming, changing patterns of weather, erosion, ozone layer depletion), however some learners are not keen in doing research and come and do presentation. We learn a lot from leaners because they might have found interesting things and they went deep in to the topic. SP, SRP, RD Teacher learner interaction which we use for them to get</p>	<p>I use to information transfer (investigative methods) Give them case study SP Are there other methods? Yes, Question and answer SP, CC</p>	<p>In most cases we use co-own method. RD, SP Group discussions SP</p>

	<p>more information and understanding. CR, RD</p> <p>Group discussions: this needs more monitoring, because some learners might be dominating and gain and others don't. AA, RD, SP</p>		
<p>5. How do you prepare a lesson for environmental impact topic</p>	<p>Through research, because we need teach them current issues, like we use charts and go for excursion. SPR</p>	<p>How do you prepare lesson, especially for environment topic, do you prepare like all other topics or will it be different.</p> <p>This one would be different, in terms of what one needs to indicate what will the lesson achieve, the aim needs to be included. SRP, SPR</p> <p>One will need to use learning teaching support and other thing that is important is how I introduce the topic and perhaps a difference concepts one can us in creating bond and of cause you need to check if you achieve the goals set in lessons plan RD, SP</p>	<p>It is similar because we have templates. CS</p> <p>Who gives you the template?</p> <p>The Cis gives the templates, because we had a challenge, where we would prepare lessons plans and we are told that It is not correct, so they ended up giving us templates CS, SR</p> <p>Any other means other than that.</p> <p>Yes these the only one, but when you feel that there's a topic that you think learner might be interested in or learn from them you include it in your lesson plan, like we talk about soil degradation where we take the learners to see AA, SP</p>
<p>6. How is the response of learners towards environmental impact topics lessons and performance in assessments</p>	<p>The response is positive and good, you find somethings its what they know and do, according to the response to the topics. SP, AA</p>	<p>How is the response of learners towards interactive lessons and the performance you just alluded to?</p> <p>Yes one need to indicate that, when I started the lesson the</p>	<p>In what they know they are positive and what they don't know they become negative because you can notice when you speak of what they don't know they look</p>

	<p>Performance is good, especially those who are more interested but of course it depends from year to year. SP</p>	<p>learners were very interested. Such that they were excited and motivated and they actively participated in my lesson such that remember that year results improved drastically AA, SRP Can you qualify the improvement? I am unable to respond I need to indicate this is my first year. I was in another school as a deputy principal. In that year I got 100% , following year 99% and 2016 98% RD, SP How many learners did you have for the group that got 98%? They were around 52 learner SRP</p>	<p>shocked and they only participate when they know AA, SRP</p>
<p>7. What are the challenges you are facing when teaching environmental impact topics in your classroom</p>	<p>Financial support from parents, when we plan an excursion parents are not able to pay for those. RD, RR The use of electronical gadgets, like now we experience tropical cyclone “dineo” but we are failing to show learners the pictures. SR Why are you failing Lack of resources. SR</p>	<p>The challenge that I had is the question of time, especially I was teaching grade 12. Because they need extra hours to catch up. One also lacks tome to debate to make it practical worksheets RD, SR Resources are also a challenge we could not make enough copies and also find that there’s only one data projector and it’s</p>	<p>The challenge we have, is that there are certain learners who reach certain grade without being exposed to certain things and it makes it difficult to teach, because we assume that, at that level they should have been exposed SP, RP Our learner they get to a certain grade not being ready for that grade because of condoning learners to next level without</p>

		been used by another teacher SR	them being ready, they would not even understand the question, I spoke to the English teacher to assist us in understanding certain terms SPR
8. What needs to be done to ensure that environmental impact topics in the curriculum are well represented if they are not.	I think team work, in terms of subjects that also cover the environment. SRP, AA, AB	I think we felt what needs to be done which we indicated in that workshop, was the inclusion of under subject and integration and also those subjects that have less educators in should be included in different topics to be included in the program. SRP, SP, RD All subject must all have a portion of environment, I am impressed that you also noted that point.	I think we need to involve the all other departments, to assist us because it seems as if it is a one man show and if they come on board they will be able to assist us because they work in the environment day in and out. And taking the learners to excursion do not really asset us. SRP, RD
9. How was the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?	It helped a lot, we realised that the different forms of teaching methods can be implemented, but some of them as I have indicated in methods I use, even if you lack resources. You can use carbon footprint, you do not need resources and those are in use now or it is practical. SP	Definitely how can I dispute that one, it really assisted our school and results improvement and my subject was part of that. The learner got 100% and the learner was recognised in the province. SRP, SP	It helped me to understand that, for learners to understand more they need to be taught practically for them to fully understand rather than theoretical. SP I remember talking about class participation, remember I spoke about lack of resources, so they said take off our shoes. The shoes were sorted in many ways, shape, colour and make and we would see differences because

			<p>we don't need to go very far SP, SR</p> <p>Don't make teaching a one man show, involve other teachers, because you may understand a topic, but the way you explain to the learners they don't even understand what you are saying , but if you speak to another teacher he or she might be able to assist you in explain in simpler terms and the and the learners are the one who were suffering SP</p>
<p>10. Did your teaching of the content improve after the training?</p>	<p>Yes it did, in terms of lesson planning the objective is practical , like pollution you don't have to refer them to the industries, because we also contribute. RD, SP, CC</p>	<p>The teaching improved a lot, because of the training. I was teaching grade 12 and grade 10 and one of the remarkable topic was one of the global warming in grade 10 and how do we contribute to it. The high percentage of pollution in the atmosphere. Looking at life styles related to environment as to why use private cars instead of public transport or common transport. Fact is that as people we love eating meat instead of eating more of vegetable which are not environment because the moment we eat meat we</p>	<p>It did have a positive improvement CA</p>

		affect the environment and there will be demands on livestock and that has a negative impact on the global warming. SPR, SP, CS	
11. What needs to be done in future to improve the training provided by Fundisa for Change.	I think they need to come with a method of teaching large classes, because that is our challenge. AB, SRP Discipline of the learners without losing contact time with them. RD	We felt that the time set and scheduled for the workshops was not enough because we were excited and we were anticipating more information sharing. SP, RD How long did it take? If I am not mistaken, it was a week or two not sure but I think it was a week AB	I think it must be done again and the invitation should be open to more teachers. SRP, RD The venue should be close because teachers, tend to run away, because the department doesn't fund them. SRP We still use the resources that we were given and if they are relevant to topics. SR
12. Name other support you are getting for teaching environmental impact topics at your school and who provides the support.	We do get support, from the parents and SGB, we bought dustbins we also during excursions. SRP, RD	I think one needs to indicate when one is teaching environment topics is to, there is one we have that comes from game reserve and they also plans excursions. SRP	Yes we do get support from the school, although we have to speak to our HOD who is very supporting, if they do not have they source it from other school. We attended another workshop for climate change we were with him were we have there, attended competition as well with the learners. Even thou it is for the learners and the school sometimes is not always aware. SP
13. How the shifts of changes of the curriculum affected the examination of	There is no change as such, like tropical cyclone it is always there it covers 60-70%, and they are still maintain that. Like	I would say that, I think the coverage was sufficient than the previous curriculum we saw some topic which were not part	It is a challenge, we use our speculations. Even if we write tell the learners they are writing a test, they always ask themselves

<p>environmental impact topics</p>	<p>they have impact and environmental cases and climate change. SP</p>	<p>of the curriculum are now were included, according to my observation, CAPS has more coverage on environment topics. SP</p>	<p>how the exam paper will be set and which topics will be emphasised more on. It is also difficult to give the scope (exam guideline) especially when you not setting the exam, so what we do we try to cover the syllabus so that they at least are familiar with all the topics. Because when you give them a scope and it is not part of the exam, they feel like you are misleading them and that they feel you don't know what you are doing. SP With the changes between the new and old curriculum Do you compare examination papers? You know if I compare the two, their question don't differ that much, they actually start with easy questions to actually encourage the learners to go on and write the exam although the exam becomes a bit difficult. SR Is there any change between old and new curriculum There is no longer drawing of structure but they are given the structure now to label. CS</p>
<p>14. Does the depth of content coverage in the curriculum affects</p>	<p>It does affect me, we have learners that are slow, and you</p>	<p>Definitely yes, SP You emphasise more if the previous year has been more</p>	<p>Yes I think it does affect, because it affect negatively, because those that set exams set</p>

<p>the way you prepare your learners for examinations</p>	<p>would not have covered and completed the topic. RD, AB If a topic appeared and another did not appear, do you focus more on those topics? What we normal do is to do revision and teach content; we make sure we teach everything. Topics are always there we contentious them that they should concentrate on all of them because it doesn't man they did not appear on previous question paper, they should not study them. SP</p>	<p>Definitely we do that SP</p>	<p>according to what should have been covered and you find that the teachers have not even reached all those topics. SP</p>
<p>15.How often you use past examination question papers in your teaching activities</p>	<p>We use them thorough out the year. Geography has activities after all completing a specific topic and we compare with all previous question papers. SR, CS We do weekly assessment. SP</p>	<p>Before I used that more, but now we used them often. because we encourage the students to use them, so that they get used to style of how the exams are set. CS</p>	<p>What I realised they do not change the questions because they just change the structure of the question. So I use those question for class activities, activities in textbooks they also have activities. I also design my own questions. SP</p>
<p>16.What is the extent of previous question papers affecting your emphasis of a particular topic in the classroom?</p>	<p>Topics are always there we contentious them that they should concentrate on all of them because it doesn't man they did not appear on previous question paper, they should not study them. RD</p>	<p>So you indicated that the style of previous exam question paper affect your emphasis on certain topics; Yes, RD, SRP</p>	<p>It doesn't not affect us, at all because; it helps us too actually to emphasis not on a particular topic. It assists a lot because the learners will be aware on how to answer question, and it won't be something new. SPR, SP, SR</p>

<p>17. Explain how are you affected by depth coverage of previous question papers in planning your lessons</p>	<p>Our planning has to work hand in hand with assessment from the department, although we work with ATP. It has topics weekly and we after planning teach and assess. The depth of content is informed by assessment. We then cross check with previous question paper. We actually informed by question from the previous exams and ATP. SR, SP, RD</p>	<p>Do you plan your lessons according schedule for the year or base on previous question paper</p> <p>No we plan our lesson according to NPD, and more over the diagnosis report, according to exams and also touches certain topics, so that one's lessons should focus more on such topics. SP</p> <p>Do you then neglect some components in the week schedule for the year because they were not on the diagnosis report</p> <p>Not necessary the first document that one should ok, is the NDP ADP while at the same time taking account what the diagnosis report has indicated and put more emphasis. There's no way one can ignore the diagnosis report SR, SP</p>	<p>It helps us a lot, because we look also at the marks given to each section and it actually assist the learners how to answer questions. AA, SP</p>
<p>18. Do you take your learners of environmental fieldwork or excursions?</p>	<p>Yes we do, take them around the school and we take them to the river because we have a topic gemmology is concerned with features land forms associated with the river and</p>	<p>Definitely, I used to, they used to be part of the program of the department. But after the development and especially our subject needs to be taken out for practicals. SRP, CA</p>	<p>Yes, I do when we deal with that particular topic and also when the department plans trips to botanical garden and Kruger national park. They actually tell us well in time, that on a particular</p>

	we have a lot of them around here. CA, SP		period we will take all learners for an excursion. AA, SP
19. What support materials do your learners have at your school e.g. textbooks	They have textbook and we lack textbook and we request them to buy study guides which we buy as bulk. We encourage them to use the internet as well. SR	Yes we had a number of them, such that the school I was n I was also making use of maps and study guides. The guides were provided by the department and pay for costs. We used textbooks SR The number of students was 1332, however not all of them had test books SR, CS	We have been sponsored by Cell C, tablets which is also a challenge because we have been given only 25 and learners not all get the opportunity to use it all the time in the class. RD CIs also they assist us with the curriculum, by preparing the it for us, they assist by summarising the information and it's easy for us because we just go and teach. SRP
20. How do you support learners without necessary learning support materials such as textbooks?	We make copies for them of all the important aspects, and we make copies for those that could not afford to buy study guides and our parents they are hands on, they would come and tell us if they cannot afford and the school together with SGB they assist in making those copies. SR, RD	We compiled notes and had handouts making use of the school printer SR	I have learner about 10 of them without textbook, because students take them and not bring them back and the policy of keeping reports if the student did not bring the text book back. SR What I do, we go and borrow from other learners who are in other classes, because some activities are individuals. SR
21. Which approach do you prefer, teachers centred or learners centred and mention reasons for your preference.	Both approach work, because our social back ground, is affected. The advantage learners make it easy and their interaction is evident in their work. AB, SP I prefer teacher centred. Because assessment proves	I think learner centred, because it's sort of allowing learners to participate and assist in understanding of the topic and also tries to note the gaps. CS, AB Did you have smaller class or crowded class	I think learner centre approach is better, because if they start talking they point out the problems or challenges and at least we would know where to start in providing solutions and it helps them as well to understand better. We have a misconception

	that learner centred doesn't not always work	It was not a crowded class and the learner centred approach worked. SP	regarding the learners thinking they do not know anything. So we are giving them a room to express themselves. We have larger number of learner in class, like 65. AB
22. Does your school have an environmental organisation for learners? If yes, what role do they play in the school and who are the members	We had an enviro-club, however we had challenges financially. We planted lot of trees. SP What went wrong? Politics, everyone wanted to be in charge. RP	The previous school had environmental organisation and it was called the green committee, which involved both the teachers and learners. It is still functions SP What was their role: Among others was to look into the school premises and also checking competitions that are related environment SRP	We had eco-school; however we had challenges in terms of our facilitator. RD Why did you not continue? We wanted to continue, but there was no support and they were don't encouraged but they learners are willing because they are tired of being in class but teachers are not supporting, because we tried to continue but when I am not available the facilitator was turned by because I was not available. AA
23. What is your understanding of environmental education	I think personal is about teaching learners to take care of their environment. Like air and water pollution. AB	It focuses on the sustainability of the environment for future generation. With the aim of ensuring that the environment is a healthy environment and knowing that the environment we find ourselves in is a healthy one and at the end of the day it contributes to the economy of the country through of tourism. AB, RD	In general to me it means to have knowledge about the nature and school, because at home they tell us if something like this is means that, and science says something else. We also get indigenous knowledge. CV

		I am glad you are touching on economy, we make the mistake of thinking that environment it only concerned with geography	
24. Do you only focus on your stipulated content for environment in the curriculum or you seek other sources?	<p>We don't focus only on what is the curriculum because it doesn't cover everything for grade 12, Like types of pollution. AA</p> <p>Does the exam cover pollution?</p> <p>No, it doesn't pollution is in grade 10 but we highlight such topics. RD</p>	<p>Not exactly, we go beyond to get other resource assist the learners. For example we sometimes take the practical examples to the community to teach about environmental issues. Because if we sometimes we only focus on textbooks and curriculum and neglect the community and the environmental issue we are facing every day. AA, RD, SPR</p>	<p>I focus on the textbook but I also use the knowledge of what is happening in the community. Problem that we encounter that the authors of the textbooks are not the same and the focus changes all the time, so we must first compare the books. SR</p>
25. Do you use the internet to search current issues on environmental education? If yes, what current issues are debated about environment locally and globally.	<p>Yes, I do to get more insight on topics. SR</p> <p>Pollution, Tropical cyclone Thunder and lightning due to rocks, killed two people, so please need to be educated on such. RD</p>	<p>Yes, I use it every day. SR</p> <p>Did you use it to search topics about environment that you taught about,</p> <p>Yes I was using it AA</p> <p>What are current environmental issues that are debated worldwide?</p> <ul style="list-style-type: none"> • Currently the is tropical cyclone AB • Air pollution from industries, this affect the climate and global warning and the end of the day it affects the vegetation AB 	<p>Yes, we do it helps us a lot because I was able to compare content of the textbooks we used. SR</p> <p>Cyclones</p> <p>How does "dineo" destroy environment?</p> <p>trees fall and break AB</p> <p>We as human being, we are nature ourselves would not want to see our house just being broken, however it did not affect us, we actually</p> <p>Apart from floods, what other issues are there.</p>

			Our problem is that our livestock, they do not have where they can graze and if they do find the place to graze, they over graze or rather they finish everything. It will by luck if we find a place where there are greens SP
26. If you were allowed to improve the section on environment in your subject, what kind of content would you like to see.	I would like to get more information on river management, it is misused and land pollution like dumping anywhere. AB	I wouldn't like to see something specific, but the content that is in depth with littering because our learners do not take it serious they just litter and don't know how it affect the environment. So the must put more details in terms of littering and also advantages and disadvantage in term of using the litter to generate income like recycling and also affect us in the community AB	I would like if they cover more information on natural resources like water, soil. Learners need to know and understand that natural resources like water and soil they should know it's not something they can grow and it is limited and they would make use of them responsible. SRP
27. How do you integrate environmental impact topics with other topics in your teaching?	There is a topic in grade 12 mining and there is the topic of effect of mining to people. When you talk about minerals people die because of mining people get disease. SP Mine they pollute, land degradation, more especially open mines, waste dumping. So all those topic can be integrated a source of income and GDP is generated by	Sometime will not distinguish between the environmental study form geography, I see geography as part of the environmental studies, fortunate the subject I majored and I've taught in has always mentioned the element of environment. It says the moment I see some environmental elements I should emphases on them so	It depends on which topic, we are discussing, and also we check which topic relates to the other. But we can't just say this and that relate. SPR

	<p>mines and at the same time mine affect environment. SR</p>	<p>that learners become aware of them. Not only the purpose of passing the grades but also for the purpose of improving the environment and the consequences thereof. SP</p>	
<p>28. Explain the environmental situation in your area.</p>	<p>Yes, we do. Do you teach a topic for another teacher? Yes, I do, in grade 10 however only in the topics in environment. RD</p>	<p>It is not good at all, as I indicated that my concern is that of littering all over in a sense that as you go around you see children are not aware of what they are doing and also that adults they just dump. SP The same applies in this school I have observed, because I am 3 months old , that they are principled, although we do not have money, we tried to get some bins and also use that come late and after bins have been filled, try to dispose it somewhere RD Is some school, they have become very creative after sourcing drums from companies, so I suggest you get from companies even in Nelspruit . Yes I was willing to buy those but we it in store RD</p>	<p>I can say it is average, it not too bad, we have basics, even though we are in the rural areas it cannot be the same as urban areas, we can see all that we talk about in classes. SR</p>

<p>29. Do you practice team teaching in your school? If yes, how to you plan teaching environmental topics with your team</p>	<p>We did not get physical resources, we only got natural resources. SR</p>	<p>Yes definitely, We actually sharing these topics that are related to environment from one teacher to the other and how do they link in our subjects SRP, RD</p>	<p>Yes and no, because when was teaching grade 9 natural science and Life orientation or grade 11, I asked one particular teacher who taught grade 9 to assist me with a task that had physical science, I asked him because I thought maybe the students will understand clear especially with terminology and refused but some teacher are willing to assist, so it depends on who you ask SRP</p>
<p>30. How far do you participate in ensuring that your school is litter free?</p>	<p>Every time and always, everyone is involved. Learners that are late for school we use them to make sure that the school environment is clean. AA, SP, SRP</p>	<p>As indicated that I am in a process of getting drums and you have already made some changes in school. RD</p>	<p>With lack of support, we had fixed our waste stations but for now we use drums, and we take the learners to go around the school if we see the school that it is too dirty. The environment department advised us not burn so we collect and the municipality comes and collects every Monday SRP</p>

TRANSCRIPT 4, 5 AND 6

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
	<p>Age: 46 Subject: Life sciences Experience: Since 2001 (16 years) Teaching life science: Since 2010 (7 years) Highest qualification: HDE higher diploma in education Location: Emalahleni Number of learners in the school: 1200 Number taught: 56+64=123 Home language: siPedi</p>	<p>Age: 45 Subjects: Geography (Grade 12) and social science (grade 8) Experience: 18 years Number of years of teaching: 18 years Highest qualification: Honours in educational and currently doing masters Location: Secunda - Embalehle Number of learners at the school: 1310 Number of learners: 173 Home language: IsiZulu and seSotho</p>	<p>Age: 26 Subjects: Life Sciences, Natural Sciences Experience: 5 years Number of years of teaching: 5 years Highest qualification: Honours degree Location: Emalahleni Number of learners at the school: 1231 Number of learners: 222 Home language: IsiZulu, IsiNdebele</p>
<p>31. How is the coverage of the new CAPS curriculum compared with the previous curriculum?</p>	<p>There is, although it is a bit difficult for us, who have been around, but the fact that it gives the learners opportunities to show case their abilities. It is not teacher focus; tough it wastes our time. It is time consuming most of the time it is difficult to cover the syllabus, because u need to have enough time to give to each</p>	<p>When I look at Grade 12, the coverage is no longer detailed, the old curriculum was more detailed for grade 12, and some of the content was removed from grade 12 to grade 11 which we lacked and it now we have continuity. SP, SR</p>	<p>what is the coverage of the new curriculum compare to the previous one</p> <p>CAPs is the only curriculum that I know, I think it was previous year when they have started with CAPS. The thing is CAPs is the only curriculum I have taught. Because when I got to the field, I think CAPS has started the</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
	<p>learner and that's the only challenge we have and we learn a lot from the learners to improve ourselves as well SP</p>		<p>previous year So it so the curriculum that I know, I believe it started in 2012. SRP, SP</p> <p>it started 2012 and I started 2013</p>
<p>32. What is your view of coverage of environmental impact topics in the CAPS curriculum</p>	<p>It is small, AB How I wish as we grow in this life, it should have been given more time, it's something that is meant to improve our situation we are faced with. Sustainability of our resources our kids need to be taught more, our kids have no idea what is happening there. When they leave the school they should know exactly what they will face when they leave the school. RD, SP Can you give me examples of those things: Global warming, the causes the impact it has on us AB</p>	<p>When I look at grade 10, the curriculum is more detailed, but what I think what is lacking when we do climate change, we do not have detailed information on how do we as people contribute to climate change. SPR Grade 12 that is when that content starts how we contribute to heat island which fall under local stage climate, but I think it should start at grade 10, so that learners can understand how we contribute to climate change AB</p>	<p>So what is your view of the coverage of environmental education topic, you know in life sciences it is strand number 3, so what is your view in the curriculum</p> <p>I think it is one of the most covered content in life sciences, SPR</p> <p>Ok why</p> <p>It takes the whole term to cover that content to cover it, whereas other topics take few weeks, others up to a month but life sciences it takes whole term to cover content. It is widely covered, especially grade 11, we start it on term 3 and finish term 4 SP</p> <p>Ok you said it extensively covered.</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
			<p>ok but grade 12 we only do revision form grade 11 SP</p> <p>Yes from grade 11, yes I think the assessment programme allows 3 weeks of revision and it is done in the first week of reopening and in the first week it very chaotic SP</p> <p>Yes, have to prepare schedules</p> <p>Yes they are chaotic, you the is still registration of learners and we have to give issue stationery, there isn't really time SRP</p> <p>And other questions about that one I will ask you in the following questions, sub question</p>
<p>33. How do you find teaching environmental impact topics in the CAPS curriculum</p>	<p>It is interesting, especially it has informed my knowledge, of the world around us. It also make me interested to protect my environment. RD</p>	<p>Most of the time I do field trips, or I just personify the items in the topic, maybe take the learners outside and dig holes and explain the soil erosion and also show them pictures of the community, let's give an example of pollution caused by Sasol and it we are close to</p>	<p>How do you find the environment elect topics in the CAPS how do you enjoy the activities.</p> <p>I enjoy it, I enjoy it because when you teach them it is something they can relate to nature. SPR</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
		<p>Sasol and it contributes to our pollution and also bad use of water. SP</p> <p><u>We have school environmental policy which contains: SPR</u></p> <ol style="list-style-type: none"> 1. Research and presentation; 2. Environment audit; 3. Greening; 4. The waste management; 5. Resource use; 6. Action projects; 7. Environmental calendar; 8. Wreath Health; 9. Photos of what we do at school, and 10. Environmental information. <p>These are problems we actually found in the School , we have mitigating factors what is that we have to do as the committee and also we have learns who call themselves as nature conservatives, we have 5 learners and I am the 6th one, as their coordinator. We have planned to extend to group to others who would like to come and join the group. SRP</p>	<p>Because they can easily relate to Yes, because it is something the live with every day, taking care of nature, taking of various organisms that we have. and the issue of instiction RD</p> <p>Yes</p> <p>I always make an example with my learners like when they walk and issue of instintion SP</p> <p>When you bored and see insects or small animals you want to kick kill it, imagine if it were you, how you would feel, they are called amazimzim in isiZulu imagine if they were actually alive, they would kill us and how would you feel. CC</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
		<p>Do you get financial support from companies or the school?</p> <p>Yes we have environmental affairs, who assists us with refuse bags. <i>(She is showing the researcher pictures of what has been done by the group “the nature conservatives”)</i></p> <p>The only challenge is not having enough water. If you can see the soil reradiating and erosions <i>(Picture from around the school)</i></p> <p>SR</p>	
<p>34. What are the teaching methods you use when teaching environmental impact topics</p>	<p>We discuss most of the time, we try to bring home situation into the class room, like littering and how they dispose.</p> <p>SRP</p> <p>I lecture, how do I teach, when they leave my class they must know, basic rules, you eat a chocolate in town, play with the paper until you find a bin</p> <p>SP</p>	<p><u>Field trips</u>, SP</p> <p><u>Collaborative method</u>, more like learner centred method, the learners we discuss in terms of what they know and we discuss and include with what they don't know. SP</p> <p><u>Lecturer method</u>: especially when I am behind schedule</p>	<p>What teaching methods are you using in environmental topics</p> <p>I try to make examples as many as possible, I like excursions, I found them very helpful, like take them (Grade 11) to the botanical gardens where they actually interact with animal. Every year I make it a point I do these excursions. SP</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
			<p>So, you use many examples and also excursions</p> <p>Yes, and we very lucky that at school we have smarts boards. SR</p> <p>How do you make use of the smart board?</p> <p>I make them watch videos, especially when it comes to endangered species and pouching and extinction. RD</p>
<p>35. How do you prepare a lesson for environmental impact topic</p>	<p>Do you just prepare or what is the content of your lesson plan: No, we do not have time for that, our lessons end in class. SPR</p> <p>How do you then prepare your lesson in general? Instead of going out we have posters about environment? SR</p> <p>Do they have projects or case studies? Yes we do that, they form part of the lesson. SP</p>	<p>I look at the concept and identify key words and I will check the terminology so I check the activities and tell them what I will be doing, and check learner activities and teacher activities and also I check assessment so I know how I will test them if they understood me CS</p>	<p>Ok, how do you prepare the lesson plans for the excursions</p> <p>The excursion, we are lucky because the botanical, always prepare for worksheets for them. SP</p> <p>Ok,</p> <p>Unfortunate at the zoo they do not have them. I always give them assignments assignment beforehand so they don't just play they have something they</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
			<p>have to cover there's something they have to learn not only play with the animals. SP</p> <p>Let's say, you are not going outside the class, inside the class how do you prepare</p> <p>You know when you give them activities that appeal to their, you know as human beings we have this thing "sinavelo" if I may put it like that, talking about activities on extinction and pouching, our curriculum talk covers a lot about rhino pouching , because it what we know the most. When you give those activities about rhino activities you appeal to their human sense make them feel. You example that the food. RD, SPR</p>
<p>36. How is the response of learners towards environmental impact topics lessons and performance in assessments</p>	<p>We have mixed responses, we have those who value the environment, and we have those who do not have an idea and they tend to be negative, but because of lack of knowledge but they change</p>	<p>In most cases learners they tend to blame someone, they do not want to take responsibility. For an example they blame Sasol for air pollution forgetting that they also use coal when they are at home which also contributes AA</p>	<p>I believe it's very positive, because whenever we go through this topic, at that time and few weeks after that, you see them taking care of the school like to nobody business. SP They taking care of it, they have recycling bins at school.</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
	<p>in a long run after they have learnt. AA, SP, SRP When they leave the class,</p>	<p>They perform well because it's what they know. RD</p>	<p>Sometime they even teach other learners, its very important to recycle, unfortunately it is not the same for everyone at the school SP In terms of the performance Exams, how is the performance, specifically for environmental education. Its, that topic it is not very difficult, it's a bit easier compared to others topics, because somethings are general knowledge, so the performance it is not bad. Some find it difficult, only on the part they need to interpret information on a graph. But because most things it's just the word is running away, it's a comprehension, what's there to like its English. It's a passage they need to read and then answer question. Most question are not difficult. And it's also an advantage because it does not have scientific terms. Compare to other topics, it's a bit easier to understand, even if they need to go through it on their own, I believe they can. Even with the</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
			<p>grade 12, when we have to do revision and we do not have time, I give them a homework test, open book test. Then sometimes it's for them to do on their own, unlike me going to class to teach, like it's their first time. We then do correction after they have done on their own. So it much each SP</p>
<p>37. What are the challenges you are facing when teaching environmental impact topics in your classroom</p>	<p>Lack of resource and time. SR Like going out for excursions because we are teaching in disadvantaged school and financial are a challenge.SR</p>	<p>The learners don't do introspection but they love blaming. SP Is that the only challenge? Yes</p>	<p>Honestly it's the time frame, content is too much and time not enough. It starts in term 3 until term 4 its exam time, so there isn't enough time really. SP Apart from time frame what other challenges do you have? Teaching mate Is the topic well presented in the curriculum? I believe it is, it is very intense. I believe there is everything there is to know about environmental studies. SR Apart the class room, the training in 2013 if you still remember it. You were still fresh from school You scored very high marks. He did not show you the marks</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
			<p>I believe so, we never receive the results we only got certificates, just saying you did this and you are competent. I We never got those portfolios back.</p> <p>Let me verify before I misguide you, however my planning template, I think</p>
<p>38. What needs to be done to ensure that environmental impact topics in the curriculum are well represented if they are not.</p>	<p>The only problem we have is security, even if you can come with idea, of have a lab but there are criminals who are hell-bent on vandalizing SRP</p>	<p>They must have a value question, like what have I done to contribute to climate change, like in the morning when you wake up, what have I done to the environment, like day to day activities. SR</p>	<p>They are okay, it's just difficult to include examples that all learners are familiar with, like if I use verlemun, when I use that they not sure what I am talking about.</p> <p>AA</p> <p>It is just the examples that are difficult to use because of background of students. AB</p>
<p>39. How was the training provided by Fundisa for Change programme assisted you in delivering your lessons on environmental impact topics?</p>	<p>The training was good, we had time to discuss and exchanged ideas and learnt from each other. SP</p>	<p>I was very informative, I used to be like my learner where I was also blaming other and I learnt that they are many things that I do, which I was not aware I am contributing to climate change. You become conscience of what is going on around you don't just litter and I don't miss use the resources. How CAPS is interrelated. Other concept for climate change that I learnt which we normally say these you</p>	<p>Yes, I got the idea, regarding the excursions from this training, became they took us to the Nelspruit botanical garden. They took us there we are adults and we are teachers but we enjoyed it like we were learners. That is where I got my teaching ideas, I started implementing the following year till today. And you can't reach about the environment in the classroom something you just can't teach</p>

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
		will learn in science and we did not know about them. It gave us confidence. SRP	while in class, they need practical experience. SRP, SP
<p>40. Did your teaching of the content improve after the training?</p>	<p>The change is when I prepare my lesson, because at the training, we had time to be outside and it actually made me realise that, there are things we can use from the school and make the lesson interesting and practical within the school yard and not concentrate only on the textbook. RD, SP, CC It helped me, that I was able to take a large group of learners to the ground. I can now manage a group of learners RD</p>	<p>Very much, it improved such that I applied what I felt, because of the confidence we gained from training and hence we started the nature conservative group. I did not even care or know how to take care for it. SPR</p>	<p>Other inputs from the program that you are using? Are you using the study guides you got from the program Yes, some, I remember they gave us a field guide for insects, plants, (Identifying insects and plants) I do used them only for excursions. The school doesn't have any trees for learners to identify the insects and plants. RD Because u started teaching 2013, you went for the program in 2013, you went late same year you started teaching in January. So in your teaching of the content, did it improve or? Let's just say, it broaden my mind, but most of the things we did in that workshops its things I did in my final year of study. CC Where did you study? University of Venda. When we were doing life science methodology, those are the things that were covered in the</p>

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			methodology. We did them maybe that is why I dosed off
<p>41. What needs to be done in future to improve the training provided by Fundisa for Change.</p>	<p>It did, changing my attitude towards prepare the lesson and presenting the lesson RD, SP At least to be organised more often, because we learn a lot of thing within a short period of time, which make to very difficult to implement when you come back. SRP, RD</p>	<p>I think it was informative and more educators need to be invited, because we were expected to transfer the information, but it would not be sufficient because we might forget other things. AA</p>	<p>So there nothing that needs to be done in the curriculum, environmental topics they are well covered? You are happy with them?</p> <ul style="list-style-type: none"> • I think they need to add more teachers we were few. AB • More outdoor activities (<i>We spent a lot of time indoors listening to presentations, we only went out once, life science its practical subject</i>) SP
<p>42. Name other support you are getting for teaching environmental impact topics at your school and who provides the support.</p>	<p>We support each other as teachers, in the cluster level. We meet and discuss SP, RD</p>	<p>We get the support from environmental affairs, SRP, RD Who initiated The department of environmental affairs initiated. We have a facilitator called Busi, RD We also have an NGO who assist us, however I do not remember their name, and they recycle plastics. SRP The department of agriculture also assist us, we have a</p>	<p>Support from school? No not really. SR</p>

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		garden, which they come and train the people that work in the garden. RD	
<p>43. How the shifts of changes of the curriculum affected the examination of environmental impact topics</p>	<p>Let me make an example, we talking about examination, meaning that the examinations contain more of what the curriculum contains? They prove less curriculum, however it differs from year to year. Sometime its more sometimes its less SP</p>	<p>It is covered adequately, as I indicated they have removed some content from grade 12 to 11. Another is that they have scenarios</p>	<p>I was not there, SP</p>
<p>44. Does the depth of content coverage in the curriculum affects the way you prepare your learners for examinations</p>	<p>It does, because you'd find that sometimes it's less because you spent too much time in class and when exam comes it is less than what you covered. And it make one questions the value of teaching the subject RD, AB</p>	<p>Yes it does, because I use the it, if they had set certain topics, you concentrate on in, if they did not concentrate on some topics, then I don't concentrate more on them. SPR We teach as per NPD, however it doesn't because it actually assist us . SP</p>	<p>I think exam preparation for this topic is easier compared to other topics. Because this one when you teach environmental studies in class like learners also can get involved it's not just teacher centred it's a very interesting topics. When it comes to exam preparation is to give them previous question papers, you don't have to go back and revise that much. RD, AB, SP</p>
<p>45. How often you use past examination question papers in your teaching activities</p>	<p>I used them a lot, because we prefer that learners get used to the standard of how exams are set, simple because I sometime set test according to</p>	<p>Most of the time of not always SR</p>	<p>How often do you use previous question papers, in your activities:</p>

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	<p>how you think and believe the learners have understood the lesson, and the examination come and it's totally different. SR</p> <p>Which grade do you teach? Grade 11</p>		<p>I use them for grade 12 from the beginning and for grade 11 I start using them for term tests. SR</p> <p>When are they writing the term test all grades?</p> <p>It becomes complicated, the department just brought time table but we have one we got in the beginning. SPR</p>
<p>46. What is the extent of previous question papers affecting your emphasis of a particular topic in the classroom?</p>	<p>I tend to focus more on what they have covered extensively; however, it frustrates when it's the way around. RD, SR</p>	<p>I check how often they ask some topics and then I emphasis on those in class. SR</p>	<p>Because we need to look at the caps document and exam guidelines, because the textbook has lot of things not everything needs to be done. So when you look at exam guidelines you have to look at the previous question papers and it will save a lot of time in class and that is where I am with the grade 12 because I have been teaching them for 5years. I know have experience with the question papers. I know the topics they set. You must emphasis on this and some you just touch on them and some you don't even do them at all, like in grade 12, there is an it's not environmental studies but when we doing human production like contraceptives and it's not part of</p>

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			<p>the exam, you don't even touch but if you have time you can play around it. Now I've been to the marking centre I have experience. RD, SP</p> <p>So how does that affect your lesson prep, because past question papers are mainly for revision purposes</p> <p>It's not just revision it also guides you, on what to emphasize on in class, for instance there are some chapters can take up to an hour to teach and finish and you just give them questions. And there are chapters because of past exam question papers you need to spend much time on them as possible, especially human production for grade 12, its very interesting for them but when they have to actually put in on paper its actually different. So its easy for a teacher to teach but when they write a test and they fail. RD, SP</p> <p>And it also helps because you look at the topics that the learners struggled with in past exams. Some things are repeated and</p>

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			same problem arises. Look at past 3 years they have a problem with the same topic It's like assays because there isn't really a time, it is not included in the syllabus to teach learners how to write an essay RD
47. Explain how are you affected by depth coverage of previous question papers in planning your lessons	I normally set to teach the whole curriculum, because I am doing what I am expected to, so it does not affect me. SP	You don't teach according to previous the question papers you teach according to the NPD, regardless the type appeared on the previous question paper or not. SPR, CC	Yes we have RR How many per year It's one per year for each grade, we can't afford more that, because some learners struggle to pay. SR
48. Do you take your learners of environmental fieldwork or excursions?	No we don't take them, because of financial constraints, even with fundraising it doesn't make an impact. SRP, CA	I do, however I only take them around the school. SP I take them to the community as well, there are places where there is a lot of pollution and also streams which we use them as examples for rivers and there's are soil erosion. SP	Textbooks are not enough and we have a computer lab but not all students can make use of the lab however it's not well equipped. SR We are fortunate, that mines do donate, and they gave us study guides for all grade Gave us microscopes and human models study guides. SR
49. What support materials do your learners have at your school e.g. textbooks	We use textbooks and we have computer labs and the departments sends us CDs and we go and watch. SR	They use textbook, and we use google search. We have WhatsApp group. (will text some examples) all information is shared to all other groups . SR What was the pass rate in geography: It was 75 %	The school has a library and computer lab that support learners in their studies. SR

QUESTIONS FROM THE RESEARCHER	TRANSCRIPT 4	TRANSCRIPT 5	TRANSCRIPT 6
		<p>School is 83% All textbook but not all</p>	
<p>50. How do you support learners without necessary learning support materials such as textbooks?</p>	<p>They all have textbooks and they all have opportunity to go to the computer lab. If there is something extra that I want to show them that is not in their textbooks we make copies for them SR, RD</p>	<p>By find information for them and share for them, we have cell phone days, where they will bring their cell phones and we share information SR</p>	<p>They share textbooks because one cannot own a textbook, for homework they write notes, for all topics, because they cannot be able do homework or prepare for the following day's work, so I prepare notes for them, because it would not be fair if you give them work and they do not have study material. SR, SP</p>
<p>51. Which approach do you prefer, teachers centred or learners centred and mention reasons for your preference.</p>	<p>I prefer learner centred approach, because it gives me as a teacher and opportunity to know them, their abilities and skills so that I know where to assist them individually without assuming what I am teaching. Though it is difficult due to large number of students in the class, because of the classes I have has 64 learners and another is 59, which I sometimes I have 30 minutes to teach. However, the shy ones suffer because of limited time and large number of learners. AB, SP</p>	<p>Learner centre because they also know staff, because it is easier when you start from what they know. AB</p>	<p>Which approach do you prefer, teacher centred and leaner approach and why? Learner centred, because we tend to bore these learners, there are some topics that need teacher centred but learner centred are very effective, you can give a sermon in class. No teaching only but they need to learn too. Most teacher go to class and they just go and teach. SP</p>

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<p>52. Does your school have an environmental organisation for learners? If yes, what role do they play in the school and who are the members</p>	<p>We have an environment project though it does not involve everybody RP, RD, SRP What is the role of the organisation? We plant vegetables and they are used for the feeding schemes and also teach the learners to do it for themselves at home. Though we did not do it this year due to challenges with water because the taps were stolen, however the department just actually made us a bow hole and other things. And we have requested the department to assist us. SRP</p>	<p>Yes we do, SRP The roles: Clean, once per quarter, last year once per month. SRP Learners and two educators and environmental committee however they send one person SRP</p>	<p>Yes we used to have it, Irene used to be on the program and she used to and visit our school. She had a number of school she used to visit. She helped to start a vegetable garden for learners and also recycling stations. Those are the only two we did. SP Are these still continuing? Yes they are continuing, even the school manage to hire a lady, because we also have a feeding scheme for less fortunate learners, sometimes they do get vegetable from the garden. SP</p>
<p>53. What is your understanding of environmental education</p>	<p>I see that environmental is important for all of us, the population is grown rapidly and most of us do not know that we can actually do things ourselves other than depending on government and other people around us. So if we are taught about environment then we can be self-sustainable. Like organisation we learn from the</p>	<p>Learning about the environment and its impact and associates AB</p>	<p>I understand that all living organisms are inter-dependent and for you to survive you need to take care of the next organism. We depend on each other. Environmental education basically means how taking care not just human being and animals, plants as well, all living organisms. AB</p>

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	<p>old ladies that come to plant here I learnt a lot, and if it can be taught to everyone, the love of planting has dropped however if we learn we can be sustained by such, because we learn from each other and other problem we are too comfortable to go buy and we don't even have the means to buy all the time. If we learn to plant and sell our economy as well can be better. SP, AB</p> <p>There are no longer classes for garden and needle work and it really assisted us, our kids are depending on the government grant. SP</p>		
<p>54. Do you only focus on your stipulated content for environment in the curriculum or you seek other sources?</p>	<p>We focus on what we have</p>	<p>No, for grade 12, we start using from grade 10, because the curriculum do not have climate change for grade 12, they only start from its heat island, so starting from grade 10 it will assist them to understand SR</p>	<p>Unfortunately yes, like I said I do not even have time for what should be done (<i>to complete what's in the curriculum</i>) there's no time for anything else. SP</p>
<p>55. Do you use the internet to search current issues on environmental education? If yes,</p>	<p>Actually we do not use the internet we only we use the CDs we get from the government. We do encourage them to use the internet for</p>	<p>Yes, we were recently talking about the cyclone "dineo" AB</p>	<p>I use it every day, learners they use their phones. Some learners have not learnt how to use the internet because they just take the information as it is. AA</p>

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<p>what current issues are debated about environment locally and globally.</p>	<p>projects however in class we discourage them, but for other subject they get internet. SR We have this policy, in our curriculum that the government will allow the people to use the resources and for a certain period. But I have a concern that what will happen after the period has lapsed, because there are lot of mines around and some you ask yourself if they are legal. SR</p>		<p>what current issues are debated about environment locally and globally</p> <ul style="list-style-type: none"> • Water shortage. AB • Water pollution (we do not drink water at Witbank we buy, due to mines around) AB • Electricity AB
<p>56.If you were allowed to improve the section on environment in your subject, what kind of content would you like to see.</p>	<p>I don't know how to put it, because we are allowed to do what we want to do, like the issue of developments of unsettlement. How can we discourage that in term of how the unsettlement are, because we will end up not having space for plantations? I was shocked to have learners in my class we were talking out ecosystems and they said they do not have grass, or tree and it happens. SP So what they need to be taught they must be considerate of</p>	<p>Start with me, how do I impact the environment The removing of some topic to the other.</p>	<p>Not just the content, but how the content is covered, I think they should allow a lot of debates current issues. Give them topics to go and research and come and debate about it. SP How can that be incorporated I think, in the activities (formal tasks) that are included in textbooks. SP</p>

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	environment when they plan to settle down when they have grown. SRP		
<p>57. How do you integrate environmental impact topics with other topics in your teaching?</p>	<p>There is a link between the topics. I am looking at health issues related to environment. RD</p> <p>The balancing of gas in the atmosphere. Health issue because the imbalance of the gasses are the causes for us to be sick, and it tempers with our health. Diseases caused by microorganisms, those can be linked to environmental studies AB</p>	<p>It is also interesting to teaching about environmental issues because they are linked to other subject, for example for grade 11 in life orientation they have environmental hazard which they learn in geography and some of the content in languages they cover it. SPR</p>	<p>I think with examples, AB, SP</p> <p>Let's say you are teaching a topic that does not have environmental issue, how do you integrate?</p> <p>Let me think. Topic like grade 12 do have environmental science and later in the year they do nerves system, when you look at what drugs and alcohol do to their nerves system and the brain and eventually lead to accidents and when we are teaching environmental studies and we teach about plants and unfortunate some they know more about plants and they use them for their own negative things "nyaope" it was on. AB</p>
<p>58. Explain the environmental situation in your area.</p>	<p>It is bad, Witbank is full of mines. It one of the areas that is known to have the dirtiest atmosphere in the world not only the country which has health hazards for people living here. What I noticed our municipality is not functional</p>	<p>We have air pollution from industrial areas Sasol., we are more affect because the wind blows towards us Embalenhle SP</p> <p>Burning of coal a problem of littering</p>	<p>We have water problem, water shortage and water pollution, our biggest problem. Littering and air pollution we gotten used to it. SR</p>

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	<p>anyone can just dump anything anywhere. As much the municipality is not functional, we ourselves are not educated we just do as we please. If the rubbish has not been collected lets come together and have a central place for dumping AA, RD</p>	<p>Soil degradation , it cracks, it's not fertile Shortage of tree</p>	
<p>59. Do you practice team teaching in your school? If yes, how to you plan teaching environmental topics with your team</p>	<p>Yes we do that a lot, we share topics, like I like life sciences and another will do another topics. We actually prefer one teacher to teach a topic where one is more comfortable and knows more about it. SRP</p>	<p>I have a team teacher from a nearby school and we meet and discuss and also she come to my school and teach some sections and I would go and teach some sections in her school. SP</p>	<p>In life sciences we unfortunately do not, because we are only two teachers and each have their own groups. So she concentrate on her group. Although I did propose team teaching for life sciences and physical sciences hoever you find other teachers they do not know the physical sciences. It should be incorporated in our time table. SP</p>
<p>60. How far do you participate in ensuring that your school is litter free?</p>	<p>I participate a lot, I have a block that I am responsible for. That says that to the learner that if there is no teacher then I am there to assist them. I am with them all the way. It doesn't take a lot of time. I actually go to all glasses and show them how to clean and they take after what I have done, rather</p>	<p>By taking part in the nature conservative program SP</p>	<p>Our school is lucky, that we have grounds men who clean. That has positive and negative impact, because these learners they just litter knowing that there are people to clean but I am very strict in my class, because I have a centre they come for life and physical sciences, they come to my centre I do not go to them but</p>

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	<p>than having them to do it on their own. SRP, AA, SP Apart from what you have done in the block you are responsible for, how are other classes? The classes are dirty, because we ourselves no longer have that love of cleaning. You know when we were growing up, they had included a period for cleaning every day and Friday we clean as far as mopping the classes. The curriculum gives us 7 hours of teaching and after we are done teaching we pack our bags and get into our cars we are gone, we tell ourselves that we are not paid overtime, and we have lost values. I had a meeting with my block teachers. AA</p>		<p>they come to me. Classes are not that clean but our school is clean only because we have grounds men. But there is a recycling station and bins on every floor and every class has a big box, some learn to keep the school clean but so just don't care. SRP, RD</p>