Exploring the selfhood of primary school teachers in the teaching and learning of Environmental Education: A mixed methods approach

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DECLARATION

The author hereby declares the content of this research project is the author's own unaided original work, except where specific indication is given to the contrary (by reference). This work has not been previously submitted to the Durban University of Technology (DUT) or any other university.

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BTech: Environmental Health

Date: 27 January 2020

PRESENTATIONS

A comparative assessment of a climate change pedagogic intervention amongst Grade 5 learners in KwaDukuza, South Africa.

Oral presentation at the 3rd International Federation of Environmental Health (IFEH) World Academic and 16th Makerere University Environmental Health Student's Association (MUEHSA) Scientific Conference, Kampala, Uganda, 11th April 2019:

ABSTRACT

Effective learning in environmental education, which is introduced at primary school level in South Africa, has the potential to encourage behavioural modification essential to mitigate current environmental issues. While methods of delivery and teaching resources are important, the educator is considered the greatest determinant of knowledge delivery and retention. Consequently, this study explored the selfhood of teachers of Life Skills influence curriculum delivery and learning in environmental education. A mixed methods intervention approach was employed with participants of one school receiving a teaching intervention and the other school designated as the control. Participants included five Grade 5 public primary school Life Skills educators and Grade 5 learners from the KwaDukuza area. All learners completed an assessment book post intervention which was designed to evaluate environmental knowledge retention. Qualitative findings from pre and post interviews with educators was evaluated by thematic analysis. Parker Palmer's Theory of Selfhood to analyse the data using key conceptual tools such as 'we teach who we are' and 'identity and integrity' (Palmer 1997). Shulman's Theory forms the framework to help understand the knowledge base of the educator which frames teacher education and teaching practice (Shulman 1987).

This study offered a nuanced perspective of Environmental Education at primary school level within KZN. The main themes emanating from the qualitative aspect of the study were teaching experiences, years of teaching, contextual challenges which influenced teaching methods and reasons for adopting these methods for environmental education. Despite the similar challenges across both schools, certain educators were able to introduce innovation into their teaching. Those educators displayed a greater passion and intrinsic belief in the subject which manifested in their pedagogic efforts. The quantitative findings of this study indicated that there was no statistical significance when knowledge and understanding was compared between the intervention and control school ($p>0.05$). It can be concluded that regardless of the method of teaching employed, knowledge and understanding of learners remained similar therefore the greatest determinant of successful environmental education is the teacher. The selfhood and experiences of the teacher played a significant role in ensuring effective environmental education delivery.

DEDICATION

I dedicate this thesis to:

My son (Skyler Peter)

My parents (Mr and Mrs Ruthanam)

My family and friends

Thank you for the endless love and support during the most difficult phase of my life.

“And we know that all things work together for good to those who love God, to those who are the called according to His purpose.”

(Romans 8:28)

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- My greatest appreciation is to my God, my Lord, my Helper, my Guide, my everything Jesus Christ. If not for Him, I would not have completed this. Through all the trials and storms, He has proven his faithfulness, love and strength. I am nothing without Christ.

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LIST OF ABBREVIATIONS

EPA	Environmental Protection Agency
EE	Environmental Education
PCK	Pedagogic Content Knowledge
CAPS	Curriculum Assessment Policy Statements
SDG	Sustainability Development Goals
CCE	Climate Change Education
MDG	Millennium Development Goals
IPCC	Intergovernmental Panel on Climate Change
WHO	World Health Organisation
SA	South Africa
IREC	Institutional Research Ethics Committee
DOE	Department of Education

LIST OF DEFINITIONS

Environmental Education

Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.

Pedagogy

Pedagogy, study of teaching methods, including the aims of education and the ways in which such goals may be achieved. The field relies heavily on educational psychology, which encompasses scientific theories of learning, and to some extent on the philosophy of education, which considers the aims and value of education from a philosophical perspective.

Teaching Method

The term teaching method refers to the general principles, pedagogy and management strategies used for classroom instruction.

Climate Change

Climate change is the long-term alteration of temperature and normal weather patterns in a place. This could refer to a particular location or the planet as a whole. Climate change is currently occurring throughout the world as a result of global warming.

Global Warming

Global warming is an increase in the planet’s overall temperature due to the burning of fossil fuels, such as natural gas, oil, and coal. Burning these materials releases certain gases into Earth’s atmosphere. These gases trap the heat from the Sun’s rays inside the atmosphere, causing Earth’s average temperature to rise.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Environmental Education is introduced to children at primary school level in South Africa but it is uncertain if effective learning is occurring in the classroom. It is envisaged that effective learning at an early stage in life will encourage behavioural and attitude modification which is essential to mitigate current environmental issues. This study explores the phenomenon of teaching and learning in Life Skills related to environmental education.

While methods of delivery and teaching resources are important factors, the educator is considered as a crucial resource and the greatest determinant of knowledge delivery and retention. Therefore, this study explored the selfhood of the educator and his/her role in environmental education in Grade 5. Palmer's theory was used to analyse the data using key conceptual tools such as 'we teach who we are' and 'identity and integrity' (Palmer 1997). The aim of the study was to determine how the selfhood of teachers of Life Skills influence curriculum delivery and learning in environmental education.

1.2 Rationale of the study

Environmental education in the early stages of childhood is an attempt at raising an environmentally literate society for a better tomorrow. In the school curriculum, Grade 5 learners are introduced to environmental concepts in the subject of Life Skills through the Curriculum Assessment Policy Statement (CAPS) curriculum. At this stage a conscious effort must be made to ensure that sound environmental literacy takes place. Learning is significantly dependent on the educator who is the primary education resource. . This study sets out to investigate the role of the educator in environmental education and associated factors related to learning in the classroom. The method of teaching used for environmental content is as important as the content taught. Therefore, findings of this study can be used to inform decision making in the education sector and for the professional development of educators.

The study also aligns itself with the United Nations Sustainability Development Goals (SDGs) thirteen (13) and four (4). SDG thirteen (13) is focuses on climate change mitigation and adaptation: "*Take urgent action to combat climate change and its impacts"* (United Nations Economic and Social Affairs 2017). SDG goal four (4) is aimed at education to *"ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*" (United Nations Economic and Social Affairs 2017). South Africa is at the forefront in Africa regarding implementation of the SDGs. The South African SDG Hub reports on national implementation was released in August 2018. The report includes the opportunities and challenges related to SDG implementation in the country, however, it focused on selected SDGs. It describes South Africa's national planning, monitoring and evaluation system for the SDGs as "*coherent and allows for alignment between planning, budgeting, monitoring and evaluation"* (Wahlen 2018).

According to a report on the progress of implementation of the SDGs, South Africa has the ability to increase the pace of implementation with the first voluntary national review taking place next year. . The areas requiring prioritization for the country are: the finalisation of a national SDG coordination instrument, capitalising on existing momentum relating to public, private and civil societies, and adequately utilising university expertise (Fourie 2018). A transformation in education is required to meet these SDGs. This entails a review of curricula and the integration of environmental concepts within the academic schooling plan. Educators, who will be key in executing these new plans, must be adequately prepared for the change.

1.3 Research Questions

The following research questions were asked in order to address the problem statement:

1. How does the selfhood of teachers of Life Skills influence teaching in environmental education?
2. How does the selfhood of teachers of Life Skills influence learning in environmental education?

1.4 Purpose and Problem Statement

The purpose of this study was to investigate the selfhood of Grade 5 educators in the subject of Life Skills and to ascertain the effectiveness of learning in the classroom. The research also offered an understanding of the effectiveness of the teaching method through evaluation of knowledge and understanding of environmental concepts in participating learners. The research problem of the study is therefore: "How does the selfhood of teachers of Life Skills influence curriculum delivery and learning in environmental education?"

1.5 Objectives

To understand the selfhood of teachers teaching Life Skills

To understand the role of selfhood of teachers in teaching environmental education in Life Skills

To determine the learning taking place related to environmental education in the Life Skills class

1.6 Methodological choices

To respond to the research questions, the most appropriate choice was the use of a mixed method approach. This approach can be described as a synthesis that includes ideas from qualitative and quantitative research. John Creswell (2008:432) describes mixed methods research as a research design (or methodology) whereby the researcher uses both quantitative and qualitative data through collection and analysis in a multiphase program or single study. The mixed methods research paradigm is an approach which facilitates the generation of important research questions and answers (Johnson 2007). This approach was most appropriate for the study as the aim of the research involved one of the five broad purposes or rationales of mixed methodological studies i.e. complementarity. Complementarity is explained as seeking elaboration, enhancement, illustration or clarification of results from one method with that of another method (Johnson 2007). The qualitative aspect

of the study sought to determine the experiences and pedagogical choices of the participating educators while the quantitative aspect sought to measure the effectiveness of the respective teaching method.

Background of the study

The aim of this research was to determine how the selfhood of teachers of Life Skills influence curriculum delivery and learning in environmental education. The study involved a two-pronged investigation of environmental education involving educators and learners separately; the participation of five Grade 5 public school Life Skills educators and their Grade 5 learners in the KwaDukuza area in the province of KwaZulu-Natal, South Africa. A mixed methods intervention approach was employed with participants of one school receiving a teaching intervention and the other school forming the control. The study involved collection of both qualitative and quantitative data. The research questions of the study informed the reporting of the pedagogic content knowledge of the participating educators in the subject of Life Skills from generated data. The use of mixed methods data collection allowed for a holistic understanding of the classroom environment related to environmental education.

Data sourced from the participating learners, through administration of activity books, provided the basis of establishing the effectiveness of the lesson delivery methods used by educators. This was done after the introductory environmental education lessons. Learners are introduced to environmental education for the first time in the subject of Life Skills in Grade 5 during lessons on water. Data was sourced from two stakeholders, the learners (quantitative data) and the educators (qualitative interviews).

Environmental Education

The United States Environmental Protection Agency (EPA) describes environmental education as a process which allows individuals to explore environmental issues. The aim is to enable individuals to make informed and responsible decisions through their understanding of environmental issues. The components of environmental education are awareness and sensitivity, attitudes, skills, participation and knowledge and understanding (EPA, 2018).

South Africans have recently experienced the effects of climate change with the frequent heat waves and irregular rainfall patterns (Department of Environmental Affairs 2018). Other African countries, such as Mozambique, have experienced the devastating effects of climate change on a greater scale. The United Nations estimates that 4.2 billion people have experienced weather-related disasters in the last two decades. The events of Mozambique, Bangladesh and the Philippines highlight the fact that climate change is a problem of the present, not just the future (John 2019). Therefore, environmental education is crucial for South Africans.

Climate change education is one of the facets of environmental education and will form part of the investigation of the study. Issues on climate change have become a topic of global discussion, making it undeniably relevant and important to education. . The ideal period for environmental education, according to Ajiboye and Olatundun (2010), is the childhood/primary school stage where misunderstanding occurs. Corrective action in the form of accurate teaching of environmental concepts can be employed and will assist in children 'unlearning' inaccurate content. Early attitudes and knowledge play a pivotal role in moulding thinking later, in adolescent and adult stages (Manoli, Johnson and Dunlap 2007). Bozdoğan (2011) describes environmental education as an investment in our children and an investment for the world. Unless the next generation realises the problem and the extent to which we are affected, policy and mitigation strategies are useless (Kahn 2002). A change in a child's thinking is needed for a lasting change to be effective. If we are able to positively change the perceptions and thinking of children related to environmental concepts, we will be able to empower children's decision-making capabilities regarding environmental choices. This deep-rooted change will inform behavioural change rather than achieving temporary change in behaviour through superficial learning.

Education is the link between this realisation and the desired change in thinking and behaviour in children. Budprom, Suksringam and Singsriwo (2010) describes education as a learning process related to scientific skills of problem solving, critical thinking and participation of learners. Jinliang et al. (2010) argue that environmental problems can only be resolved through promotion and education of the public, causing a greater sense of personal responsibility toward the environment and forging an equilibrium between nature and human behaviour. Family members and

educators were identified as the most common influencers of children in formulating pro-environmental behaviour (Chawla, 2009). Educators play a crucial role in the influence they have on children in the classroom. Educators' pedagogical choices stemming from their selfhood is an important factor to consider when evaluating the effective delivery of environmental education. The educator is a vital element in the conveyance of environmental concepts, therefore, the selfhood of an educator must be understood. The focus of this research was on the education delivery link between the educator and the learner related to environmental education. The study involved both educators and learners to provide an understanding of the environmental education taking place in the classroom environment.

Pedagogical Methods

The methods by which a school subject is taught is as important as the content itself (Hasni and Potvin 2015), therefore, the pedagogical reasoning of a educator would be exercised in selecting the most effective and appropriate delivery method. This decision is based on the subject matter to be taught. Educators, particularly South African educators, can be trained to identify and select potential lesson delivery methods to incorporate environmental aspects (Vogel, Schwaibold and Misser 2015). There has been a growing interest in research on the teachers particularly their knowledge and understanding of climate change. Teachers in Nigeria were found to have inadequate knowledge of the required strategies required for management of climate change instruction in the classroom (Nwankwo and Unachukwu 2012b). A study amongst 32 Geography teachers in Gauteng Province, South Africa revealed gaps in the understanding of teachers regarding climate processes and limited understanding on climate change (Vujovic 2014). Similar results were found amongst 194 high school Geography teachers in Western Cape, South Africa. There were gaps on teachers' knowledge of climate change and literacy (Anyanwu, Le Grange and Beets 2015).

It has been found that non-conventional teaching methods, are most effective in achieving environmental literacy (Harker-Schuch and Bugge-Henriksen 2013). The idea is that content that is based on life choices and living environmentally cannot be learned using a textbook or chalk and talk method. Issues that pertain to lifestyle and behavioural changes require a more practical approach that stimulates critical

thinking for pro-environmental decision making when required. It is on this premise that the research study is based.

The Environmental Protection Agency (EPA) defines Environmental Education as the process of the exploration of environmental issues through action. This engagement leads to an individual's deeper understanding of environmental issues informing responsible decision making. The key concepts of EE are awareness and sensitivity, knowledge and understanding, attitudes, skills and participation. The purpose of EE is to equip individuals with education to make informed decisions through critical thinking, problem solving and decision-making skills (United States Environmental Protection Agency 2017).

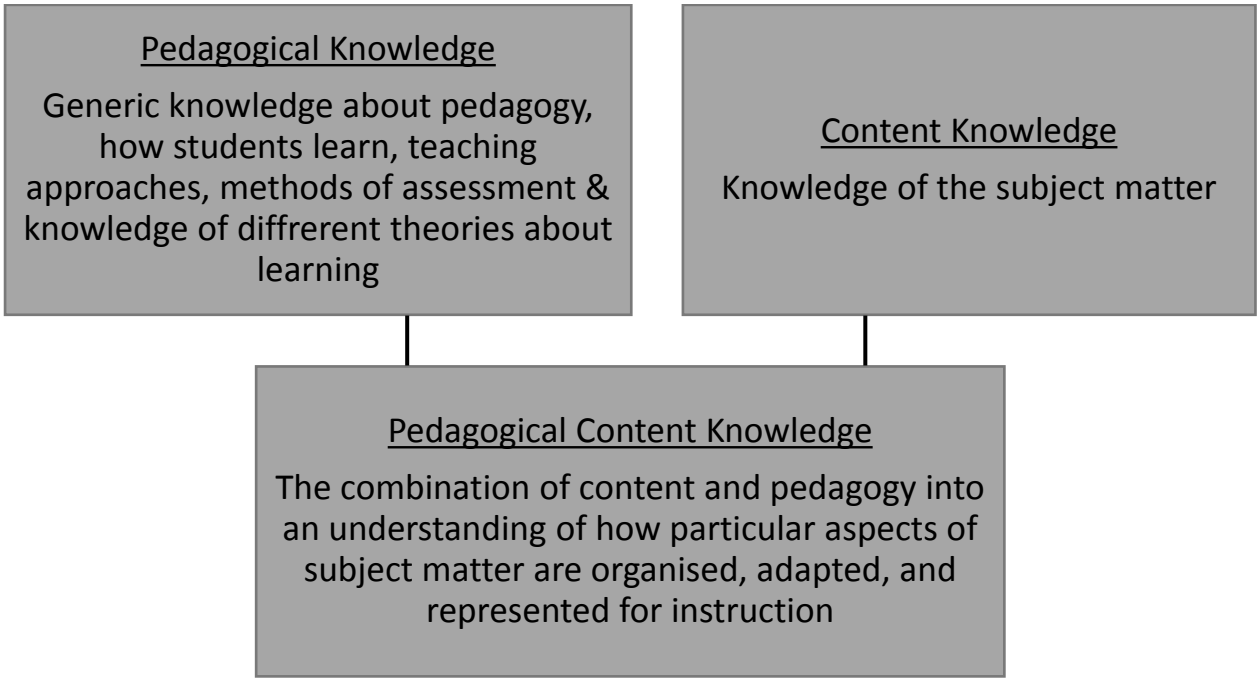


Figure 1.6.1: Shulman's description of PK, CK and PCK

Pedagogic Content Knowledge (PCK) comprises subject matter knowledge, knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of the pedagogy. According to Shulman (1987), it is the knowledge base of the educator that frames the educator's education and teaching practice. Shulman used the following categories to partition the different aspects of educator knowledge: content knowledge, general pedagogical knowledge (classroom

management and organisation), curriculum knowledge (materials and programs), pedagogical content knowledge (content and pedagogy unique to the educator), knowledge of learners and their characteristics, knowledge of educational contexts, knowledge of educational ends, purposes, values, philosophical and historical grounds.

Feiman-Nemser and Buchmann (1987) explain that pedagogical thinking is "*strategic, imaginative, and grounded in knowledge of self, children, and subject matter*". PCK is an understanding of what it means to teach a subject and the methods and principles used. These two categories informed the theoretical lens adopted for the study. Parker Palmer and Shulman's Theories will be used to focus the study on the practicing of PCK of the educator related to the field of environmental education.

Parker Palmer's Theory was also used to frame the understanding of the selfhood of the educator in answering the research questions. This theory states that "we teach who we are" (Palmer 2007). It is based on the notion that teaching emerges from one's inwardness and selfhood is identity and integrity (Palmer 1997). Palmer explains that teaching consists of three important sources: the subject, the learner and the inwardness of the educator. The educator projects the condition of his or her soul and can be a source of self-knowledge if the educator chooses to face this mirrored image of the educator. He describes knowing one's self as an educator as crucial to good teaching. Parker explains that good teaching cannot be reduced to technique; good teaching comes from the identity and integrity of the educator. It is this belief that grounds the exploration of who are the educators that teach Grade 5 Life Skills. It is interesting to understand the role of individuality and self in the Life Skills class specifically related to environmental education.

Shulman's Theory forms the framework for research question two of the study. This theory establishes that the knowledge base of the educator frames teacher education and teaching practice (Shulman 1987). Shulman based his investigation on the question of what educators knew or did not know about why they taught in a specific manner. Teaching requires basic skills, content knowledge and general pedagogical skills. The educator has the ability to use understanding, skills, attitudes or values through pedagogical representations or actions to relay information in a

manner that causes understanding and comprehension in those that did not previously know. The foundation of teaching is therefore the educator's understanding on content and how it is to be taught. Fenstermacher (1986) adds that educators should be able to use their knowledge base to inform choices and actions. Such a process of sound reasoning requires educators to inform their thinking about what they do in conjunction with their base of facts, principles and experiences. It can be concluded that the key to distinguishing the knowledge base of teaching is at the intersection of content and pedagogy. The educator has the ability to deliver content knowledge in a form that is "pedagogically powerful" and in a way that is unique for the background and type of student (Shulman 1987). These two frameworks were used to interpret the findings on the importance of the educator's role in environmental education.

The amalgamation of these two theories, Parker Palmer's Theory of selfhood and Shuman's Theory of PCK, form the framework for the interpretation of the findings of the study. This framework assists in understanding the educator from the selfhood perspective and the arena within which the personal and professional aspects of the educator overlap in PCK. This is an understudied area of teaching which will enhance this aspect of teaching environmental education.

1.7 Study setting

The study was conducted at two public primary schools in the North Coast of KwaZulu-Natal, South Africa, located in the Stanger area, KwaDukuza within the Ilembe District. KwaDukuza Local Municipality has a total population of 231 187, with 51 536 within the Stanger area (Statistics South Africa 2011). There are 59 public schools in Stanger (South Africa. Department of Basic Education 2015).

The involvement of two schools allowed for comparison of data. Primary schools were chosen based on the underlying belief that younger learners are more receptive to change and to adopt pro-environmental behaviour and attitudes. The schools are situated in residential areas, predominantly comprising African and Indian residents in the low to middle socioeconomic category with a mix of urban and rural dwelling households. Both schools have minimal resources and fees are paid by parents. The researcher was motivated to pursue this study because of her

interest in the teaching methods employed by educators in delivering environmental education.

1.8 Overview of the Study

This study comprises six chapters:

Chapter One maps out the terrain of the study and provides an overview.

Chapter Two provides a review of literature regarding environmental education which includes theoretical frameworks, and the role of learners, educators and education in climate change in the South African context. An overview of founding and current research is provided to allow for a holistic understanding and context for the research.

Chapter Three focuses on the methodology that was used in providing a comparative assessment of an environmental education pedagogic intervention amongst Grade 5 learners and determining the experiences and pedagogical choices of their educators. A detailed description of the research design, methodological approach, data analysis and background of the study is presented.

Chapter Four presents the results and discussion of the quantitative aspect of the study. Statistically analysed data from critical questions are presented and discussed including the experiences of learners regarding the intervention.

Chapter Five presents and discusses the qualitative findings of the research. Information from educators' interviews are discussed as cases with further subdivided themes.

Chapter Six presents the discussion and conclusion of the study which includes a theoretical interpretation of the research findings, a consolidated discussion of both the qualitative and quantitative results and recommendations for the South African education system.

CHAPTER 2

LITERATURE REVIEW

2.1 Environmental Education at Primary level

The key to developing children who are agents of change commences at school and the goal of education is not only to prepare learners for their future but also to enable them to create a future that is conducive for them to live in (Davis and Cooke 2007). Dewey (1938) envisioned the school as a miniature democratic society with experiential learning as an essential component of civics education. Schools are expected to raise awareness of environmental issues and develop the advocacy of children (Taber and Taylor 2009). Schools have been tasked with empowerment of children as citizens, however, they have not fulfilled this objective (Aikenhead 2006; Sadler 2009; Byrne et al. 2014). A limited number of studies have been conducted on South African educators. Therefore, substantial South African literature sources were not available for comparison. This highlights the gap which exists in the literature, requiring more South African studies on the subject of Environmental Education, climate change and pedagogy.

Knowledge of climate change improved by 11% in a study in Austria and Denmark, suggesting that climate change knowledge can be improved within a formal education environment (Harker-Schuch and Bugge-Henriksen 2013). If education is to be effective, students must understand the underlying principles of climate as a system and how changes to the system result in climatic and environmental effects (Shepardson et al. 2012). Lambert, Lindgren and Bleicher (2012) explain that primary school learners require development of a basic understanding of fundamental concepts related to weather and climate change (Karpudewan, Roth and Abdullah 2015). Cutter-Mackenzie and Rousell (2018) advocate a revision of curriculum beyond climate change content. The approach should consider creative and visionary alternatives. There must be a shift from a scientific mode of education to a more research and thought-driven method.

Science curricula must be revised to include topics that can be applied to real contexts to enable learners to share and design ideas for individual circumstances beyond the classroom (Byrne et al. 2014). School curriculum design has attributed to

the misconception that science education is irrelevant to everyday issues and is treated as an isolated theoretical subject (Byrne et al. 2014). The Australian Curriculum, Assessment and Reporting Authority (2013) emphasized the need for physics and chemistry of the climate system to be incorporated into the curriculum which will enable critical evaluation of information (Boon 2014). Richard and Bader (2010) state that school science curricula have declined, possibly due to deterioration of public scientific culture or disinterest in school science (Osborne, Simon and Collins 2003; Turner 2008). There is a dire need for the next generation of learners to express interest in science research. Good performance in science has been identified as positively influencing environmental attitudes (Boeve-de Pauw and Van Petegem 2010).

Learners have been identified as lacking the scientific understanding of the concept of climate change. This is evident amongst high school learners in Europe, regardless of the vast awareness of the issue over the past 25 years in the country (Harker-Schuch and Bugge-Henriksen 2013). Learners have limited knowledge of the types of solar radiation, and of the crucial understanding that the greenhouse effect is a natural process required for the survival of life on Earth and enhanced by human activity. Deforestation and burning of fossil fuels are concepts which require attention in environmental education as students struggle with understanding the linked effect on the carbon cycle (Shepardson et al. 2012).

There is an increasing disjoint between school scientific and technical content and the employment sector. Researchers in various countries have attributed this to a disinterest of students in science and technology (Ourisson 2002; Porchet 2002; Hannover and Kessels 2004; Convert 2005; Cotgreave and Davies 2005; Haas 2005; Foster 2010; Dobson and Burke 2013). Hasni and Potvin (2015) hypothesise that the diminishing interest of students in science have possible associations with age, curriculum content and the method of teaching used. As schooling progresses, more emphasis is placed on memorisation and testing without the applicability of content to everyday life situations (Graeber and Lindner 2008; Walczak and Walczak 2009; Hasni and Potvin 2015). Roth (2014) believes that science, environmental and health issues play an enhanced informative role when integrated into everyday real-world experience rather than in categorised school subjects.

2.2 Environmental Education

Climate change education is only one aspect of the broad scope of environmental education. In 1992, the Earth Summit in Rio provided principles for environmental education which include: *"Environmental education whether formal, non-formal or informal, should be grounded in critical and innovative thinking in any place or time, promoting the transformation and construction of society"* and the second principle being *"Environmental education is not neutral but is value-based. It is an act for social transformation"* (Livernash 1992). In later years, revised definitions of environmental education were formulated. The International Alliance of Leading Education Institutes (IALEI) (2009), developed two possible definitions of Climate Change Education (CCE). One regards CCE as a natural science topic, and the other refers to CCE as a fundamental aspect of sustainable development. It is a sensitive balance between man's need to improve the standard of living and sense of security while conserving natural resources and eco-systems (Global Development Research Centre 2009). The Sustainable Development Goals (SDGs) sufficiently address CCE. SDG thirteen (13) and SDG four (4) focus on climate change.

These goals cover climate change mitigation and adaptation and education strategies. It has been said that education is crucial in achieving many of the SDGs (Moretti 2016). The target of Goal thirteen (13) is to

> *"strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries, integrate climate change measures into national policies, strategies and planning and to improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning"* (United Nations Economic and Social Affairs 2017).

A feeling of apprehension arises from the fact that climate change threatens the progress toward achievement of the SDGs. It can be suggested that an investment in education regarding climate change is pertinent in attaining the SDGs (Makrakis, Gkotzos and Larios 2012). The Millennium Development Goals (MDGs) (2000-2015) linked social factors to climate change while SDGs (2015-2030) directly focus on the issue of climate change through Goal thirteen (13) (Zottarelli 2016). South Africa has

made progress in translating SDGs into national, sub-national and local contexts in implementing programmes to achieve these targets.

2.2.1 Conferences and developments to EE

The United Nations Education, Scientific and Cultural Organisation (UNESCO) (2015) defines Education for Sustainable Development as addressing key issues such as sustainable consumption, biodiversity and climate change amongst others (Singh 2010). The aim is to encourage an environmentally knowledgeable, aware and literate society in a holistic manner. UNESCO has affirmed that participatory teaching and learning is an effective means of achieving the desired outcome. Arising from UNESCO, the 'Tbilisi Declaration' was developed to advance education programmes in the realm of environmental degradation (Thomas 2009). The National Oceanic and Atmospheric Administration (NOAA) (2007) states that

> *'climate is an ideal interdisciplinary, integrating theme for education. Content is introduced with simple concepts and observations of weather and water thereafter building increasingly complex inquiries and investigation into the physical, chemical, biological, geographical, social, historical and even technological dimensions of interconnectedness of this important topic. The acquired knowledge is aimed to inform decisions in the lives of individuals and in the community'*

Environmental education aims to equip people with informed decision-making regarding their environmental behaviour (Boyes and Stanisstreet 2012). Lester et al. (2006) state that a scientifically educated population are better informed for decision making regarding purchases, consumption, disposal and investment. Lynch (2011) describes sustainable development as encompassing the needs of the current generation while ensuring that the needs of future generations are not compromised. Education can be described as a learning process related to scientific skills of problem solving, critical thinking and participation of learners causing knowledge generation and circumstantial application (Budprom, Suksringam and Singsriwo 2010). Knowledge alone is inadequate to transform moral norms and attitudes but it is also essential for change (Robelia and Murphy 2012). Jinliang et al. (2010) argue that environmental problems can only be resolved through promotion and education

of the public, raising a greater sense of personal responsibility toward the environment and forging an equilibrium between nature and human behaviour.

Environmental education has been prioritised among political, economic and technological resolutions of present environmental challenges, describing it as an investment in our children and an investment for the world (Bozdoğan 2011). Environmental education is seen as a limited tool due to the subject being viewed as "*highly politicised*" and its legitimacy as *"questionable and scientific debate manufactured"* (Moser 2010). Spence et al. (2011) explain that a contributing issue to effective communication on climate change is both the complexity of the subject and the increased scepticism of the reality of the phenomenon. Individuals often lack understanding and belief in climate change as it is not visualised or experienced daily. Environmental education provides a natural context for science study through the involvement of personal and social references. Responsibility for decision and policy making regarding the planet stems from a sense of accountability which can only be achieved through adequate comprehension of the environment (Shepardson et al. 2009).

2.2.2 Educating on environmental education

An understanding of climate change requires a knowledge of natural and social systems to enable critical and holistic thinking (Mirchi et al. 2012; Sterman et al. 2012). Information dissemination on the science of climate change is essential in persuading public to mitigate climate change through action (Boon 2014). Societal education should involve a holistic approach, highlighting the role of mundane activities in the context of the whole ecosystem and the consequent implications (Karpudewan, Roth and Abdullah 2015). It is said that individuals need to be educated on their personal contributions to global warming as an increase in knowledge related to environmental issues may evoke a sense of concern leading to subsequent changes in practice (Karpudewan, Roth and Abdullah 2015).

According to Tjernström and Tietenberg (2008), individuals who are ignorant about climate change lack environmental concern (Harker-Schuch and Bugge-Henriksen 2013). However, a confounding factor is the significant influence of non-scientific, subjective sources providing information on climate change. The internet, media and interpersonal communication are common channels of information dissemination

(Harker-Schuch and Bugge-Henriksen 2013). Environmental education may be influenced by external sources of information such as television, movies and other informal learning experiences influencing the understanding of learners along with variability of social, cultural and educational backgrounds (Shepardson et al. 2012). A challenge to climate change education are the pre-existing values and worldviews held by individuals which prevent acceptance of new information if personal beliefs are challenged (Kahan et. al. 2012; Rutherford and Weber 2012; Lombardi and Sinatra 2013). Davis and Cooke (2007) reiterate the fact that the window of opportunity to effect significant climate change action to avoid disastrous consequences is narrow. The primary focus should be education and effective learning strategies in developing resilient activist citizens.

2.3 Climate change

The world is realising that change is urgent to avoid or delay eminent disaster (Uttara, Bhuvandas and Aggarwal 2012). South Africans have seen such occurrences in the extreme heat and erratic rainfall experienced (Abiodun *et al.* 2017). The heat or drought causing lack of usable water is fatal for plants, animals and humans. Approximately 250 million people in Africa could be affected by water stress by 2020 (IPCC 2007a). South Africa has been highlighted as a vulnerable African country due to more than 70% of the country's labour force's livelihood dependent on natural resources (Elum, Modise and Marr 2017). The agricultural sector contributes around 2.6 per cent to South Africa's GDP (DAFF 2013). Over the past 8 years, South Africa has experienced several climate-related events such as the 2010-2011 floods in Orange River, the earthquake in Barberton and Nelspruit in 2013 and earthquake in Orkney in 2014 (Elum, Modise and Marr 2017).

Africa has been classified as a continent vulnerable to climate change effects. Its rapid globalisation and inability to institute measures to eliminate climate change effects, predispose our developing country to a state of susceptibility (Nigatu, Asamoah and Kloos 2014). The escalation of drought and flood occurrence in Africa are evident effects of climate change. The present water state of Africa is at dire levels with water-related diseases surging in some parts (Byrne et al. 2014; Nigatu, Asamoah and Kloos 2014).

Leiserowitz et al. (2013) noted that, although approximately 63% of American adults acknowledge the existence of climate change, only 14% categorise themselves as “very worried”. Americans were found to be the most disbelieving of climate change (Carlsson et al. 2010; Infographic 2011). Stern et al. (2006) conducted a critical review of the impacts of action or lack thereof in relation to climate change. It was concluded that the benefits of early action outweigh the costs. A more sustainable world can be attained through learning; however, it needs to transform rather than repeat current trends of unhealthy lifestyles and environments (Davis and Cooke 2007). A possibility is to enable our future generation to make necessary changes for containment. It might be too late to reverse the damage caused but strategies can still be employed to minimise the effects of climate change in the future. It is often said that children are the future, and therefore they would be the most logical agents to execute such change. Children might be our only possible solution for future adaptation and mitigation.

2.4 Environmental Education in institutions of learning

High school and primary school learners in America and Canada have associated global warming and climate change with air pollution occurrences such as acid rain, dust, harmful and unnatural gases and the ozone depletion. This is indicative of their poor understanding of key concepts (Shepardson et al. 2012). Learners hold the view that global warming occurs due to the ozone hole and an increased infiltration of solar radiation (Shepardson et al. 2012; Svihla and Linn 2012). These authors suggest that the root cause of misconceptions on environmental matters stems from a misunderstanding of the greenhouse effect. Similarly, studies focussed on university students’ understanding and knowledge on climate change and related issues, report that a substantial number of students have erroneous beliefs regarding the issue (Khalid 2003; Viscusi and Zeckhauser 2006; Cordero, Todd and Abellerra 2008; Wachholz, Artz and Chene 2014). Many students do not possess a holistic view of the impact of climate change on ecosystems and the environment. Commonly identified concepts that were misunderstood were temperature and precipitation changes (Shepardson et al. 2009). Simple concepts such as the carbon cycle and its relationship with greenhouse gases have been misunderstood with the

inability to distinguish between climate change and global warming. For change in behaviour to occur, it is crucial that the impact of climate change is understood in a holistic manner through meaningful context which bears personal reference and relevance (Shepardson et al. 2009).

A common belief is that the root of many misconceptions is media influence and the way the phenomenon of global warming is portrayed in school curriculum as well (Moser and Dilling 2004; Cordero, Todd and Abellerra 2008). Media often exaggerate unscientific information causing mass misunderstandings (McBean and Hengeveld 2000; Schreiner, Henriksen and Kirkeby Hansen 2005). Multiple research studies revealed that many students and educators obtain environmental information from television (Andersson and Wallin 2000; Khalid 2001; Kilinc, Stanisstreet and Boyes 2008; Oztas and Kalipci 2009; Lambert, Lindgren and Bleicher 2012). Popular media sources relay mixed messages to the public providing a challenge in rectifying misconceptions (Svihla and Linn 2012).

Environmental education is often acquired from informal sources beyond the confines of school (Cheng et al. 2013). The lack of curriculum content on climate change (Choi et al. 2010) has caused learners to accept information from the media (Robertson 2015). School and television news have been identified as the primary sources of information amongst sixth grade learners in the Philippines (Cruz 2011). Home and school have been identified as the main influence on children's ability to participate in climate change from a critical perspective (Boon 2014). Family members and educators were identified as the most common influencers on children in formulating pro-environmental behaviour (Chawla 2009). Parents play a significant role in the lives of school age children and behaviour traits are similarly moulded according to parental example. Cutter-Mackenzie and Rousell (2018) found that, although previous climate change research described children's conceptual knowledge as "*limited, erroneous and highly influenced by mass media"*, their study describes children as "*insightful, creative and politically active*". Pro-environmental values, attitudes and behaviours of children are often a reflection of their parents as indicated in a study by Grønhøj and Thøgersen (2009). Ojala (2012) listed parental influence on teenagers as a greater effect regarding environmental behaviour when compared to friends or other knowledge variables.

Remediation efforts have been directed toward correcting misconceptions regarding climate change using constructivist-based climate change activities (Karpudewan, Roth and Chandrakesan 2015) and over decades, authors have suggested that misconceptions held by children are resistant to change even with the most effective teaching methods employed (Boyes and Stanisstreet 1993; Rye, Rubba and Wiesenmayer 1997; Koulaidis and Christidou 1999). Sterman and Sweeney (2007) discovered misconceptions amongst highly educated adults on the basic understanding of climate science suggesting that a specifically designed curriculum is required to alter student ideas. While it may be relatively difficult to rectify in the older generation, several authors agree that children are the future of the planet, therefore "*the environmental education investment*" should be made in them as it is an investment made in our planet (Bozkurt and Cansüngü 2002; Yılmaz et al. 2002; Atasoy and Erturk 2008).

2.5 Children as agents of change

Children participating in a research study explained the knowledge they have acquired as '*situated knowledge'*, with one ten-year-old learner from the United Kingdom stating in an interview that '*we just store it in our brains, and keep it there. We know it, but it just stays in there. We don't do anything about it. We forget about it until our next science lesson'*. Such a comment illustrated the lack of application of environmental education (Satchwell 2013). The National Research Council of the National Academies (Forest and Feder 2011) conclude that action orientated education is key in promoting pro-environmental change. Three factors have been identified as the most effective predictors of action: gender, socio-economic status and environmental attitudes and/or knowledge.

Other research studies suggest that there is no significant correlation between environmental behaviour and knowledge and a willingness to apply pro-environmental actions (Boyes and Stanisstreet 2012). Corbett (2006) reiterates that although it may be rational to assume that knowledge affects attitude, and attitude affects behaviour, a model as linear and simplistic as the knowledge-attitude-behaviour model is not correct. These factors may be associated but not necessarily cause one another. Contradictory research has been published regarding the

relationship between knowledge and attitude. A moderate link between student attitudes' and understanding about science has been reported (Shrigley 1990; Weinburgh 1995). Evidence of significant influence amongst these variables were also noted in a meta-analysis study by Osborne, Simon and Collins (2003). Individuals tend to select their environmental behaviour based on their own interests and more importantly the cost factor (Yumuşak et al. 2016). DeWaters and Powers (2013) explain that knowledge on energy-related content does not relate to the expected behaviour such as energy conservation. Knowledge has been highlighted as a prerequisite for belief; however, it cannot be said that practice will reflect such knowledge.

An amalgamation of climate change activities into primary science teaching and learning is a preliminary introduction of the relevance of the subject content to the learners' lives (Karpudewan, Roth and Abdullah 2015). Shepardson et al. (2012) discovered through analysis of three (3) studies, that there were a proportion of learners in secondary schooling that were not aware of the greenhouse effect and others who were not able to make a distinction between global warming and the greenhouse effect. Learners in the 16-17-year age group displayed a lack of interest in the topic of climate change which was directly seen in their poor survey performance evaluating knowledge retention in Austria and Denmark. Similarly, an Australian study which investigated the environmental knowledge of upper primary school learners determined that a vast number of 11- and 12-year olds held misconceptions on general environmental issues and global warming (Skamp, Boyes and Stanisstreet 2007). In rectifying such misconceptions, Leeming et al. (1993) advise that environmental education at early primary school may be most effective. Very little subsequent misunderstandings may be present for 'unlearning' with minimal acquired harmful environmental behaviours.

In 2006, a survey of school children was conducted on an Australian television show to establish the issues which are of greatest concern to them. In shared first place, children accounted the environment as a major concern along with the death of a friend or family member (Taber and Taylor 2009). However, children have been found to display no sense of urgency toward environmental actions as they hold the misconception that the environment can be mended after it has been ruined (Cruz 2011). This information provides a vague understanding of the environmental

attitude of children. They may be able to identify the issue but are not always willing to act. The opinions and views of children have become a valued source of data. Children are now being consulted on issues of disaster-risk reduction and emergency response. Their views and experiences are solicited in the development of plans for response (Bartlett 2011). Taiwan has incorporated environmental education into primary and secondary school curricula following the devastating Typhoon Morakot that claimed over 1000 lives (Cheng et al. 2013). Education programs have shown to significantly assist learners in hazard preparedness by allowing them the resources to develop realistic risk perceptions through increased knowledge (Ronan and Johnston 2001).

Decision makers have realised that children hold a wealth of information to assist in planning and development. Younger children have been found to have a more optimistic point of view (Byrne et al. 2014). Kilinc, Stanisstreet and Boyes (2008) found that second grade learners in Turkey had a good knowledge on global warming although conceptual misconceptions were already present. Primary school age is regarded as the most impressionable, during which habits are cultivated, enhanced and retained. Information and environmental education initiatives may be most effective at this phase (Ajiboye and Olatundun 2010). The most appropriate time for teaching environmental issues would be the latter years of primary school as improved knowledge on environmental matters translates into informed decisions regarding environmental choices (Taber and Taylor 2009).

The inception of environmental awareness at primary school level will increase the opportunity for nurturing environmentally knowledgeable citizens in the hope of a sustainable future (Karpudewan, Roth and Abdullah 2015). This period is thought to be ideal in engaging with children in climate change science for future pro-environmental behaviour (Chawla and Cushing 2007; Holden 2007; Blanchet-Cohen 2008). Krapp and Prenzel (2011) and Swarat, Ortony and Revelle (2012) regard interest as vital in the subject of science. Kefford (2006) explains that over-exposure of children to overwhelming issues such as global warming may cause a state of hopelessness resulting in a lack of interest in pro-environmental action. Similarly, there is a risk of desensitization where children have prolonged exposure to such information (Nicholson-Cole 2005). However, Jensen and Schnack (2006) argue that prior to any learning intervention, a sense of worry exists in children. Explicit

teaching could provide a platform for discussion of such concerns and allow for constructive management of them. Over-exposure to climate change education often through media and school program initiatives account for desensitization of the topic and is seen as a possible cause of lack of interest in learners (Harker-Schuch and Bugge-Henriksen 2013). A potential hazard of initiating environmental education too early in a child's life might lead to over-exposure and environmental fatigue rendering efforts ineffective and futile at the receptive stage (Boyes and Stanisstreet 2012).

Piaget (1995) discovered that Grade 6 has been identified as the inception phase in which students develop the cognitive skills required for the understanding of challenging concepts such as direct relationships between weather and climate and the role of humans in this phenomenon. The youth are viewed as guardians of the future. Therefore, there is a need for ecological responsibility to be nurtured (Cruz 2011). Many children are capable of being experts and responsible citizens as seen amongst 9-10-year-old study participants who were able to produce knowledge rather than reproduce it, by developing new ideas (Byrne et al. 2014). Knowledge and attitude are determining factors which greatly influence the achievement of a safe environment (Ibrahim and Babayemi 2010). Researchers believe that the development of positive attitudes toward the environment at an early stage is crucial in later behaviour (Chawla 1999; Meinhold and Malkus 2005; Ballantyne, Connell and Fien 2006).

However, convenience is a major deciding factor when learners weigh the options to act pro-environmentally. A convenient yet less useful action was found to be favoured over a less convenient more meaningful action with greater environmental impact (Shepardson et al. 2012). A study involving sixth grade learners, investigating their environmental perspectives and influences, showed that the majority accounted laziness and negligence as reasons for not acting in a pro-environmental manner, highlighting that knowledge and awareness does not necessarily manifest through learners' actions. Modernization may also play a hand in the natural predisposition of learners toward idleness and a lack of interest and attention to the environment (Cruz 2011). Children have become more attracted to technology with less attention or time available for nature or environment.

Contrary to this, some studies have provided evidence to suggest that an increase in knowledge may be linked to increased concern and expressions of activism. Lester et al. (2006) found that learners with greater global warming knowledge demonstrated activist behaviour. Similarly, increased concern was evident in Taber and Taylor's study in an Australian primary school (Porter, Weaver and Raptis 2012). Studies have demonstrated a link between knowledge and behaviour (Mogensen and Nielsen 2001; Fien, Sykes and Yencken 2003) whilst others offer contradictory views (Hungerford and Volk 1990; Kollmuss and Agyeman 2002) leading to the identification of a "gap" between knowledge and action (Kollmuss and Agyeman 2002). This gap may be due to a number of contributory factors that shape and influence behaviour apart from knowledge (Barr 2006). Social norms, social pressures, educational background and self-efficacy synergistically influence an individual's manner of action (Corraliza and Berenguer 2000; Devine-Wright, Devine-Wright and Fleming 2004; Laskova 2007). Shove (2010) and Blake (1999) describe the bridge between knowledge and practice as the "value-action gap" and believe that this gap can be addressed through modification of environmental education. More recent studies suggest that scientific knowledge-based approaches are ineffectual on the attitudes and behaviour of children regarding climate change (Dijkstra and Goedhart 2012; Brownlee, Powell and Hallo 2013).

It is suggested that studies should encompass children's environmental attitudes and behaviour as it is believed that early attitudes and knowledge plays a pivotal role in moulding thinking later in adolescent and adult stages (Manoli, Johnson and Dunlap 2007). Boyes and Stanisstreet (2012) suggest that teaching pro-environmental practices may have greater effect on older learners (Grades 8 and 9) as opposed to their younger counterparts. The views of adolescents seemed to be flexible, showing a greater willingness to act regardless of belief in a pro-environmental action. Older learners also displayed a response in their intended action seemingly linked to their understanding. Educators should focus on factors that can be influenced such as learners' knowledge and attitudes toward the environment and appropriate action (Chawla and Cushing 2007).

2.6 Primary School Educators and Environmental Education

Yumuşak et al. (2016) place the responsibility on educators to develop an environmentally responsible society. Educators themselves should be environmentally aware as they are responsible in providing guidance to the youth and community at large. Educators are seen as the drivers of environmental education programs in both schools and universities; however, a great reliance is placed on the student to take necessary action (Obasoro, Oyinloye and Ilesanmi 2013). Emergent research revealed that educators are viewed as trusted sources of climate change communication over sources such as media and government information (Ashworth et al. 2011). Van Driel, Beijaard and Verloop (2001) describe educators' practical knowledge as "*the integrated set of knowledge, conceptions, beliefs and values that educators develop in the context of the teaching situation*".

A barrier to teaching climate change has been identified as the inadequate learning of practicing educators in their own schooling years and/or insufficient training on the topic (Fortner 2001; Wise 2010). Science and Mathematics educator candidates in Turkey showed inadequate environmental knowledge. Although they were familiar with the general subjects, their knowledge on technical, conceptual and essential environmental issues were limited (Yumuşak et al. 2016). Practicing educators in rural Queensland expressed that they were unprepared to teach climate change education and had insufficient knowledge to enable them to do so (Boon 2014). Educator development is emphasized for policy implementation and curricula and for improved educational standards (Hennessy, Harrison and Wamakote 2010).

The experience of educators contributes towards decision-making. It also influences the ideas and views of teaching methods for specific science content such as climate change (Ratinen et al. 2015). Research supports that training and practicing educators often hold similar ideas and misconceptions as their students and have been cautioned to avoid reinforcing of existing student misconceptions (Summers, Kruger and Childs 2001; Khalid 2003; Michail, Stamou and Stamou 2007; Demirkaya 2008; Shepardson et al. 2011). Over half of college students, majoring in elementary education, were unaware that carbon dioxide was the most prevalent greenhouse gas and they did not comprehend the carbon sequestration ability of trees (Khalid 2001).

A review on education related to global warming revealed that educators held misconceptions due to superficial knowledge of certain environmental issues stemming from their source of information being visual and print media (Bozdoğan 2011). Despite many educators stating their uneasiness in teaching climate change and global warming due to a lack of foundational knowledge received on the subject, they agree that learners should learn about climate change (Porter, Weaver and Raptis 2012). Planned teaching focusing on environmental concepts is fundamental as educators can positively contribute to the shaping of the mind set of learners (Porter, Weaver and Raptis 2012). Educators have been found to be reluctant in engaging learners on topics of environmental issues and climate change due to the pedagogical insecurities of their own knowledge and understanding (Satchwell 2013).

Educators in Mpumalanga, South Africa underwent a training session on climate change with introduction to a developed teaching series called EnviroTeach. The sessions and material intended to provide these educators with resources for limited access areas. Educators felt like professionals as the program provided them with agency, with comments such as '*I have observed as an educator that it is important to venture out using a variety of teaching methods'* and '*I did not know about integrating the environment with the curriculum*". South African educators can be trained to appreciate and incorporate environmental aspects into their activities given the necessary tools to achieve it (Vogel, Schwaibold and Misser 2015). There is a need for more research in this field, in evaluating the preparedness and development of South African educators in the area of Environmental Education.

Educators require an incorporation of the environment into their institutional training such as environmental courses, field trips and involvement in social responsibility projects. Future educators will be able to internalise their environmental awareness, increase their knowledge and shape their attitudes during the training allowing for effective training of our children (Yumuşak et al. 2016). Educators' practices are a result of their own schooling experiences (Pérez and Furman 2016). Educators are required to facilitate debate in the class to ensure discussions are constructive; however, this requires a sound and superior background (Zohar 2007). Over time, such skills can be enhanced with experience (Simon, Erduran and Osborne 2006). Insufficient training, inadequate knowledge coupled with the challenges of the topic

of climate change offer additional hindrance to engagement of educators on the subject (Wise 2010; Beatty 2012). Improved teaching practices have been suggested in effective fostering of increased climate change literacy which has been identified as a precursor for commitment to environmental stewardship (Wachholz, Artz and Chene 2014).

Educator competence has been raised as a component of improving educator training, being described as a set of interrelated personal qualities such as knowledge, abilities, skills and ways of performing activities (Khutorskoy ; Celik, Akin and Saricam 2014; Shieh and Demirkol 2014; Tagunova, Selivanova and Valeeva 2016). Experience has been ranked as the prerequisite for educators' competence by researchers (Ekinci 2012; Kalayci and Humiston 2015). Training of educators should prepare the educator while stimulating a need for self-education, self-development and self-management (Zakirova 2016). It is the values, ideals and goals of the educator that direct the management of the teaching activity and directly impacts on the effectiveness of the activity itself. A study was conducted in the Maldives with results highlighting the urgent need for the incorporation of Life Skills Education in initial educator training (Zahir 2018).

The professional development of educators should include inquiry-related knowledge while evaluating and addressing the goals, values and principles of education for educators' conceptions (Lotter, Harwood and Bonner 2007). Ozel and Luft (2013) concur with this statement and support the need for inquiry instruction in training. Student educators' views and teaching strategies are formulated by personal experiences as learners (Abell 2007). Professional development is the tool to address various avenues of teaching in order to eliminate such beliefs from influencing teaching service (Fajet et al. 2005). Thinking and feeling also form part of teacher learning (Damasio 1994). Teaching is a profession in which feelings and motivation play an essential role. This has previously been eliminated from teacher professional development until recent. Korthagen (2004) promotes a change in perspective of teacher learning and the approach used. He suggests incorporating teachers' actual concerns and experiences instead of from theory taking thinking, feeling and wanting into account.

The design of professional development programs for teachers' should take into account teachers' core qualities. This term refers to one's personal qualities such as creativity, sensitivity, spontaneity, commitment and flexibility which is essential for 'good teaching' (Korthagen 2017). It is found that the more a teachers' core qualities influence their professional role and behaviour, the more effective the teacher will be (Fredrickson 2009; Boniwell 2012). It should worth mentioning that developers of training programs for teachers' take these findings into account when designing professional development programs. The 'person of the teacher' must be incorporated in teacher learning to ensure it is multi-dimensional and multi-level and link the personal strengths of people in schools with academic knowledge (Kelchtermans and Vandenberghe 1994; Postholm 2012).

Educators have been advised to integrate climate change education into their learning and teaching methodologies with a transformation from the conventional role as the only source of information to a role of supportiveness (Makrakis, Gkotzos and Larios 2012). Khalid (2001) states that educators should equip learners with the knowledge and information of relevant natural phenomena to prevent misconceptions. Educators, who are well-equipped and trained, are able to ensure that environmental awareness is achieved in the classroom while adopting the most effective method of teaching for positive knowledge, attitude and behaviour development toward the environment (Moseley, Reinke and Bookout 2002; Khalid 2003; Pekel 2005). One of the educators participating in a United States study explained her desperation for new material with activities and instructional assistance (Peterson 2016). Workshop studies assisting pre-service educators in teaching environmental problems (Paul and Volk 2002) and extracurricular activities demonstrated an increase in self-competency in environmental problems in the classroom (Moseley, Reinke and Bookout (2002). Educators involved in a study in Maldives mentioned that there are no opportunities or expert mentoring in the field. There is a lack of opportunity to evaluate their use of experiential learning to teach Life Skills (Zahir 2018). In South African primary schools, educators provide education on a range of different subjects which requires a continual imperative to evaluate and improve their teaching.

2.7 Learning strategies

Environmental education is said to be experience-based and practice-centred in order to adequately prepare societies for sustainable living (Makrakis, Gkotzos and Larios 2012). Many educators do not favour interdisciplinary teaching as it is perceived as time consuming to collaborate with colleagues in other disciplines (Gayford 2002). This particular challenge is true for South African schooling. A transdisciplinary approach is direly needed but educators in the South African schooling system have not been trained to maximise this opportunity of integrating environmental education on a transdisciplinary level. Eylon and Linn (1988) propose that regardless of the learning approach, in-depth coverage of climate change topics is necessary and more effective in addressing misconceptions.

Traditional classroom practices involve brief educator-centred lessons whereas thematic learning activities encompass long-term, interdisciplinary, learner-centred learning combined with real-world issues and practices. Learners are encouraged to strategize, execute and assess programs which have significant bearing on issues outside the class (Makrakis, Gkotzos and Larios 2012). Professionals in the field of pedagogy argue that knowledge-based learning is inefficient in providing effective environmental education. With this method, individuals are not motivated to translate their learning into behaviours (Uzzell and Räthzel 2009; Chen and Martin 2015).

The Malawi Institute of Education (2004) advocated participatory approaches in which students should adopt teamwork, co-learning and dissemination of information while developing important life skills. Involvement in developing possible solutions to a challenge evoke a sense of ownership leading to refined and more appropriate options (Gayford 2003). For a participatory technique to be adopted in the schooling environment, a transition is required from educator-centred teaching to active participation of learners in their own learning (Emsheimer and Mtana 2003; Mtana, Mhando and Hojlund 2004).

2.8 Types of teaching methods for teaching EE

2.8.1 Methods of instruction

There is a paucity of literature relating to the challenges of South African educators, particularly on pedagogical choices and resource availability. Traditional teaching and learning is centred on delivering information to prepare students for tests and examinations. This approach forges learning with the purpose of memorisation of content and the possibility of little environmental knowledge acquired and retained (Aini, Nor Azura and Fakhru'l-Razi 2011). It has been stated that simple instruction in climate change science is not enough to render a holistic understanding of climate change science and lacks the provision for interdisciplinary reference to be made. Simple instruction lacks the tools for opinion formulation as students are talked "to" rather than "with" and the opportunity for opinion cultivation and critical thinking is not achieved through constructive argument and debate (Harker-Schuch and Bugge-Henriksen 2013). Kelly, Chen and Prothero (2000) and Kuhn and Udell (2003) agree with this notion stating that an understanding of science is enhanced through argumentation and science literacy is fostered (Duschl and Osborne 2002).

Hundal, Levin and Keselman (2014) emphasise the significance of discussion in a learner community where learners are the chief contributors in articulating their identities in the process of learning science. A suggestion was made that teaching topics that are of importance to learners, yields a greater level of engagement in discussion. Approaches that employ active participation, provide learners with the platform for development and refining of scientific content knowledge while sharpening decision-making and debating skills (Scott 2008). Claxton (2008) describes decision-making, critical analysis and autonomous learning skills as pivotal for twenty-first century learners. These methods are suitable for South African education as they require very few or no resources and is a shift from educator preparation and delivery to the learner. Lessons that are formulated around the socio-scientific climate change rudiments including non-conventional teaching methods are thought to be most effective with enhanced knowledge and comprehension as the projected outcome (Harker-Schuch and Bugge-Henriksen 2013).

Moser and Dilling (2004) suggest that climate change education be developed for the engagement of educators and learners whilst encouraging pro-environmental action. This sentiment has been echoed by educators in other research studies (Mason and Santi 1998; Cross and Price 1999; Lester et al. 2006). A study amongst

university students in California showed that learning activities developed around personal action were good motivators for learning (Cordero, Todd and Abellerra 2008). Instructional strategies and methods are crucial in dispelling misconceptions and effective teaching of environmental knowledge, attitudes and values (DiEnno and Hilton 2005). A student-centred approach rather than traditional instructional methods has proven more effective (Andersson and Wallin 2000; Kapyla and Wahlström 2000; Pekel 2005; Demirkaya 2009). Methods such as student participation in activities (Sağır, Aslan and Cansaran 2008), group work (Andersson and Wallin 2000), experiments and field trips (Bozkurt and Cansüngü 2002) accompanied by the use of effective mediums of environmental learning (Darçın et al. 2006; Lester et al. 2006) can evoke student curiosity and attention resulting in positive knowledge, attitude and behaviour development regarding environmental issues.

Kostova and Atasoy (2008) and Dogru (2008) have documented improved outcomes in Bulgaria when methods such as problem solving, field trips and laboratory tasks were used instead of educator-centred methods for environmental education amongst Grades 6-10 learners. Oluk and Özalp (2007) revealed a greater effectiveness in elementary school learners when using cartoons and comics in teaching environmental problems. Such teaching resources encourage learning, sustain learners' attention and incorporate the element of fun into the lesson. Meaningful environmental learning among elementary school learners can only be achieved with supplemented instruction using encouragement, interest-arousing and captivating materials (Darçın et al. 2006).

Learners were receptive to the use of a film in raising awareness of scientific and climate change issues (Lambert, Lindgren and Bleicher 2012). A quasi-experimental study which used a 5E learning approach was evaluated. The 5E's being engage, explore, explain, elaborate and evaluate. The study reported an outcome which suggests that learners who received the climate change curriculum displayed enhanced positive environmental attitudes than learners who were taught by the conventional educator-centred, lecture-orientated method (Karpudewan, Roth and Abdullah 2015).

2.8.2 Inquiry based and action learning

Pérez and Furman (2016) describe open inquiry as all planning and implementation done solely by the learners with support provided by educators throughout the process. The constructing of knowledge either through individual or shared meanings involves learners' interaction in shared inquiry supplemented through continuous reflection, reconceptualization and active experimentation (Makrakis, Gkotzos and Larios 2012). Inquiry learning, which provides a platform for testing ideas, conducting investigations, tracking progress and problem solving opportunities, is supported by a vast body of research. Coherent understanding prompts learners to reflect on their own learning experiences and knowledge while integrated understanding is achieved. Learners are given the opportunity to compare and evaluate ideas through investigation of scientific phenomena (Svihla and Linn 2012).

Active learning assists in retaining content while developing critical thinking and writing skills. However, for these activities to be effective, instructors must provide the platform for learners to "*meaningfully talk and listen, write, read, and reflect on subject matter"* (Bromley 2013). Taber and Taylor (2009) found that certain scientific phenomena were best understood through an experimental approach which is a more effective method in enhancing understanding of the issue. Children found hands-on activities highly enjoyable and informative following an interactive teaching intervention (Taber and Taylor 2009). However, educators have difficulty in integrating experiments into their lesson plan as they do not understand that there is more to the approach than a succession of steps (Pérez and Furman 2016). A socio-scientific science method is one which incorporates all aspects of climate change into the climate change science discipline.

Opinions are cultivated through inquiry and investigation rather than closed questions with predetermined results. However, a prerequisite for such a method is a sound basic understanding of science for learners to debate and discuss these issues. With such skills, a group is created to critically evaluate relevant subjects while formulating opinions (Lewis and Leach 2006). Visual depictions have been identified as assisting in the understanding of textual subject matter, particularly, in

learning of science (Vekiri 2002; Lee 2010; Finson and Pederson 2011; Tversky 2011; Van Genuchten, Scheiter and Schüler 2012).

Time constraints pose a challenge for many educators (Trautmann, MaKinster and Avery 2004). Prior planning before the school year begins may aid in managing inquiry-based activities in the class (Pérez and Furman 2016). Educators discovered that experimental activities need not be expensive, requiring a complex lab. There are several ways of conducting experiments with easily available materials as alternative options. Active participation and sustained learning are achieved through such activities (Pérez and Furman 2016). Cordero, Todd and Abellerra (2008) believe that the main factor to consider in the selection of an appropriate learning method is its ability to emphasize the relationship between the personal role of the learner in climate change while utilising active learning.

Teaching by inquiry is designed to promote conceptual knowledge and scientific skills in reference to research on mundane challenges and social interactions by use of models and theories offering explanations (Pérez and Furman 2016). Complex learning is achieved when increased degrees of inquiry are present and learners' autonomy encouraged (Cuevas et al. 2005). However, such a change requires time and is a continuous learning process for both learner and educator alike (Pérez and Furman 2016). Pérez and Furman (2016) explain that experiments allow learners to discover explanations to natural phenomena that develop personal understanding instead of confirming prior knowledge, and also allow them to think and act like scientists by generating knowledge instead of duplicating existing findings (Peters 2005).

A study by Karpudewan, Roth and Chandrakesan (2015) confirms similar research findings elucidating the effectiveness of hands-on activities on primary school learners' understanding of global warming and related issues. An increase in knowledge of carbon cycle and the greenhouse effect was seen when an inquiry-based approach was used (Taber and Taylor 2009; Lambert, Lindgren and Bleicher 2012; Bilgin, Coşkun and Aktaş 2013). Inquiry-based approaches must be complemented with direct instruction as research has found that integrating methods provides domain-specific clarity and instruction is essential (Österlind 2005). Knowledge-based teaching materials, together with interdisciplinary and

transdisciplinary curriculum, yielded promising results in a study in Mpumalanga, South Africa involving students and educators (Vogel, Schwaibold and Misser 2015).

Action learning encompasses a framework which allows for the deconstruction of generalizations (Daniel, Stanisstreet and Boyes 2004). An example of such a concept is rethink, reduce, reuse and recycle which eases the process of new information incorporation for learners. Long-term retention is attained through embedding of knowledge in learners' memory structures (Porter, Weaver and Raptis 2012). Educational research supports the notion that active learning provides effective engagement of learners and an excellent opportunity for learning (Porter, Weaver and Raptis 2012). Ratinen et al. (2015) explained that although educators were aware of the relevant teaching methods, they were unable to use them in the class. Educators have demonstrated reluctance toward using inquiry-based learning because of the difficulty. (Luera and Otto 2005; Zion, Cohen and Amir 2007). Their lack of professional development restricts the range of teaching approaches available and has shaped their conception of science as prescribed with minimal creativity (Krajcik et al. 2001).

2.8.3 Outdoor education

Outdoor education adopts a holistic approach by utilizing a learner's entire environment as a learning tool, providing the community as their platform for learning. Pupils are encouraged to identify environmental problems, develop and implement solutions with educators and peers through active participation in the learning process (Olatundun and Adu 2013). Outdoor education has proven to offer a vast array of advantages in assisting learners in evaluating and dealing with risk, acquiring valuable leadership skills and teamwork dynamics, all of which are fundamental in the transition into adulthood (Olatundun and Adu 2013). Outdoor education activities, such as adventure experiences have been explored in Nigeria as means of curriculum enrichment when teaching the subject of environmental education. It was found that higher order skills associated with participation cannot be derived from academic programmes in school. Experiential learning provides improved interpersonal skills and learner empowerment and constitutes learning by doing with reflection as experienced by the participants (Olatundun and Adu 2013).

Ford (1986) embarked on the first study in outdoor education which showed that analysis can be done based on four premises. These include teaching of human responsibility, commitment for stewardship of the land, solid knowledge of facts and concepts, different facets of the ecosystem and the interrelationships which exist. Outdoor education equips individuals with knowledge required to make well-informed choices based on the impact of the action from understanding ecological matters. Outdoor education must be understood as a continual education experience rather than a once-off event or trip (Olatundun and Adu 2013). This method could provide a means for South African educators to practically engage with learners on environmental issues. Outdoor education research has not been adequately explored in the research field.

A study comparing the effects of outdoor education activities to conventional teaching of environmental education yielded significantly better results after the intervention method. The study was conducted in Nigeria amongst primary school pupils. A possible reason for the result can be attributed to the opportunities provided to pupils to learn as an individual while exposed to various environmental problems. The techniques employed in facilitating the outdoor education activities ranged from discovery, inquiry, excursion and field trips with careful consideration to ensure that the balance between indoor discussion and outdoor activities is maintained. The development of physical skills, increased physical and mental energy and self-confidence are fostered through this method of teaching learning is practical and applicable from real life settings (Olatundun and Adu 2013).

2.9 Theoretical Frameworks

The constructivist theory elucidates that ‘learning’ is a process of active construction and not merely the acquiring of knowledge. Instruction in such an approach is designed to support such knowledge construction rather than relaying of information or knowledge (Duffy and Cunningham 1996). Constructivism has been highlighted as a favourable method to educate learners on climate change concepts using the appropriate science and is most effective when delivered by educators rather than community speakers (Porter, Weaver and Raptis 2012). Initial constructivist researchers posit that learners actively create their own knowledge and an inquiry-

based, investigative approach is an effective tool to dismiss misconceptions (Ausubel, Novak and Hanesian 1968; Driver 1983; Roth 1989; Novak 1993; Vosniadou 2009; Somerville and Green 2011).

A constructivist perspective was adopted in many studies which aim to understand the meanings constructed by learners' use of language when participating in a context-specific activity. These reflect social, educational and cultural experiences which are unique to a learner (Shepardson et al. 2009). Puk and Stibbards (2012) stress the need for constructivist approaches in institutions training pre-service educators as learners are able to grasp a meaningful understanding of complex issues solely by information transmission. McInerney (2013) claims that the process of learning in the classroom is constructed through interactions with a number of sources of information. This theoretical approach is referred to as social constructivism and postulates that the environmental knowledge of children is formed from interactions and experiences between family, media, educators and schooling over time.

Cruz refers to Lasswell's model showing that communication results in, the creation of beliefs and perspectives that translate into action. Interpersonal communication and mass media play an important role in shaping the knowledge of children and directing the consequential actions (Cruz 2011). Karpudewan, Roth and Chandrakesan (2015) expound that constructivist approaches improve learners' understanding of concepts such as global warming and greenhouse effects while inquiry-based methods complemented with direct-instruction improve the recognition of learners' of ozone depletion and the greenhouse effect. However, the strategies employed should also enhance attitudes while improving reasoning skills.

Parker Palmer has a different explanation of education. He highlights the educator as the most important resource. He explains that education reform requires more than rewriting curricula and restructuring schools, and that the human resource, called the educator, is the dependent factor. His theory propounds that good teaching involves the heart of the educator and requires deeper inquiry into the seldom asked question of "who" – who is the self that teaches? Technique is described as *"what educators use until the real educator arrives"* (Palmer 2017). This theory is the lens through which the selfhood of the educator is analysed, parallel to

the pedagogical content knowledge of the educator to understand what informs an educator's teaching methods.

Shulman's Theory will be employed as the overarching framework for this study. This theory establishes that the knowledge base of the educator frames educator education and teaching practice (Shulman 1987). Shulman based his investigation on the question of what educators knew or did not know that caused them to teach in a specific manner. Teaching requires basic skills, content knowledge and general pedagogical skills. An educator has an understanding of something not understood by the learner; he/she has the ability to use that understanding, skills, attitudes or values through pedagogical representations or actions such as speech, showing, enacting or simply relaying information in a manner that causes those that did not previously know, to now comprehend and understand. The foundation of teaching is, therefore, the educator's understanding of content and how it is to be taught. Fenstermacher (1986) adds that educators should be able to use their knowledge base to inform choices and actions. Such a process of sound reasoning requires educators to inform their reasoning by thinking about what they do in conjunction with their base of facts, principles and experiences. The pedagogical reasoning model comprises a five (5)-step cycle, initiated by comprehension. This is based on the premise that educators should comprehend subject matter in a multidisciplinary manner. In summary, the key to distinguishing the knowledge base of teaching is at the intersection of content and pedagogy. The educator has the ability to use the content knowledge and deliver it in a form that is "pedagogically powerful", in a way that is unique to the background and type of learner (Shulman 1987). The second step of the process is transformation. This involves instructional selections for approaches or strategies of teaching to deliver ideas in a comprehendible manner.

Shulman used the following categories to partition the different aspects of educator knowledge that comprise their knowledge base: content knowledge, general pedagogical knowledge (classroom management and organisation), curriculum knowledge (materials and programs), pedagogical content knowledge (content and pedagogy unique to the educator), knowledge of learners and their characteristics, knowledge of educational contexts and knowledge of educational ends, purposes, values, philosophical and historical grounds.

This research will focus on the aspect of pedagogical content knowledge (PCK) and curriculum knowledge. This is the combination of content and pedagogy and the curricular alternatives available for instruction (Shulman 1986). Shulman describes PCK as a form of content knowledge compromising subject matter knowledge, knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of the pedagogy. For the purposes of this study, these categories will be used to evaluate the findings of the qualitative research (Wilson, Shulman and Richert 1987). Shulman quotes Feiman-Nemser and Buchmann (1987) in explaining that pedagogical thinking is "*strategic, imaginative, and grounded in knowledge of self, children, and subject matter*". PCK is an understanding of how to teach a subject and the methods and principles used.

2.10 Conclusion

Environmental education is needed to combat climate change. Climate change is a pressing issue currently facing the world with no country excluded from its effects. Immediate action is needed to ensure sustainability of the future. Children have been identified as the implementers of such action as they are the stewards of tomorrow. Therefore, extensive and appropriate solutions should be used in ensuring the outcome is achieved. Climate change has been explained as a highly scientific subject requiring the understanding of underpinning meteorological concepts to critically analyse situations and provide significant and effective recourse. Curriculum planning and design for environmental education can be a difficult and a challenging process as the concept is scientifically complex. However, the conceptions held by learners should serve as guideline of the areas that need attention. An amendment of the curriculum to reflect the environment and its related issues will provide a clear understanding to learners thus alleviating misconceptions and complexities.

Environmental education cannot be merely added to a presently congested curriculum. Professional support and collaborative efforts are much needed for the implementation of multidisciplinary school programs to address environmental issues. Environmental education should be taught in conjunction with mathematics, science, social studies, language arts, environmental studies amongst others, as this is the most effective method of curriculum integration (Makrakis, Gkotzos and Larios 2012). Human health and the wellbeing of the ecosystem are interdependent, and

curriculum and education should echo this. A shift in the educational paradigm must incorporate the improvement of critical thinking and learning in the effort to advance human health and the environment (Davis and Cooke 2007). Learners are encouraged to analyse and understand the climate and its associated effects in order to make personal behaviour decisions. This can be achieved through integration of the necessary climate science concepts into the curriculum for classroom practice (Shepardson et al. 2012).

Through cross-curriculum, learners will be provided with the opportunity to identify the relationship between knowledge and skills amongst all school subjects. This knowledge will enable them to apply this in real life scenarios. Curriculum that is ideally designed will only be successful if educators are competent and adequately informed in making an appropriate pedagogical choices. An exposure to a host of options available to educators is crucial for the most effective method to be employed. According to the World Health Organisation (2009), teaching strategies such as real case discussions, brainstorming, field visits, panel discussions, oral and digital storytelling, songs, group discussions, debates, poster presentations, role play, games, projects, poetry recitals and drama must be employed by educators when teaching Life Skills. The participatory and inclusive approach sees the educator in a facilitator role and a co-generator of knowledge and not as the sole provider of information to passive learners.

This highlights the crucial role of the educator in the classroom. The educator is the greatest resource. Therefore, Parker Palmer's theory and Shulman's Theory were used as a framework for this study and provide a lens through which different aspects of the educator is viewed in relation to environmental education.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will outline the research methodology that was used for the study. Environmental education has become a key driver in the hope of developing a sustainable future. School-based education affords learners an opportunity to acquire environmental knowledge and understanding. It was important to ascertain what methods were employed to inculcate this knowledge. This study investigated the implementation of a teaching intervention and educators' experiences relating to aspects of environmental education through inquiry-based research method.

3.2 Research Design

The research study used a multi-method approach involving qualitative and quantitative data collection (Creswell 2008: 432). Qualitative data was collected in through semi-structured interviews with educators. The aim was to understand the influence of selfhood of Life Skills educators' and its influence on choices of methods and approaches of teaching. Quantitative data collection was used to evaluate knowledge retention amongst learners through completion of activity books after intervention.

Methodological Approach

The theoretical framework used was Shulman's Theory. Pedagogic Content Knowledge (PCK) as a form of content knowledge comprises subject matter knowledge, knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of the pedagogy. These categories were used to evaluate the findings from the qualitative research. This theory was used to inform the implementation of the intervention related to the knowledge of the learner, knowledge of the context and knowledge of the pedagogy. The results of the intervention informed the reflection of the educators on the categories mentioned above.

Parker Palmer's Theory was used in conjunction with Shulman's Theory. Parker Palmer's Theory provided a new lens to interpret and evaluate educators'

pedagogical choices. The selfhood of the educator is a great determinant in providing an explanation to the research questions of this study (Palmer, 2017).

Themes arising from the qualitative data were analysed and presented according to Shulman's theory. Data responses from interviews were categorised using the categories of PCK to determine the link between participant responses and the knowledge base of educators. According to Shulman, it is the knowledge base of the educator that frames the educator's education and teaching practice (Shulman 1987).

Practical issues relevant to education were highlighted and reviewed through the phases of data collection (interviews, intervention and assessment). The teaching intervention formed a comparative basis to explore the differences in conventional teaching methods to an interactive approach. The lesson on water was chosen according to the stipulated CAPS lesson schedule. Lessons on water and the relationship with the environment and climate change are within the prescribed topics specified by the Department of Education, CAPS Document (South Africa Department of Education 2016).

3.3 Study Site

The study was conducted at two public primary schools on the North Coast of KwaZulu-Natal, South Africa, located in the Stanger area of the KwaDukuza Local Municipality, within the Ilembe District. Due to constraints of time and resources, two schools were used in this study. Primary schools were selected because environmental education is introduced in Grade 5 as part of Life Skills. In addition, the belief is that younger learners are more receptive to change and more likely adopt pro-environmental behaviour and attitudes. KwaDukuza Local Municipality has a total population of 231 187, with 51 536 within the Stanger area (Statistics South Africa 2011). There are 59 public schools in Stanger (Department: Basic Education 2015).

The two schools were selected through purposive sampling based on proximity, similar socio-economic levels and demographic distribution. The schools are situated in residential areas predominantly comprising African and Indian residents in the low to middle socioeconomic category with a mix of urban and rural dwelling households. Both schools have basic resources and fees are paid by parents. A geographical

difference between schools was required to alleviate interaction and discussion between educators or learners which could possibly influence the results of the study.

3.4 Sampling

School A- Sky Primary comprised of 994 enrolled learners ranging from Grade R to Grade seven (7). There were 24 classes and 25 educators collectively. There were Three (3) Grade 5 classes with 41, 41 and 43 learners in each class respectively. The estimated learner racial distribution was approximately 70% African and 30% Indian. There were two Life Skills educators for the Grade Five (5) classes with one educator teaching two classes and the other teaching one. Both educators were participants in the study.

School B, Sun Primary comprised 1200 enrolled learners with grades ranging from Grade R to Grade Six (6). There were 28 classes and 37 educators collectively. The school had three (3) Grade Five (5) classes with 43, 45 and 40 learners respectively and three (3) Life Skills educators. The racial distribution of learners was 49% African and 51% Indian.

Sun Primary was chosen to receive the intervention based on similar educator to pupil ratio in the Life Skills class to eliminate any possible bias during delivery of the intervention or assessment. Sky Primary was designated as the non-intervention school.

3.5 Data collection

Initial qualitative data was generated from educators through semi-structured interviews that were conducted to understand the experiences shaping educators' choices for teaching environmental education. Only Grade Five (5) Life Skills educators in both schools were interviewed and included in this study to meet the prerequisite of the inclusion criteria. Educators who taught more than one Grade Five (5) Life Skills class were also allowed to participate. The total number of educators were five (5) according to the allocation of educators to the Grade 5 Life Skills subject by the school. As Grade Five (5) Life Skills introduces environmental education to primary school learners with lessons on water, the focus of the study

was on Grade Five (5) educators only. This is the initial delivery of environmental information to learners, therefore, the delivery, pedagogical reasoning and role of the educator is of crucial importance in ensuring environmental literacy is achieved.

Piloting the interview schedule

The initial interview questions were piloted with a Grade 5 Life Skills educator from a non-participating school. This validated the data collection instrument and allowed for screening of errors, ambiguity and validity. After piloting, the interview schedule was amended according to the suggestions received (Appendix 6).

Setting up relationships

The principal briefed the educators about the study. The researcher held separate sessions with educators individually to provide details of the study and their role as participants. With verbal consent from educators, letters of information and consent were administered. Interviews were scheduled and discussed telephonically and reminders were sent.

Conducting the interview

The purpose of the interviews was to generate information on the educator's background from inception of teaching, reasons for their career choice and most importantly their current teaching methods and what informs their choice. The interview schedule was designed with themes such as teaching experience, years of teaching, challenges, methods of teaching and reasons for adopting certain methods. Demographic information was collected through the interview questions posed (Appendix 6).

An empty classroom situated away from the main offices or the staff room was used to allow for an uninterrupted and private discussion. The interviews were recorded on a digital audio recorder after permission was obtained from the interviewee. The discussion was guided by the interviewer to ensure the necessary information was obtained. Respondents were encouraged to elaborate on their responses. Interview sessions differed in duration depending on the flow of the conversation while ensuring all predetermined questions were answered.

A discussion session followed with educators of the intervention school to determine the elected intervention methods. These conversations were not recorded as the aim of these discussions was to determine the intervention option choice of each educator in the delivery of the lesson on water for Life Skills. A range of options were presented to the educators (Appendix 7). The intervention options were determined by the researcher, based on resources available, creativity and the ability to entice interest and involvement while learning. The purpose of the intervention was to provide a comparison of knowledge retention between conventional teaching and interactive stimulating methods. This information was obtained through administration of the activity assessment book.

All three educators in the intervention school opted for the same interventions from the list of options, namely, a water related crossword puzzle, a water related word search sheet and A3 paper for designing of posters depicting water pollution. The reason for their choices were time allocation for Life Skills periods to enable them to deliver the lesson while utilising the intervention. Another possible reason for their choice could be the simplicity in implementing these options, where little or no discussion or instruction is required from the educator. The intervention options were basic complementary options that could be replicated in any public school. Intervention materials were supplied to the intervention school as part of their involvement in the study.

This phase included an activity book (Appendix 8) to assess the knowledge and understanding of learners about water and climate change based on the teaching methods used. The activity book was developed by the researcher based on concepts taught in Grade 5 Life Skills under the section of *'Health and Environmental Responsibility'*. The activity book was printed in colour and titled '*The Environment and Me'* and designed to evaluate knowledge and understanding in a fun and creative way. The cover required a selection between the options of gender in providing demographic data. This allowed for categorical analysis of data for further statistical testing using gender as a variable. The questions in the activity book required knowledge on the content taught as well as critical thinking, reasoning and application skills. An example of such a question is the selection between two pictures both depicting consequences of climate change and water. The learner is required to use deductive reasoning to substantiate their choice as both pictures are

correct. Their opinions and feelings on the lessons taught and the teaching method used were also included in the activity book as concluding open-ended questions (Example: Did you enjoy the way you were taught on the subject of water? Please explain your reason?).

The books were administered by the educator 2-4 days after the lesson was taught. All Grade 5 classes (intervention and non-intervention) received and completed the books offering a comparable set of data between the intervention and non-intervention/control classes. The activity books were designed to indicate understanding or knowledge retention on the lesson of water and its relationship to climate change. All Grade 5 learners participated in the study following their consent and consent from their parents. The assessment involved the subject of Life Skills, therefore all research procedures were conducted during the allocated periods for Life Skills only.

Reliability of the assessment tool (activity book) was ensured by:

- Revision of complicated questions to ensure simplicity in understanding and response of learners
- Development of questions to provide only one answer per question to eliminate complexity

A second set of interviews was conducted with all educators. The questions differed based on their allocation as the intervention or non-intervention school. Two sets of interview questions were developed for the intervention (Appendix 9) and non-intervention/control (Appendix 10) schools respectively. The aim of the interviews was to obtain information on the experiences and views of educators on the intervention method and the activity books. The questions were designed to provide information on the educator and the perceived experiences of the learners on the intervention and activity book respectively.

Interviews were audio recorded following verbal consent from the educators and there was no time allocation, thus allowing for free communication and explanation of answers and experiences. The interviewer concluded by offering assistance that educators may be require in accessing necessary resources in implementing similar intervention teaching methods in the new term.

Trustworthiness

Trustworthiness was ensured by application of the following principles of credibility and dependability. Graneheim and Lundman (2004) define credibility as the focus of the research and the confidence with which the data and analytical process address the intended focus. Credibility was ensured in the following ways:

- Well-established research methods were employed (multi-method approach with appropriate theoretical frameworks)
- Interview participants were selected through purposive sampling

Similar to the concept of reliability, dependability refers to the stability of findings over time. Dependability answers the questions on whether similar research results will be achieved, if the study were to be replicated with similar participants in a similar context (Bitsch 2005). Dependability was ensured through data being transcribed by the researcher following each interview and additional notes made immediately after the interview.

3.6 Data Management and Analysis

Quantitative data collected was captured into Microsoft Excel Software, thereafter, cleaning and editing of data was done. Statistical analysis was performed using STATA (version 12, College Station, TX, USA). Descriptive analyses were conducted following completion of the data collection, data entry and data verification phases. Frequency distributions of categorical variables and means and standard deviation were calculated. Bar charts were used to illustrate data variables and cross-tabulations. Bivariate associations between categorical variables were done using the Pearson's Chi squared test. Three questions from the assessment book were used to evaluate knowledge and understanding of content. Data from these questions were used to provide comparative results and depicted using graphs and tables.

Qualitative data analysis consisted of highlighting themes evident in the transcribed conversations between the educators and the researcher during interviews and

discussions. The data analysis method used was a case and theme based approach. Themes were generated based on the frequent occurrence of explanations or information provided by participating educators. Codes and categories were developed using Shulman's framework and used to develop and analyse the data, focusing on pedagogical content knowledge as the framework in answering the research questions of the study. Palmer's Theory was used to understand how the personal and professional aspect of teachers influence teaching. In order to answer the research questions, the qualitative data was used to understand the 'why' dimension of teachers and their reasoning, the 'how' dimension and the application of how teachers' teach and lastly the way in which the findings will be represented and the data used.

The framework approach was chosen as it best suits the analysis of cross-sectional descriptive data. The approach is also advantageous for novice researchers to manage and analyse data (Smith and Firth 2011).

Themes can also be referred to as categories. These are groupings of codes to form one major idea in the database. Generally, themes may include ordinary (predicted themes) and unexpected developing or emergent themes through analysing the data. Each transcript was thoroughly analysed for the attitude, experiences and views of participating educators in relation to the research questions. Transcripts were checked for accuracy and code drift. A three (3) step flow analysis was used by initially transcribing interview audio recordings, generation of categories, themes and sub-themes to identify important issues and lastly, establishing trustworthiness (Lincoln and Guba 1985; Miles *et al.* 1994).

The same three step analysis process was employed for this study. All interviews were transcribed and analysed, manually scanning for categories of responses and evident themes in the data. The theoretical framework provided a lens through which the data was categorised, and themes identified in relation to the research questions. For research question one, interview responses were analysed to provide information on who are the educators involved in teaching Grade 5 Life Skills. Transcribed interviews were evaluated in relation to the second research question related to environmental education, to provide an understanding of the PCK of

educators. The last research question elicited responses on educators' explanation of learning in the Life Skills classroom.

From the transcriptions of interviews, a narrative was formed for each educator. Narrative inquiry was used as to explore personal experiences of teachers using a one on one interview approach. The data set for each participating educator was manually examined and initial categories for analysis were generated. Texts were highlighted which depicted themes and colour coded for differentiation. The identified categories were then compared, combined and refined. The final categories were coded for reference. On completion of coding, grouping related categories by themes (e.g. choice of teaching method) and subthemes (e.g. student participation in lesson) was done. Thematic analysis is often coupled with content analysis and provides tools to analyse textual data and illuminate themes. Content analysis is a group of various strategies used to analyse text with the aim of describing characteristics of the transcription by examining who says what, to whom, and with what effect. Thematic analysis is an approach used to identify, analyse and report patterns or themes. This method has been identified as providing core skills to a researcher for qualitative analysis of various forms (Vaismoradi, Turunen and Bondas 2013). Both approaches provide a systematic process involving the coding of data, studying of meanings and providing a description through highlighted themes. Themes allow for the consolidation and reporting of subjective meanings of participant contributions (Vaismoradi *et al.* 2016). An example is provided of the analysis process undertaken in the images below:

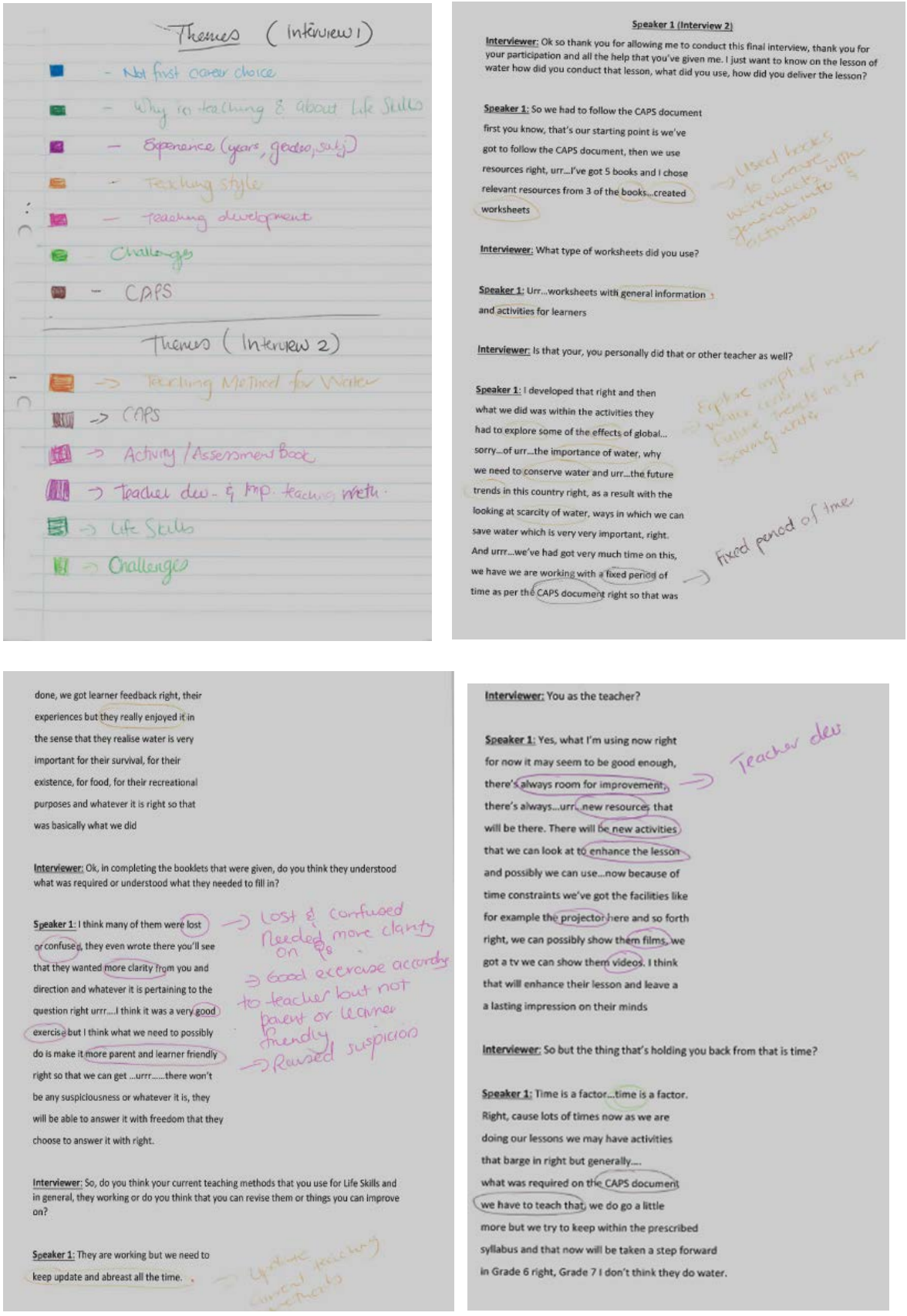


Figure 3.6.1: Extracted images of the data analysis process

3.7 Ethical Considerations

Research ethics governs the standards of conduct for scientific research for the protection of dignity, rights and welfare of research participants. Children are considered as a vulnerable group requiring special ethical protection.

Conformance to ethical standards was ensured throughout the study through the following methods:

- The research proposal was approved by the KZN DOE Research Ethics Committee (Appendix 1).
- Gatekeeper permission was requested from the principals of both participating schools (Appendix 2).
- Pseudonyms were used for identifying and referring to participating schools
- Consent was received from educators for use of their names in the research study
- Learners participating in phase three data collection were not requested to provide their names on the activity booklets. Data collected was coded in this phase.
- All electronic data collected from phase one and four was transferred and stored on a password encrypted personal laptop accessible only by the researcher. All phase three activity books were securely stored in a locked cupboard with restricted access. Records will be kept for a period of five years and thereafter shredded and appropriately disposed.
- Participation was voluntary and informed consent and assent were obtained from all parents (Appendix 3) and participating educators (Appendix 4) and learners (Appendix 5).
- Participants were informed that they could withdraw from the study should they wish without any prejudice toward them.
- Interview sessions were confirmed the day before to ensure availability and consent. Interviews were guided by an interview schedule (Appendix 6). Intervention options (Appendix 7) and Activity books (Appendix 8) were discussed with teachers during respective interview sessions. Post interview sessions were guided by an appropriate schedule of questions (Appendix 9 and Appendix 10).

- The participant’s privacy was always protected during the study.
- An ethical clearance number was issued by the DUT IREC (ethical clearance number: IREC 84/16) (Appendix 11).

CHAPTER 4

QUANTITATIVE RESULTS

4.1 Introduction

The aim of this chapter is to present the findings that were obtained from the quantitative aspect of the study which included the administration and evaluation of the assessment book to evaluate knowledge and understanding of learners.

4.2 Demographic Information

The schools are situated in residential areas, predominantly comprising African and Indian residents in the low to middle socioeconomic category with a mix of urban and rural dwelling households. Both schools have minimal resources and fees are paid by parents. Grade 5 learners in both primary schools participated in the study. Learners were evenly distributed with 48% male (n = 129) as depicted in Figure 4.2.1. There was no significant difference in the gender distributions across the schools (p= 0.392). Racial distribution (Figure 4.2.2) displayed a disparity for both schools but this was not significantly different (p= 0.119).

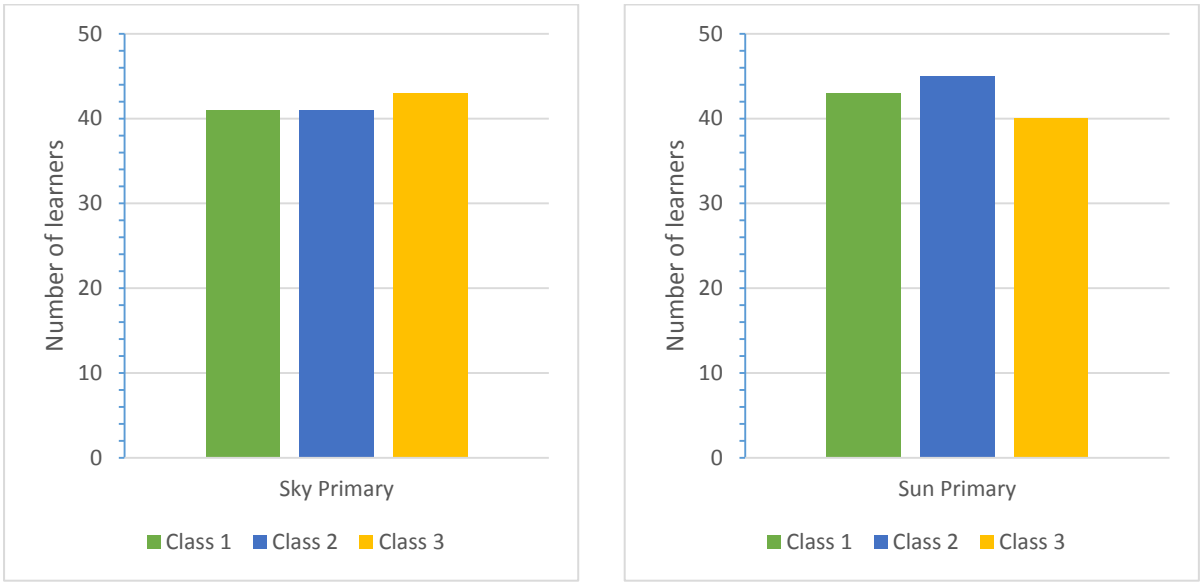


Figure 4.2.1: Distribution of total number of learners in each participating class per school.

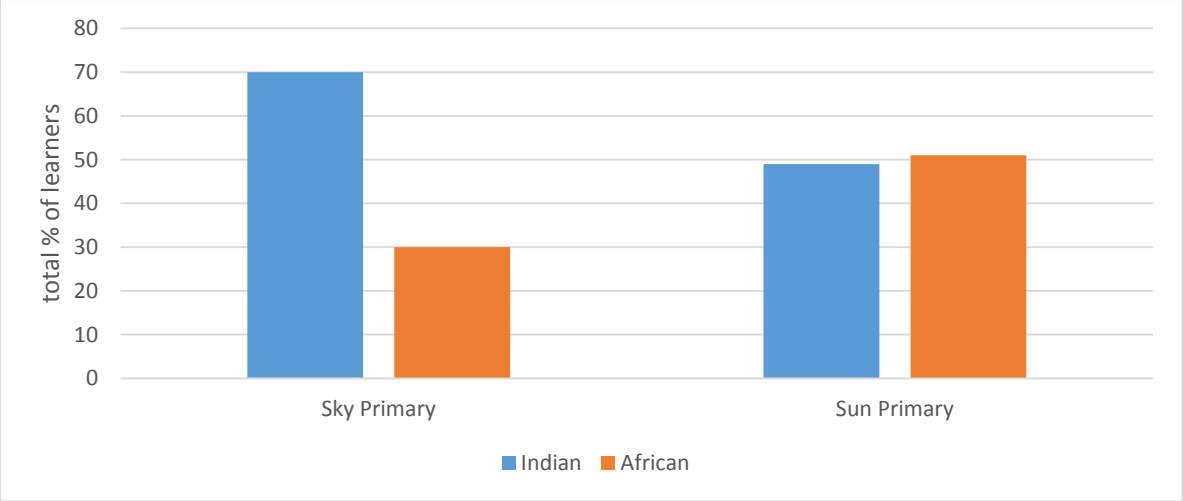


Figure 4.2.2: Racial distribution of learners amongst participating schools.

4.3 Assessment books

Questions two, three and four of the assessment books were used to evaluate knowledge and understanding of content relating to the lesson of water.

Questions from assessment book:

Question 2:

Complete the sentence:

Water pollution is caused by……

Question 4:

What is your understanding of the above picture regarding climate change and water? Which do you think is true?

Question two and four provide an estimation of the level of critical thinking and logical analysis displayed by the learner relating to global warming, climate change and the current water situation. Question two evaluates whether learners are able to explain a basic concept of the causes of water pollution. Question four requires more application and reasoning, critical thinking skills possessed by participating learners, hence the provision of a vague picture.

Table 1: Expected answers from Question Two

Question Two	Answer
Water pollution is caused by….	- Urbanisation (sewage, fertilizers, litter) - Deforestation - Deconstruction of wetlands - Industries - Mining - Agriculture - Accidental water pollution (burst pipes, oil spills)

Examples of actual student responses are presented in Figure 4.2.3 and Figure 4.2.4:

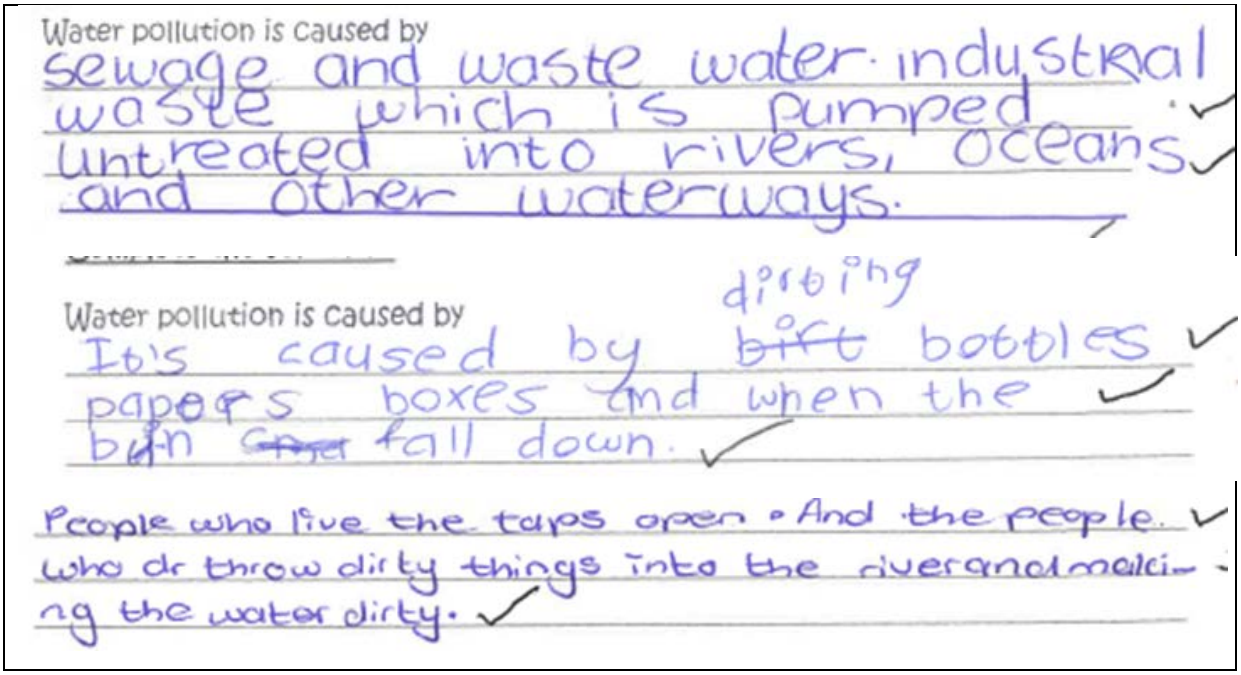


Figure 4.2.3: Responses to Question two from intervention school learners – Sky Primary

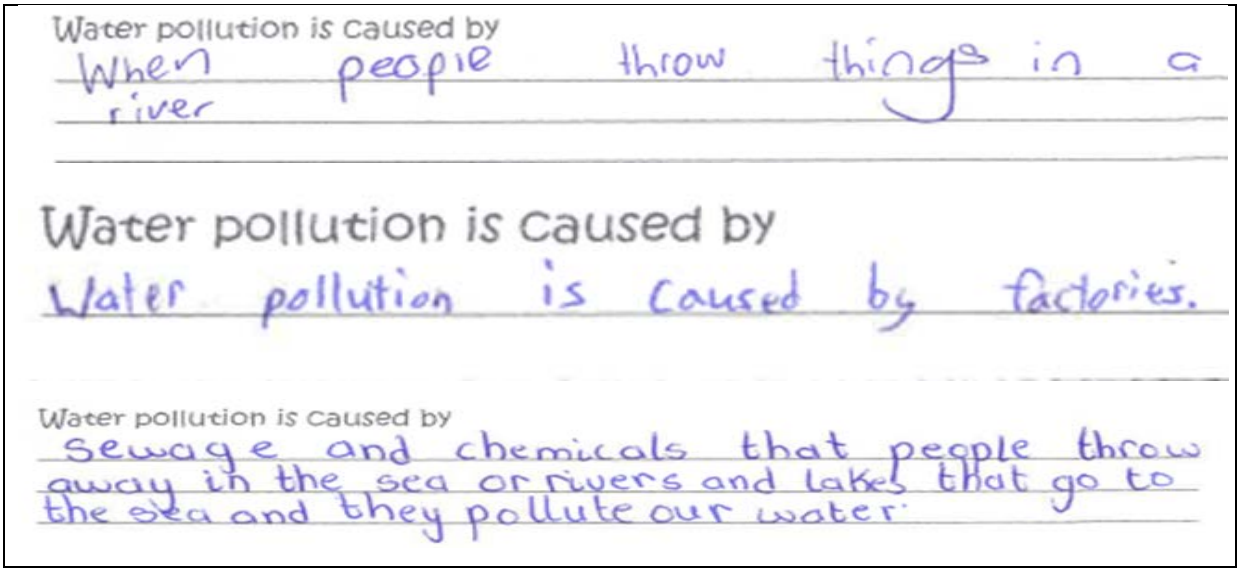


Figure 4.2.4: Responses to Question two from control school learners – Sun Primary

Results showed that the control school (Sky Primary) demonstrated better knowledge retention and understanding of questions assessing critical thinking and analysis skills. Their reasoning and explanations were more detailed showing better grasping of concepts and ability to articulate. Question two required learners to complete the sentence on the cause/s of water pollution. Learners' responses are

similar in both schools although more students gave correct answers in the control school. The answers among students in the control school were relatively consistent. The common answers given in the control school were pollution caused by the community and industrial pollution as key contributors to water pollution. The intervention school provided an array of responses with 78% of correct answers. Eighty-four percent of learners in the control school answered question two correctly. The purpose of this question was to establish if learners were able to identify the basics of water, the source of water pollution. Majority of answers produced by learners were correct. It is expected that Grade 5 learners should be able to answer a question requiring general knowledge. The intervention school yielded 22% of incorrect answers, and the control school, 16% of incorrect responses. There was no significant difference between answers for question two among the intervention and control schools (p= 0123). Although issues of vocabulary and articulation were evident in the intervention school, there was a basic understanding of the concepts investigated amongst learners of both participating schools.

Question four provided learners with two pictures, both depicting effects of climate change. Learners were requested to choose the correct picture which truly represents climate change and water and explain the reasons for their choice.

Table 2: Expected answers from Question Four

Question Four	Answer
What is your understanding of the above picture regarding climate change and water? Which do you think is true?	For the top picture: True for climate change because rainfall is affected by decreased rain received leading to droughts and lack of available water. (Further explanations are accepted) For the bottom picture: True for climate change because rainfall is affected in certain areas by increased and unseasonal rain in high amounts leading to flooding and damage. (Further explanations are accepted).

It was expected that learners would choose the top picture associating drought as a common effect of climate change and global warming. A small percentage of

students were expected to choose the bottom picture. This assumption was based on the recent events of lack of rainfall experienced in the community. It is possible that learners are likely to associate climate change effects with the current state of their environment. Approximately 84% of learners in the control school demonstrated limited understanding of question four compared with 66% of learners in the intervention school. In this context, 'limited understanding' is denoted by the expected answer. Majority of learners in the control school opted for the top picture explaining a drought situation however both pictures are correct and are acceptable answers. For learners to identify both drought and excessive rain as effects of climate change, they must possess an advanced understanding of the environmental concept. Learners must be able to identify both situations, drought and floods, as weather phenomenon as effects of climate change. Based on their lacking ability to identify this, it can be concluded that their current understanding is limited and requires improvement.

What is your understanding of the above picture regarding climate change and water? Which do you think is true?

If we don't ~~so~~ stop ~~puti~~ pulluting The ozon layer will break and whats happening will come true ~~it~~ in the photos

it is true that the top picture is True regarding climate change so as the down picture is also true regarding climate change and ~~wt~~ water

The first one is true because it looks more realistic. It reveals global warming

The climate change the weather to cold, hot, warm, and windy. Sometimes it be very cold. It globle warming Picture A show global warming is taking place. Trees and plants is being destroyed. Picture A is true.

They are true pictures.
It is getting hot.
The ice is muting.
water levels are getting higher and higher.

Figure 4.2.5: Responses to Question four from intervention school learners – Sky Primary

What is your understanding of the above picture regarding climate change and water? Which do you think is true?

I think the first one is true because we are having a drought and we had heavy rain so dams, lake and seas shall be filling up

The weather is changing.
I thats the second picture is true

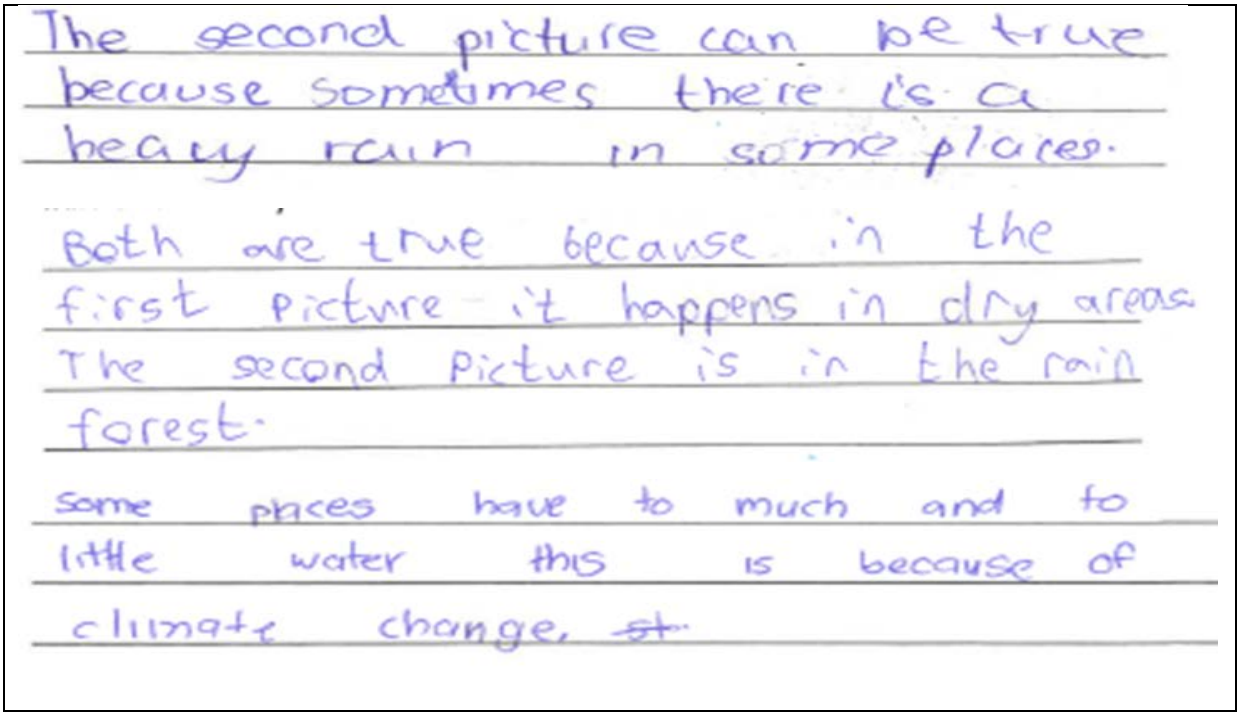


Figure 4.2.6: Responses to Question four from control school learners – Sun Primary

Learners responded with a range of reasons for their choice, with some learners choosing picture A, some picture B and a few indicating that both pictures are true reflections of climate change and water. Both pictures depict effects of climate change, however, based on perceived knowledge and commonly publicised effects of climate change, learners were expected to choose the top picture illustrating drought conditions. A significant number of learners opted for picture A showing a lack of water as they probably related the picture with their current state of drought in KwaDukuza. A small number of students identified both pictures as true but their reasoning was not accurate therefore it cannot be taken as they fully understand the concept of climate change. There is evidence of the introduction of scientific concepts in the classroom but the understanding of these concepts was poor. The distinction of knowledge and understanding between the intervention and control school was not significantly different based on the responses of the learners for questions two and four. There was only one child in Sun Primary, amongst all participants, who was able to identify both pictures as true. The statistical test for question four yielded a p value of 0.706. Therefore, the null hypothesis cannot be

rejected. There is strong evidence suggesting the method of teaching does not directly affect learning as learners in the control and intervention school displayed similar results. These findings are contrary to some research studies which suggest non-conventional methods are more effective than traditional teaching methods (Makrakis, Gkotzos and Larios 2012; Harker-Schuch and Bugge-Henriksen 2013). A study on a larger scale may provide more conclusive evidence to support or reject the initial aim of this research in determining the relationship between knowledge retention and method of teaching used.

Other factors may contribute to the lack of knowledge such as preconditioned beliefs and thinking. The educator is the most important factor to consider. An educator's understanding and beliefs on environmental education as well his/her misconceptions may be imparted to the learners. This has been mentioned by other research studies (Chawla 2009; Plutzer *et al.* 2016). The behaviours and attitudes of teachers' are learnt and imitated by students (Cviko, McKenney and Voogt 2014).

In question two, learners displayed simplistic reasoning on the cause of water pollution with similar answers from both schools. Their observations from the environment as well as their learning in class provided them with the answer to the question. This question evaluated their basic understanding of water pollution. Question four required a greater level of critical thinking and analysis, probing deeper into their understanding of the scientific concept of global warming and climate change. Literature suggests that the element of critical thinking and evaluation is crucial regarding climate change concepts. It is this understanding and rationale which will lead to the desired behavioural changes required for climate change mitigation. Studies related to environmental education and schooling have yielded findings supporting this statement (Uzzell and Räthzel 2009; Chen and Martin 2015; Kabir *et al.* 2015). The education system has been allocated the task of empowering children but they are not making substantial strides in achieving this. Children are unable to talk about controversial issues and educators lack the confidence to engage with learners on climate change concepts. This applies to children globally, including South African children. (Aikenhead 2006; Sadler 2009; Byrne *et al.* 2014).

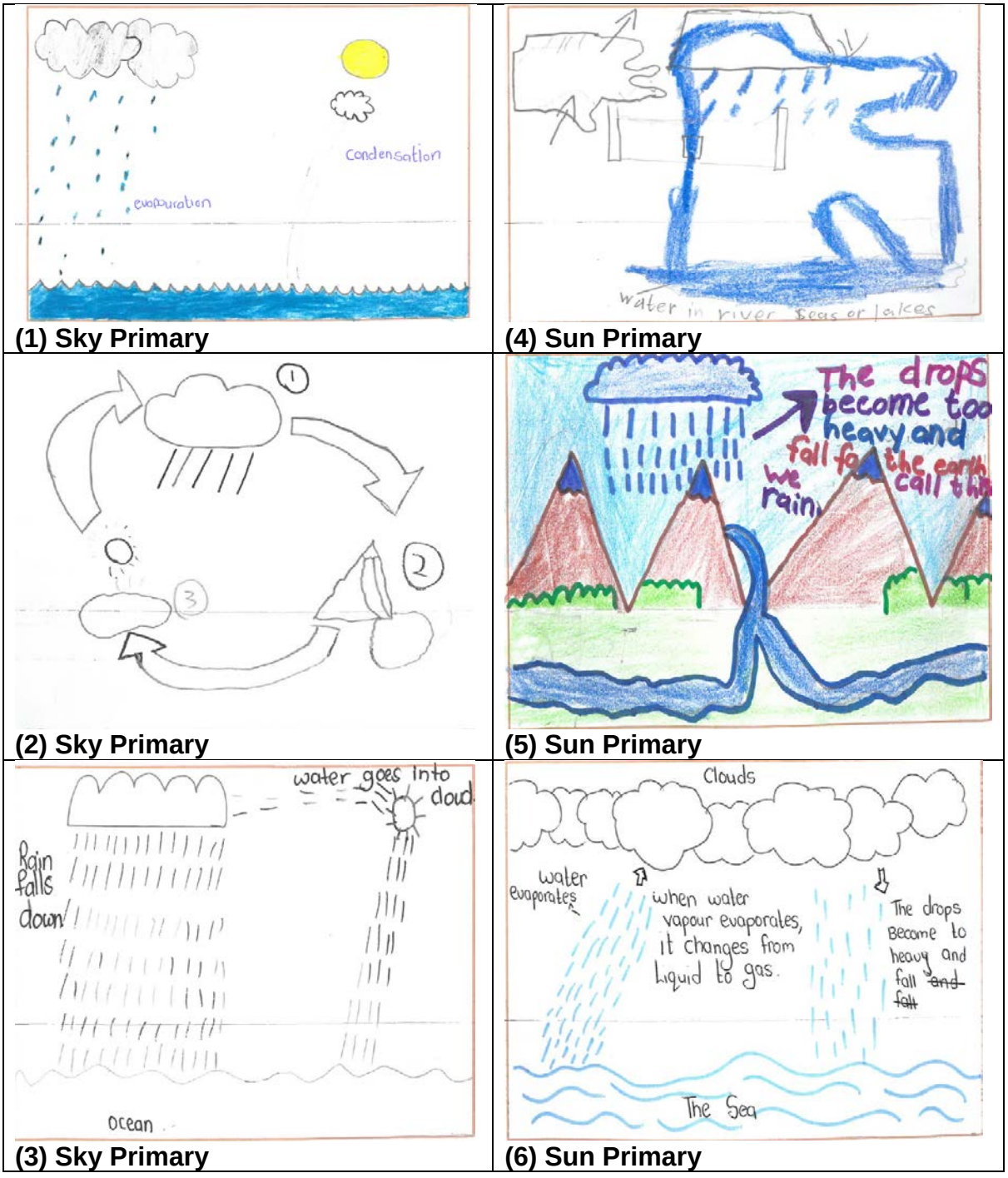
Question 3:

Draw a diagram or picture illustrating the water cycle

Question three was designed to establish the basic understanding of learners of scientific concepts of the water cycle. A marking memorandum was developed by the researcher with possible correct options. Learners were requested to draw a water cycle depicting the main points within the cycle. The figures below display the answers from each school. The inclusion of this question was to assess learners' knowledge of the water cycle. An understanding of the points in the water cycle can be used as an indication of their understanding of the natural processes of water and its stages and the effects of climate change on the water cycle. It can be assumed that this knowledge and understanding will influence their behaviour in water saving practices and in making environmentally responsible decisions.

Sky Primary (control school) scored higher in the number of correct illustrations of the water cycle (72%) when compared to the intervention school (59%). It was assumed that some educators assisted learners with this question as similarities were evident amongst learner responses and educators did mention this in their interviews. There was no statistical significance between the intervention and control school and learners' responses to question three ($p= 0.27$). Sky Primary learners' pictures demonstrated a fairly basic and common understanding of the water cycle with little detail or explanation of the respective concepts. The water cycle pictures provided a range of illustrations and many similarities were noted in the assessment books. There is a possibility that the educator guided learners in completing this question. The key concepts of the water cycle are present in most learners' submissions with at least 60% of total learners with a correct score for the question. This is a limitation of the study as the assistance through revision of the content may have skewed the results.

Examples of the best, mediocre and poorest illustrations from both schools are presented below (Figure 4.2.7). Pictures from Sun Primary learners were more detailed and demonstrated greater understanding although there were a few poor responses such as Frame 4. Both schools' responses consisted of poor, mediocre and good illustrations depicting the water cycle with a slightly better range of responses from Sun Primary, the control school.



(1) Sky Primary (4) Sun Primary

(2) Sky Primary (5) Sun Primary

(3) Sky Primary (6) Sun Primary

Figure 4.2.7: Extracted illustrations from each school: Frames 1 – 3 are from Sky Primary (Intervention school) depicting selected responses for Question 3 (The Water Cycle). Frames 4 – 6 are responses from Sun Primary (Control school).

Table 3: Summary of results for Question Two, Question Three and Question Four

		Sky Primary	***Sun Primary***	***p Value***
Q2	Correct	14	96	0.123
	Incorrect	5	14	
Q3	Correct	13	65	0.278
	Incorrect	5	45	
Q4	Correct	9	47	0.706
	Incorrect	10	63	

4.4 Learner experiences of the teaching method and assessment book

Learners were asked if they enjoyed the respective teaching methods used for the lessons on water and to explain what they did and did not like about the methods used. One (1) learner from the control school stated that he did not enjoy the teaching method while eight (8) learners from the intervention school stated the same. Most learners expressed challenges with drawing and found it difficult to illustrate the water cycle in a poster. It was assumed that learners would enjoy drawing as opposed to writing but this was not the case as established from the responses received. These learners found it difficult to illustrate the water cycle and methods of saving water. This may be due to their lack of understanding the process of the water cycle and sequence of concepts and the challenge of demonstrating this knowledge through illustration. It was anticipated that learners would not find it difficult to create a poster on ways to save water as it requires general knowledge.

Learners that have not previously been exposed to activities that require certain application or analytical skills may encounter those tasks as difficult. This may not be due to the level of the task but the inexperience of the learner in engaging with such exercises. Exercises involving deep thinking, critical skills and analysis are not common as the conventional teaching method used by educators is the chalk and talk approach or textbooks. An inclusion of these though provoking methods require educators to intentionally opt for this teaching approach for selected lessons. The water cycle required memory and understanding to provide details of each step, and logic and creativity which learners found challenging. The poster required creativity and general knowledge of daily activities in their homes. It is unsure which of the above aspects posed a challenge to the learners in hindering them from completing this task. A slight difference can be noted in the results of learners from the control school. The study sample consisted of an even distribution of racial groups. However, the socio-economic status of learners may have contributed to their willingness and enthusiasm for education and learning.

The intrinsic motivation and passion for the subject also plays a crucial role in lesson delivery and enjoyment of the teaching method. An improvement of cognitive learning, motivation as well as behaviour of learners has been associated with educators' enthusiasm (Keller *et al.* 2014). A small group of learners in the

intervention school stated their dislike for the intervention regardless of the innovation and excitement introduced through the activity book. There is a similarity of results from both schools regardless of one receiving the intervention. This directs us to the possibility that the method of teaching may not be the greatest determinant for knowledge retention and understanding related to environmental education in the subject of Life Skills. These findings oppose research studies which advise that environmental education teachers should adopt appropriate teaching methods(Kose *et al.* 2011). (Clarke, Triggs and Nielsen 2014) explained that teacher competence is the ability to evaluate curricula, teaching methods and materials and apply to achieve the objective of environmental education. These studies elude to the importance of selecting appropriate teaching methods to ensure effective environmental education.

This finding forms the basis for the enquiry into educators and the evaluation of the educator as a factor. Jurik, Groschner and Seidel (2014) argue that educators are key characters in environmental literacy. Knowing the personal and professional background of the educators, assists in understanding their pedagogy. Several researchers have looked at the educator and their role in environmental education particularly teachers' beliefs and environmental education. It is their belief that incorporates teaching material choices, teaching process, teachers' inner thoughts, self-reflection abilities and personal self-actualization amongst other factors. Therefore, educators' beliefs are directly liked to and includes the selfhood of the educator (Canrinus *et al.* 2011; Yuan *et al.* 2017).

CHAPTER FIVE
QUALITATIVE FINDINGS

This chapter presents responses to the research questions, "*How does the selfhood of teachers of Life Skills influence teaching in environmental education?"* and "*How does the selfhood of teachers of Life Skills influence learning in environmental education?*" These questions focus on the subject matter knowledge and pedagogic knowledge of educators drawing on Shulman and his theoretical framework on professional knowledge base and pedagogical reasoning (Calderhead 1987). It is Shulman's categories that form the theoretical framework within which the qualitative findings are discussed and analysed. The aim of the research is to establish the connection between educators and how their selfhood (personal experiences and their thoughts/ideas) influences the delivery of information on climate change environmental education. Educators have been influential in transferring their beliefs of environmental education to their students from either a favourable or unfavourable perspective (Plutzer et al. 2016).

Understanding the personal and professional aspects of the educator is important in understanding his/her stance on environmental education. (DeWaters and Powers 2013) explain the factors in teacher belief include past experiences, professional background, personality traits, teaching seniority, social background and family factors amongst others. These factors will be evaluated in the study and referred to as the selfhood of the educator. Educators' thinking, judgement and decisions are influenced by their beliefs. (Hossain and Tarmizi 2013) suggest that teachers' teaching belief is formed before entering teacher training institutions.

Parker Palmer's theory assisted in understanding the importance of selfhood of the educator which plays a crucial role in the relationship between the educator and learner and educator and subject (Palmer 2007). Tsikata (2017) explains that teaching from a place of denying one's selfhood is an alienation of one's identity anchors and "confounds the pedagogic encounter". He also refers to Palmer in explaining the pedagogical process as an interrelationship between the self, the subject and the student (Palmer 2007). Integrity and Identity are at the foundation of selfhood (Tsikata 2017).

This theory aligned with Shulman's Theory in understanding that the PCK of educators includes the factor of selfhood which informs the educator's knowledge base. Shulman's Theory of the knowledge base of an educator together with Parker Palmer's evaluation of selfhood of the educator, provides a well-rounded understanding of the professional and personal aspect of the educator. This information is crucial to the research questions of the study.

The 'who' behind the individual is important as this informs the learning and knowledge one acquires and possesses as an educator. It is also important to note that the educators involved in this study are Life Skills educators who did not opt to teach the subject and therefore may not have the skills required to effectively deliver the subject matter. Researchers have identified an educator's commitment, knowledge of instructional methods and facilitation skills in the class as crucial in teaching Life Skills/Life Orientation (Lamb and Snodgrass 2017). This information is important as it forms the lens through which participants' responses are viewed.

5.1 Structure of the qualitative findings

In this section each educator will be discussed as an individual case. The data elicited from each educator about his/her pedagogical knowledge on climate change and methods will be discussed according to the following themes: educators' subject matter knowledge,' general pedagogic knowledge and pedagogic content knowledge. The findings are presented under two sections: Section A: educators in the control school followed by Section B: educators in the intervention school. Educators at the intervention school were provided with a range of options for implementation in two Life Skills lessons on water. All options were carefully considered to be applicable in any public school setting as discussed in the methodology section of the study.

The concluding section will wrap up the analysis of the findings. The identified themes will correspond with the research questions:

1. How does the selfhood of teachers of Life Skills influence teaching in environmental education?"

2. How does the selfhood of teachers of Life Skills influence learning in environmental education?"

5.2 Section A

The data generated from interviews with educators related to their experiences of working in public schools in the KwaDukuza region. The male educator, Mr Maharaj, teaches Mathematics, English and Science in Grades 4 and 5 in his present school. He also has experience in teaching at secondary level. He has been teaching for 30 years in total. The second participating educator, Mrs Pillay, has taught all subjects at primary school level, specialising in English and Geography. She has 18 years of experience as an educator and has also taught at secondary school level.

Case 1: Mr Maharaj

The selfhood of Mr Maharaj

Mr Maharaj described his initial experiences as an educator during an era when education was the key to freedom. Being born in the 1960's and matriculating in the era of Apartheid, Mr Maharaj explained that teaching was not his first choice. He entered the profession because of the lack of opportunities that were available due to growing up in a low income, marginalised community. Another reason was a great need for quality education within the Indian community. He said:

> *When I got into the profession it was a noble calling, it was an outreach to the community.*

His career choice was never about money and he believes, that regardless of his further qualifications and certificates, there is no mobility in the profession:

> *It wasn't monetary gain on our behalf. We made that sacrifice. I've got quite a few degrees and higher diplomas. Nonetheless there is no mobility because we are caught within the system, but we are working for the community to empower them.*

Challenges

Mr Maharaj can be described as a seasoned and passionate educator who has retained his passion for the profession. When discussing teaching methods he mentions that there are limitations which restrict him from incorporating various teaching methods:

> *We are guided on teaching aspects that are specifically within the CAPS document. We can wonder out but not too much. We have to complete this within a specified time frame and we have to follow a prescribed syllabus. In certain quarters we are doing the basics…the very basic things. What hampers our progress is large class sizes. We are unable to bring them to the library to show them movies because our timetable is structured in such a manner that while we are teaching Life Skills, another class is going on in the library. We do have barriers but we try to overcome these barriers.*

It is worth noting that regardless of the willingness or innovation of the educator, there are uncontrollable factors like the prescribed curriculum, specified time frames and the lack of appropriate physical spaces for engaging in non-traditional teaching approaches which prevent the exploration and flexibility of alternate teaching methods. These are similar challenges that have been found in other South African studies. Large class sizes also pose a challenge. A greater strain is placed on a educator's time in explaining activities, providing the individual attention required when introducing a new concept to students and facilitating the new methods or ideas (Bantwini 2010). Bantwini (2010) also found that the educator-learner ratio in South African schools ranged from 1:50 to 1:80 in some schools.

The hurdle of the stringency of the CAPS document places added pressure on educators. Satchwell (2013) explained that time is an issue in addressing climate change education if it has not been allocated in the curriculum. There is no opportunity to integrate new or innovative concepts, content or methods as the prescribed curriculum does not allow it. It is possible that if climate change is not incorporated into the curriculum some educators would not bother with the topic. (Satchwell 2013).

Lack of resources, such as library access, is a common problem in public schools. This issue is interlinked with the large class numbers where the library sometimes

serves as a classroom for an under-resourced school. These sentiments have been echoed by Bantwini (2010) in his study on South African schools. Schools in South Africa are not all on the same playing field. Some schools do not have technological resources while others do not even have a library. In analysing Mr Maharaj's response using Parker Palmer's Theory (2007), his view of teaching as a service to the community causes him to go beyond his duty as an educator. His choice of the profession was not fuelled by monetary gain and is neither the reason for remaining in the profession for over 30 years.

Mr Maharaj's knowledge of teaching methods

Life situations as a teaching approach

A method of referring to real life situations as a platform for learning and understanding concepts is commonly used by Mr Maharaj. He is a strong believer in using the "everyday" (Roth 2014) as a tool for education and arousing interest from his use of local newspapers, the television news and family discussions about present environmental situations. Mr Maharaj explains:

> *It's very important that learners are not passive within the class, they need to be active. I do create group activities for them whereby they have panel discussions or a quiz and they like that. The quiz is set on questions on water. We talk about us going to supermarket all the time and we buy plastic bags. I encourage learners to tell their parents not to buy these bags. It's a simple thing that could make a difference. If you look around how plastic bags are thrown like your bin packets. I don't understand why we are not using for example paper bags which degrades and gets back into the environment. I think as much as the CAPS document is important, coupled a personal experience will give them a broader outlook in life if I could put it that way.*

Mr Maharaj has supplemented his teaching with real-life examples to evoke thinking and inquiry. He does research and extensive reading to widen his view of the topic covered. He integrates group activities, quiz sessions and creative activities when teaching a topic. It can be said that Mr Maharaj develops his subject matter

knowledge and knowledge of the context through updating himself on the content he teaches. Sund and Ohman (2014) found that when teachers address and analyse their own contexts and experiences, they are able to challenge the concepts of their own situated knowledge and actions as well as global values. His use of quizzes and creative activities can be attributed to his personal professional development and his pedagogical content knowledge. Wood (2003) describes problem-based learning as the use of carefully selected problems to increase knowledge and understanding while developing attributes such as respect, information dissemination, working in a team and effective communication. These methods are particularly useful for the topic of environmental education. The current weather phenomena related to global warming and climate change can be discussed using such methods which will result in a greater level of understanding and retention of knowledge due to its relevance.

Mr Maharaj believes that encouraging learners to think and reflect on their own lives will broaden their outlook on life. Olatundun and Adu (2013) explain that learning occurs when it is practical and applicable from real life settings. Literature also suggests that future efforts be focused on learning objectives supported with practical examples of real-life situations (Porter, Weaver and Raptis 2012). Mr Maharaj has developed the necessary content knowledge and pedagogic skills to incorporate such learning into his teaching. The personal experience of learners provides a basis for them to discuss the environment and its relationship to their daily lives. Mr Maharaj has also gained a good understanding of the knowledge of the learner, one of Shulman's categories for PCK. This understanding assists him, as an educator, in employing the best delivery method based on the needs and profile of his learners. His use of life situations as a teaching approach has proven favourable and effective.

Case studies as a method of teaching

Mr Maharaj explains that learners love to be proactive. This has been his observation over the years from his use of debates, quizzes and case studies in class lessons. Case studies are a major component of his teaching method whereby a relevant and realistic case/situation is presented to learners with leading questions

on comprehension but more importantly on their feelings, opinions and understanding and is seen as a source of empowerment for a child.

> *Supposing we do an example of violence in the home, looking at child abuse. We tell learners their rights. We also give them a case study which is based on learners' experiences for example, the uncle touched the learner, what are the symptoms of it and that it's not acceptable. A whole lot of questions are based on it, just not comprehension – "What are your feelings, what are your opinions, what rights do you have, do you understand?" That empowers the child.*

Schools have been tasked with empowerment of children as citizens but they have not fulfilled this objective (Aikenhead 2006; Sadler 2009; Byrne et al. 2014). According to the literature, for social change to take place stemming from environmental education, a personal learning experience must be present. Environmental education should build critical thinking skills, prioritize problem solving skills and enable learners to understand the sources of climate change (Hudson 2001). Other researchers task environmental education with affording learners the opportunity to engage in interventions linked to psychosocial and ethical aspects of climate change (Harris 2009; Brownlee, Powell and Hallo 2013; Grady-Benson and Sarathy 2015). Mr Maharaj is successful in providing this opportunity for learning to occur through relatable and real examples based on the learner's life. The case study method for environmental concepts may yield a better understanding of concepts and achieve the desired change in individuals' attitudes and practices. In comparison to other methods, the case study method allows for contextual and subject knowledge to be attained, thus altering the attitude of the learner.

Pedagogic Content Knowledge (PCK) of Mr Maharaj

According to Shulman, PCK refers to "*a new type of subject matter knowledge that is enriched and enhanced by other types of knowledge – knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of pedagogy*" (Shulman 1987).

Professional Development

Mr Maharaj often uses the method of discussion in his class. He uses daily news based on key news stories, particularly those pertaining to the environment. Relevance and practicality are integrated into lessons:

> *I try to keep abreast as much as possible especially the news.*

The statement above directly explains the professional development of Mr Maharaj in constantly developing his PCK, particularly his knowledge on curriculum. In maintaining a good knowledge base, Mr Maharaj has a strong foundation of knowledge which informs his pedagogical choices:

> *I encourage them to listen to the news then I ask them questions based on the happenings in the environment. For example, last week the water situation in Richards Bay. There were some very thought-provoking questions that were coming out in discussion.*

Hundal, Levin and Keselman (2014) believe discussion should be encouraged and if properly facilitated by the educator, helps learners articulate their identity through contribution. Discussion also engages students on a greater level and requires active participation. This allows learners to develop their decision-making and debating skills (Scott 2008). The role of environmental education, which includes critical thinking in young learners, aims to equip learners with informed decision-making on environmental issues.

Constructive argument posed by thought-provoking questions lead to opinion cultivations and critical thinking (Harker-Schuch and Bugge-Henriksen 2013). Bromley (2013) explains that active learning provides students with a platform to learn content while developing critical thinking skills. However, for the methods to be effective, there must be meaningful talk and listening on the subject matter. These are simple and implementable pedagogical methods that can be employed by an educator in any school setting which will achieve favourable outcomes as demonstrated in similar research studies.

Mr Maharaj enhances and broadens his knowledge through reading, looking at subject material and observing international education and subject trends.

> *I'm teaching this subject for a few years now so every year I try to improve by reading, looking at new material, looking at trends that are set in other countries not only first world countries. I look at problems that first world countries are experiencing and solutions, success stories and failures. So reading is very important.*

The educator's self-directed inquiry and learning assists in learning and improving his/her pedagogical content knowledge to deliver the knowledge and skills required by learners. Mr Maharaj improves his knowledge on the subjects taught and his professional field by reading relevant content. A simple, yet empowering tool of reading relevant literature may assist educators in keeping abreast of their profession and increasing their level of knowledge and skills. Educators tend to be reluctant in engaging students on topics of environmental issues and climate change because of their pedagogical insecurities and lack of knowledge and understanding (Satchwell 2013). Some educators find it challenging to translate scientific facts into social change with problem solving skills and advocacy (Stevenson 2007; McNeal *et al.* 2014). Consistent training will equip educators with the confidence they require to initiate and conduct activities relating to environmental education. Mr Maharaj emphasises the need to be updated on subject matter and teaching content.

A contradictory statement made by Mr Maharaj below is an indication of his willingness and ability to identify these possible options for lesson delivery. The reason for not using these resources is unknown.

> *There will be new activities that we can look at to enhance the lesson. We've got the facilities like the projector, we can possibly show them films, and we have a television we can show them videos. I think that will enhance their lesson and leave a lasting impression on their minds.*

The use of a projector or television is a good audio-visual medium to captivate learners. Catering for the needs of visual learners is a common practice in education. The aim is to enable the learner to achieve academic success through a learning style which is favourable for the unique learner (Rogowsky, Calhoun and Tallal 2015). Sternberg, Grigorenko and Zhang (2008) argue that educators should consider the needs of learners and their different learning styles when selecting and developing instructional resources. While some learners may learn effectively by the

chalk and talk method, others may grasp concepts better with the use of pictures or a video. Learners think and learn by one of two equally important styles: personality-based and ability-based. For educators to make this decision, they must have sound pedagogical content knowledge on which they base such choices. An educator without an established knowledge base may be ignorant of the variety of learning styles available. Thus, knowledge of the learner and knowledge of pedagogy is crucial in educators' choices.

Mr Maharaj's Knowledge of the learner

Specific pedagogic methods have been identified as yielding greater results in captivating the attention of learners and enhancing their understanding and knowledge. One of these methods is the use of multimedia to deliver a lesson. Mayer and Moreno (2003) define multimedia learning as the use of words and pictures for learning. For meaningful learning to occur, learners must be able to construct a mental model of what is learned, recall what was presented in a lesson and solve problems using the material presented. Meaningful learning is explained as an in-depth understanding of content, leading to mental organization of the information into a rational cognitive structure and integrating it with previous knowledge. Consequently, for learners to experience meaningful learning, the choice of multimedia is important.

Mr Maharaj's perceptions of how learners experienced the assessment book:

> *I think many of them were lost or confused. I think it was a very good exercise but I think what we need to possibly do is make it more parent and learner friendly so that there won't be any suspicion and they will be able to answer it with freedom.*

His use of the words, "suspicion" and "freedom" stem from the fact that the participating learners and their parents had not been involved in a research study before. Parents found it challenging to understand the consent form and the basics of a research study. This was a fairly new concept for parents who had have never participated in a research study prior to this. The learners' sense of wariness may have developed from their parent's confusion or from their own novice participation.

Sections on water were done through worksheets that the educator developed as supplementary material to the lesson.

> *They had to explore the importance of water and why we need to conserve water and the future trends in this country. As a result, we were looking at scarcity of water and ways in which we can save water which is very important. We don't have much time on this, we are working with a fixed period of time as per the CAPS document. We got learner feedback and their experiences but they really enjoyed it in the sense that they realised water is very important for their survival, for their existence, for food and for their recreational purposes.*

The sourcing, development and administration of the worksheet enhanced the lesson and was undertaken because of the interest and passion Mr Maharaj possesses for the learners and the profession. The use of worksheets was one of the options of the intervention that was supplied to the intervention school and not the control school at which Mr Maharaj was an educator. A point worth noting is that Mr. Maharaj had chosen to supplement his teaching with an easily sourced and feasible resource. The learners were able to assess the method and added that they enjoyed it and achieved the purpose of delivering knowledge and understanding of the content. Worksheets are an easy and accessible method of supplementing a lesson with a fun activity. Crosswords, word search and other methods of learning using worksheets provide learners a refreshing addition to the conventional and monotonous classroom learning style. The choice of method used by Mr Maharaj is informed by his pedagogical content knowledge through his years of teaching and personal development of his knowledge base as an educator.

It is evident that the sub-categories of pedagogical content knowledge, namely, knowledge of the learner, knowledge of curriculum and knowledge of pedagogy have all been developed in the case of Mr Maharaj through formation of a rich knowledge base from which he operates as a passionate and well informed educator. His development through personal edification, continuous learning and learner observation have contributed to the development of Mr Maharaj over the years, whether intentional or not. In increasing my understanding of the role of self in the life of an educator, It is also evident that the selfhood of this educator played a

crucial role in his intrinsic motivation to view his occupation as a service to his community and that passion was still evident in his voice. His attitude towards the profession manifests in his eagerness to go beyond what is expected of him and encourages him to do more even in the face of challenges. It is selfhood that enables Mr Maharaj to discuss and deliver content, on a personal and relatable level, to the learners to ensure learning is achieved through the most favourable medium possible.

Case 2: Mrs Pillay

The selfhood of Mrs Pillay

Mrs Pillay had hoped to become a lawyer and completed her first year of law but was unable to follow through with her professional goal. She started a family, and due to personal commitments and complications she chose to become an educator. Her husband stated that the vocation she chooses should allow her to take care of her children. Mrs Pillay then settled on teaching as this was the only profession that allowed for that.

Her love for kids and enjoyment in working with them fuelled her decision into teaching.

> *It gives me an overwhelming feeling of satisfaction to know I've made a difference, a positive difference in the life of not just any learner but a weak learner.*

Drawing on the aspect of selfhood, it is the strand of love for law and her goal to make a difference that motivates Mrs. Pillay to assist weak learners. It is also this sense of satisfaction that has kept her in the profession for 18 years. Educators that find satisfaction in their jobs display care and sincerity in their work. Job satisfaction is said to display devotion by an educator, determined to achieve his/her objective. Educators tend to demonstrate greater commitment to their role when they experience job satisfaction. (Dhull and Jain 2017).

Mrs Pillay's current method of teaching has enabled her learners to work well in completing the assessment book:

> *I think it's the way I've been teaching them so they understood it and they could relate well to it because they already had prior knowledge apart from the booklet impressing a bit more on the subject. They enjoyed filling it, they enjoyed completing it and obviously it had to reflect on what they knew and think a little bit harder and it groomed them. It would work perfectly well because it cuts across level 1, level 2 and level 3 thinking, reasoning and comparing and that's how we need our kids to think on any subject. It was a quite a good booklet that was designed.*

A point worth noting is Mrs Pillay's personal thinking (selfhood) which influences her teaching. It is this advanced level of reasoning and critical ability that is scaffolded into her pedagogy which may be rooted in her "lawyer" approach to content and the importance she places on it.

Challenges faced by Mrs Pillay

The lack of internet access in Mrs Pillay's school prevents her from using visual learning techniques which may be a more effective learning tool for some learners. Visual teaching methods have demonstrated learning amongst learners through animated videos, drawings and cartoons (Oluk and Özalp 2007; Vethanayagam and Hemalatha 2010; Reinfried, Aeschbacher and Rotterman 2012). There is a difference in the learning styles of different learners. Some learners may enjoy reading and textbook instruction while others may find visual methods more effective in knowledge construction and understanding:

> *They don't take much too audio but as soon as you put up a picture there you go they are all interested. That for me is disappointing. There are so many ways we can teach a subject except just chalk and talk and write notes. We are always backstopped because of our resources. We are just as ambitious and technologically inclined to the changes but we don't have the resources.*

The willingness of Mrs Pillay is evident but little can be done to overcome this particular challenge in public primary schools. A study conducted in the North-West

province investigated information and communications technology (ICT) usage in rural schools. It was discovered that it is not a given that multimedia will be integrated by educators where these resources and infrastructure are available. The willingness and capability of educators to incorporate multimedia in lessons is a vital factor for its success (Bester 2016). A lack of professional development and training of educators may pose a challenge even where such resources are available. The pedagogical knowledge of educators must be on par for such resources to be adequately utilised. Non-electronic material such as photos, maps, newspaper clippings and pictures are other forms of multimedia that are more easily available and accessible to supplement a lesson in the absence of computers and the internet. This is a viable option in such schools where resources are limited but educators must be willing to incorporate these into teaching, as evident in the case of Mr. Maharaj and Mrs. Pillay.

Mrs. Pillay's Knowledge of teaching methods

Discussion

Talking and reflecting on situations are common methods used by Mrs Pillay in delivering a lesson to evoke a feeling of appreciation and awareness on environmental issues amongst others:

> *Let's just reflect first, what our lives would be like if we didn't have the commodity of water. And for the children to basically go back and reflect and appreciate.*

This valuable skill of teaching learners to reflect and appreciate is key in attaining environmental education and advocacy. Mrs. Pillay's technique of delivering the subject content and linking with reflection on daily practice and life, is effective in teaching learners to become environmentally literate citizens. For a change in practice or behaviour to occur, one must be able to relate learning to his/her personal life and transform learning into action. Such a level of self-reflection is encouraged by Mrs Pillay and learners are allowed the space and opportunity to do so.

This method of teaching is the basis for further brainstorming, exploration and discussions of the learners' experiences of any subject. Mrs. Pillay explains that her approach has proven to capture the attention of her learners and intrigue them, allowing for the lesson to flow thereafter. She has noticed this effect on her learners and she achieves this by ensuring that her lessons are fun and interactive. An example of her interactive and captivating teaching is:

> *Talking about something that would make them smile…think…giggle…talk and at the same time reflect it to their daily lives. It is selected based on the topic covered.*

Talking can be considered as a medium and tool for learning (Myhill, Jones and Hopper 2005). In the typical classroom environment, learner talk is considered a by-product of learning activities, however it is a significant method in supporting learning: "*talk is one of the materials from which a child constructs a way of thinking'* (Edwards and Mercer 1987: 20). The learning environment created by Mrs. Pillay is one of freedom and provides a platform for learning in a non-authoritarian way. She makes talking, discussion and reflection fun while deep learning occurs. Mercer (1996) explained that talk in the classroom must be carefully guided to facilitate knowledge construction. Talking and discussion alone do not yield favourable results. They must be facilitated by an educator with a sufficient pedagogic knowledge base to use the correct techniques for optimum results. The interaction of learners in talk can assist them in developing and applying reasoning skills. Such opportunities are unlikely to occur in educator-led discussions. Mrs. Pillay creates an environment that encourages students to learn. Brophy (2013) noted that sustained motivation to learn is achieved when students view their learning as meaningful and worthwhile.

By comparing content with their own lives, Mrs. Pillay's learners are engaged in discussions and learning activities that enable them to view the relevance and importance of the subject matter. This approach is known as place-based education which is designed to situate learning in a living environment. The method is based on 'real world learning experiences' and to assist learners in developing an appreciation for the environment and nature (Velempini *et al.* 2017).

Pedagogic Content Knowledge of Mrs Pillay

Knowledge of the learner

Mrs. Pillay's enthusiasm for teaching has led her to embark on unconventional motivation techniques and encouragement as an educator. She related a story about a learner who was struggling to complete a task. With her motivation and support, the learner completed a beautiful piece of work.

> *I saw he's talent come to life just by motivating him and by viewing the evidence of his work. He didn't think he could do it but with motivation he was able to complete the piece of work and do it extremely well.*

Brophy (2013) describes learner motivation as stimulating a learner's motivation *to* learn. In achieving this, educators are urged to encourage "thoughtful information-processing" methods to build skills while learning. Brophy (2013) explains that identified preconditions must exist for motivational strategies to be effective. An environment which is comfortable, appreciated and safe is conducive for a learner to develop a positive attitude toward school, resulting in academic motivation and learning. A picture of such an environment is portrayed through Mrs. Pillay's conversation. Mrs. Pillay's knowledge of the learner as a part of her pedagogical content knowledge enables her to identify and employ the best teaching techniques for learners, based on their needs. She is able to assess the situation and make a choice in order to achieve the necessary learning outcome.

Knowledge of context and knowledge of pedagogy

Mrs. Pillay described other techniques of teaching that she employed such as the method used for the lesson on water:

> *They had to do a survey. They made their neighbourhood more away. They educated elderly neighbours or people with little children on how to be wise in saving water. It was part of going the extra mile in taking what you learn in school and teach it to the community. As a child in school you take your knowledge a step further. We looked at the consumption of water at home to flush a toilet, have a bath, have a*

> *shower, your dishwashing, washing by hand and we compared both even the garden sprinkler, the hose and we looked at ways which water could be saved.*

This type of method may not be applicable for all lessons but was advantageous for this particular one:

> *It was very beneficial because the feedback that came from the kids was WOW. Neighbours and friends commented that they didn't think there was another way of doing this. They also shared their ideas and views. I researched this and in countries like Australia there are two drain lines where one goes for recycling water. They shared this information with their parents and other people. Even the plumbers found new ways of doing things. So the lesson that started from this research went to the class and beyond the class.*

Mrs. Pillay's enthusiasm for teaching and extending the boundaries of learning is a refreshing case of an educator who wants to ensure that knowledge retention and life-changing learning takes place. Bantwini (2010) identifies lack of parental support as one of the challenges faced by South African educators. Research has shown enhanced academic performance in learners whose parents are involved in their children's education out of school (Matthews *et al.* 2017). Educator-parent relationships are critical in the development of schools and communities. Similarly, where environmental concepts are concerned, such learning is ideal to achieve the understanding and change required in individuals.

The role of self is a major influence on Mrs. Pillay as an educator. It is a strong driving force behind her teaching choices and the kind of learning environment that she offers her learners. The challenge of resources was also mentioned by Mrs. Pillay but she has overcome this by being innovative in her approach. She used a cost-free pedagogic method such as a survey to complete what would have been an otherwise monotonous chalk and talk exercise.

5.3 Summary of Section A

The challenge, highlighted by both Mr. Maharaj and Mrs. Pillay, is the lack of resources. Mr Maharaj mentioned the lack of access to the library for multimedia use as a challenge while Mrs Pillay attributes the lack of internet access which prevents her use of innovative techniques. The unique challenge that Mr. Maharaj faced related to the CAPS document which is restrictive and time-consuming. The document prescribes the content to be covered by the educator and the time frame in which to do so. Large classes are a compounding factor as the issue of time, the amount of work and managing the high number of learners proves a difficult task for educators. These issues were not mentioned by Mrs Pillay but are also applicable to her. Both educators seem to derive a great deal of passion for teaching from their selfhood. While Mr. Maharaj sees it as a calling and service to the community, Mrs. Pillay's love for the legal field motivates her to be an advocate for weak learners. Their content knowledge is richly developed as both educators have been in the field for many years. Both educators have a vast knowledge base because of their personal professional development and the efforts they make as individuals in keeping updated on content, researching subject matter and being innovative by making use of free resources such as the newspaper, worksheets and quizzes to supplement lessons.

Environmental knowledge was not a speciality or area of expertise for both educators although they did have a basic understanding of key concepts. This challenge can be overcome by educator preparedness through workshops and training to ensure educators are knowledgeable enough to have open discussions with students with confidence in their knowledge of the content discussed. Teachers do a disadvantage to students when teaching environmental education when they are not equipped, personally or professionally (Sund 2015). This knowledge can further inform their PCK to ensure environmental education is delivered optimally. The findings from the participating educators assist in answering the research questions of the study and understanding the pedagogic knowledge of climate change education of Grade 5 primary school educators in the specialisation of Life Skills, and in finding out what teaching methods are used by participating educators. From the findings of Mr. Maharaj and Mrs. Pillay, it was evident the greatest factor which enabled these educators to do more than was expected was their PCK. It was

their selfhood that led them to place significance on a subject like Life Skills and to ensure that learning took place in their classroom. Both educators used innovative methods and added excitement to their lessons on water; both develop themselves professionally and hold intrinsic beliefs in environmental education.

5.4 Section B

This section will discuss the findings for participating educators from the intervention school. This school received the teaching intervention in the form of teaching method options provided by the researcher to supplement their teaching method for the two lessons on water. Their responses are categorised into the subheadings as done with Section A: Selfhood, Pedagogic Knowledge, and Pedagogic Content Knowledge.

Case 3: Mr. Moodley

The Selfhood of Mr. Moodley

Mr. Moodley's passion for children and his love of sports guided his decision into becoming a sports specialist. It was this undying dedication that has kept him in the profession for 34 years. He went on to specialise in English and Physical Education (P.E). He currently teaches English, Physical Education and Life Skills to Grade 5 – 7 learners in this public school. He says:

> *Teaching has got to be a passion. I have a passion for children and basically I love sports so I decided to qualify as a sports specialist so I can give forth my expertise to these young ones. I'm teaching now for 34 years and if you don't have that passion for teaching you'll never get them. You got to have that love because you can't become a rich man in teaching. You can just live life. For me it's a passion that has led me to teach and so many years thus far.*

Mr. Moodley portrays himself as an educator who is in the profession for the right reasons. He refers to the passion that is required to become a good educator. Mr. Moodley refers to the monetary aspect of being an educator. To him, teaching is

visualised as a calling. In Mr. Moodley's opinion, the intrinsic factors required in the profession can only be supported by an educator with passion. Mr. Moodley sees himself as an educator with such qualities. This confidence in his selfhood is evident in his demeanour as an educator.

Challenges of the intervention and assessment book

Mr Moodley described his perception of how the learners took to the intervention.

> *The word search was very challenging to them. It was difficult and they found it hard to find those words. They took it home and completed it. Eventually you'll find some of their comments say they enjoyed it. The children don't enjoy writing. They enjoy drawing, they enjoy colouring but when it comes to answering questions they don't like it.*
>
> *They basically understood. If you look at the water cycle, they did it in geography and I refreshed their mind. I showed them a diagram on the board on the water cycle, how it is a continuous cycle. They saw that, they drew it and they understood it.*

Mr. Maharaj also mentioned similar challenges regarding the assessment book. The issues could be attributed to language differences or the assumption that Grade 5 learners would be able to understand and complete an assessment book of that nature. Mr. Moodley mentions that learners dislike writing and prefer drawing instead. This is a problem worth noting as a Grade 5 learner should be able to apply critical thinking skills and reasoning to their work. Learners' dislike towards completing questions and writing is an alarming finding as learners at the senior phase should be accustomed to such activities. Mrs. Pillay mentioned that her learners enjoyed the assessment book and were accustomed to such levels of thinking and reasoning. Her learners were able to complete the assessment book with ease because they were prepared for it through similar teaching and learning methods. Since the same assessment book was administered to both cohorts of learners, it can be said that the exposure of learners to such levels of questioning was the key difference.

Mr. Moodley demonstrated pedagogic knowledge on the environmental concept taught as he was able to refresh learners' memories on the subject matter. An area of concern, however, is that this does not provide a clear indication of whether or not learners understood the initial lessons on water or received assistance in completing the assessment book with revised answers. Such assistance may skew the quantitative results by not providing a true reflection of the learners' knowledge.

> *They misunderstood the questions on global warming where you look at the two pictures. One picture - the oxygen is depleted, not much water, no trees. They didn't understand that. It was basically on a too high level for them. They answered it after I did tell them that this is global warming. I explained the pictures to them then they understood.*

The pictures in the assessment book both depict scenarios of global warming. The effects are different based on the geographical location. Some areas may experience erratic rainfall resulting in floods while others may experience extreme heat resulting in drought conditions. One picture was of a drought-stricken area while the other was a flooded area. The question was created to determine whether learners knew that both conditions can be caused by climate change.

In Mr. Moodley's explanation of the pictures to the learners, it is evident that although he has basic pedagogic knowledge (of the water cycle) he does not have sufficient subject matter knowledge to answer the question in the assessment book. This is evident in his comment that the question was pitched on too high a level for learners to understand. This is a concern because Mr. Moodley did not mention any professional development activities that he is involved in to add to his knowledge base or prepare him for teaching content. Glomo-Narzoles (2013) explains that it is essential for teachers to constantly learn, to accept new knowledge, improve teaching and enhance professional knowledge and competence.

The concept of global warming and climate change is not new and educators have had very little, or no training and instruction on the subject (Bantwini 2010). It is assumed that educators are knowledgeable about climate change, its related concepts of causes, impacts and solutions and that they will be able to integrate such knowledge into teaching. (Anyanwu, Le Grange and Beets 2015). Educators participating in a study in Kenya displayed low levels of climate change awareness

and evident discrepancies in their understanding of the concept (Ochieng and Koske 2013). Similar findings were discovered for participating educators in Nigeria (Nwankwo and Unachukwu 2012a), Australia (Boon 2010) and Gauteng (Vujovic 2014).

Obstacles faced by Mr Moodley

The resources of the school and social realities of the learners are challenges experienced by Mr Moodley. He highlights the need for more resources that can assist in crafts and creative learning. Many educators, like Mr Moodley, use learners' experiences as a means of teaching certain content. This is an indication of Mr Moodley's ability to use his knowledge of the learner to make lessons meaningful to learners in the face of resource challenges.

> *We find that some children don't have tapped water they have to walk distances to collect water. We teach them how precious water is and about the present drought*

From this statement it is evident that Mr Moodley holds an intrinsic belief that water is a precious commodity. This is important to note as his personal belief reflects the emphasis he places on the subject.

Educators are also faced with the challenge of large classes:

> *Most of the cases we have 1:48 and our classrooms caters for 40. If you look at the desks in the classroom I teach in, it is one long fixed table, it creates a problem concerning group work. With Life Skills, group work is very important. They get into groups and they discuss a certain aspect then they have to come in front and present.*

This has been highlighted as a major challenge by Mr Maharaj as well. The large classes place huge demands on the educator's time. There is not enough time to provide individual attention to those learners that require it the most, resulting in frustrated educators and learners. It is evident that the issue of time was a concern in both participating schools regardless of resources and the individual educator. One of the three educators already discussed in the findings, integrates innovation

and supplementary content into lessons regardless of the time constraint. Educators in a study in Maldives mentioned lack of adequate resources, low morale and insufficient time as hindering factors when teaching Life Skills Education (Zahir 2018).

CAPS document

Mr Moodley has a positive view of the CAPS document and believes that it is a well-structured lesson guide; however, it is designed for the "ideal" school and unfortunately many public schools are not at that level.

> *The CAPS documents is very well structured. The lessons are well done. It's an ideal situation. But not all schools have an ideal situation. It all depends on the environment, it depends on the school and unfortunately we are a different school and in different schools, children react differently.*

Mr Moodley seems to enjoy the prescriptive nature of the CAPS document. Although he finds the structure and direction advantageous, he does not see it as implementable in the general public school. From his experience, the environment and the school are not ideal to adopt CAPS. It can be assumed that he is referring to the lack of resources in his school. He explains that the reaction of the children to the CAPS document differs in different schools. The content is standard and it is subject knowledge which a learner must possess within that grade to be promoted. Little of the CAPS document prescribes how the content is to be delivered. This leaves an opportunity for the educator to use his/her PCK - knowledge of pedagogy, knowledge of context and knowledge of the learner in determining the method of lesson delivery. As observed in Mrs. Pillay's case, costly resources are not mandatory in ensuring that the lesson is delivered in an innovative manner that can even transcend beyond the classroom. It is purely based on the PCK of the educator to make well informed choices.

Mr. Moodley's words sum up his idea of teaching in under-resourced and challenging circumstances. He views the added administrative duties as deprofessionalisation:

> *Well, if you think of it, life is a challenge and the decision is in your hands. It's what you do that's very important as a educator. And I must emphasize, teaching has become difficult. It has become stressful, a lot of paper work. Emphasis has become more on paperwork than anything else. When we started teaching it wasn't. It was emphasis on learning and teaching, now the emphasis is on paperwork and as a result it has killed the culture of learning.*

An undertone of demotivation can be detected in Mr Moodley's comments above. The culture of learning has been "killed" by the requirement of educators to undertake a vast amount of administrative work, demanding more time from the educator which should otherwise be used in teaching. While educators, like Mr. Moodley, recognise the agency that they have to make decisions that make teaching and learning productive, they acknowledge that the schooling culture is one that contributes to educator de-professionalization (Hargreaves and Dawe 1990). The focus has shifted from educators and their systematic organisation of learning to administrative work and 'busyness'. Such expectations are deprofessionalising.

Mr Moodley's knowledge of teaching methods

Outdoor education

Mr Moodley explains that he has always taught using methods that are similar to the intervention.

> *Basically that's how I've been teaching. I believe in taking them outside. When I do pollution we go on a walk. We use the environment and we look at the things that's in the environment that causes pollution. We look at the sky, we look at the smoke that's coming out of the factory, and we smell the air. We use a hands-on approach, that's how they learn Life Skills so with a hands-on approach, the children really learn. Actually that's what educators are supposed to be doing as part of teaching. They have to give worksheets and give enrichment exercises.*

Mr Moodley uses the outdoors and nature as a tool for teaching and learning. These methods require pedagogic knowledge to facilitate and inform discussion, without which such exercises are merely observations and will lack sound scientific reference from which environmental education of the learner will occur. Discussions need to be directed involving the concepts of climate change or global warming with reference to learners' reflection on their behaviour and action for environmental literacy and advocacy to occur. The educator must have a thorough pedagogic content knowledge and understanding for this to happen. In 1986, Priest defined outdoor education (a variation of a 'hands-on' approach) as a holistic term based on six major points; (1) it is a method of learning; (2) it is experiential; (3) it takes place primarily outdoors; (4) requires the use of all senses; (5) based upon interdisciplinary curriculum matter and (6) relationship between people and natural resources (Priest 1986).

The life experiences of Mr Moodley

Mr Moodley's teaching methods demonstrate the practicality of the subject of Life Skills and its relevance to everyday life. He uses life experiences to develop the learner and it is in this developing process that Mr Moodley finds joy in the profession. He feels a Life Skills educator requires a distinct set of skills to develop a learner's life lessons. Educators' characters and moral standards are factors that present immense challenges in the delivery of Life Skills. Life Skills educators need to uphold good values to qualify to teach the subject matter (Prinsloo 2007).

Listening and comprehension

A useful resource used by Mr. Moodley is a tape recorder for listening and comprehension lessons.

> *If I've got a story that brings a moral, they listen to it. I question them and we discuss it and they answer questions*.

The use of a tape recorder seems conventional when compared to resources used by educators in the control school and to a degree, quite primitive. Bromley (2013) agrees that active learning requires a platform for meaningful talk and listening.

Mr Moodley's Knowledge of the learner:

> *When it comes to working with the average and below average we haven't got much time because of the class size but it would be an ideal situation if we could work with the below average. That is where we are having a problem. Basically we find that literacy is still a problem in this country. Many of them still can't read. They are in Grade 5 but they still can't read. They can't recognise basic things.*
>
> *I've got four learners in my class who still can't read to this day, no matter how much you do they still can't read and this is because of the language barrier. They isiZulu speaking and they come to an English school and they are battling.*

An element of blame is conveyed by Mr Moodley in the excerpt above. Learners are perceived as a hindering factor in their own learning. A possible reason for the frustration of not being able to have all learners on the same level, is the lack of time previously mentioned by Mr Moodley. He mentioned that although ideally more time should be spent with the average and below average learners, constraints of time do not allow it.

Mr Moodley can be viewed as an educator that genuinely wishes he could help these students, but even the most enthusiastic educators are rendered helpless in the overwhelming demands of each day. He makes a sincere effort to ensure that all learners are learning. He attempts to introduce innovation, such as outdoor observation, despite the resource and logistical challenges.

Case 4: Mrs Ramkilawan

The selfhood of Mrs. Ramkilawan

Mrs. Ramkilawan has been teaching for 22 years and has experience in both public and private schools. She teaches every subject in the intermediate phase and has spent at least half her career teaching in the current school. She chose teaching as a career because if the convenience of the working hours and holidays which coincided with her children and her husband's (also an educator) schedule.

Obstacles faced by Mrs Ramkilawan

She lists one of her challenges as parent involvement. Parent interest in learners' schoolwork has diminished. Many parents place sole responsibility on educators to adequately educate their children with little or no reinforcement at home.

> *You have to be very guarded as an educator. You don't know when to care. This is what you need to do, you do it at home, and I'll mark it the next day. It's a thankless job basically from parents and learners alike, an absolutely thankless job. You stand there the whole day, you talk the whole day and you get nothing out of it. Parents say you don't give my child homework and the homework is there but your child doesn't do it. We are blamed for everything, it's "the educator doesn't do this". It's a thankless job. It saddens me, I've loved it over the beginning of my career and now I really wish I didn't do it.*

Mrs. Ramkilawan's response is despondent and depressing. Of all participating educators, Mrs Ramkilawan is the most demotivated and regretful. In analysing the role of selfhood in the life of Mrs Ramkilawan as an educator, her reason for opting for this profession appears to be the key factor in her choice of being an educator. In conversing with Mrs Ramkilawan, her disdain for the profession is evident. The cumulative effects of the challenges and the reality of teaching seem to have dampened Mrs Ramkilawan's passion. The lack of support of parents "*can sabotage even the most well-intentioned reforms"* (Rambiyana and Kok 2002).

Parental support and healthy home environments are not a common occurrence, making nurturing and "life skills" in the responsibility of the school. Mrs. Ramkilawan identifies the type of learners as a challenge. Their socio-economic backgrounds and

lack of parental support place a strain on children and educators. She explains that children are the barriers themselves:

> *They being in school, is not important to them. It's like they couldn't be bothered. They here to finish your day but doing well is not important. The barriers are the children themselves. As I said because we dealing with such large numbers, it's hard to go through with half an hour and 45 children. You don't have even a minute with each of them so it's the best you can do with that time. We have half an hour and most days we don't finish and catch up the next day or next few lessons. We just sit in the class with 45 children, you can barely get through them between the desks and get through the day.*

Mrs Ramkilawan blames the learners, calling them "barriers". It could be said that such educators are directing their professional frustration by allocating blame on the learners.

Mrs Ramkilawan's knowledge of teaching methods

Conventional methods – Chalk, talk and textbook

Mrs Ramkilawan explains that the availability of resources dictates the method of teaching for many of her lessons. The lack thereof stifles the creativity and willingness of educators to go the extra mile in making lessons as effective as possible.

> *It's basically textbook, chalk, charts, pictures and magazines. We don't have concrete resources with the learners and even things come from home – very little.*

These challenges, expressed by her, can be interpreted as excuses as there are ways overcome them. There are educators, in the same situation as Mrs Ramkilawan, who have overcome such challenges

A policy brief mentioned that some of the challenges of the South African education system are overcrowded classrooms with the educator to learner ratio 1:32, high dropout rates, poor educator training, poor support of learners at home and a lack of

resources (Modisaotsile 2012). Mrs Ramkilawan describes her impression of the learners regarding the assessment book:

> *It was a good exercise for them, they enjoyed your activities. It was very positive for them. My point of view, it was very exciting for the learners to have completed all your crosswords and colouring in and posters. So it was good for them.*
>
> *In general, they love that…colouring, drawing, word search, they just enjoy it so that was basically it. The activities were stimulating for them.*

Mrs Ramkilawan had a positive view of the intervention and assessment book as experienced by the learners and herself. The learners seemed to enjoy the challenge, particularly since it involved colouring, drawing and a word search. This is similar to Mr Moodley's comment on the learners enjoying colouring and drawing instead of writing. This seems to be the norm amongst the Grade 5 learners in the participating classes. An increase in understanding and pro-environmental attitudes was noted when worksheets and small guided discussions were used as an intervention (Theobald *et al.* 2015).

Routine teaching

Mrs Ramkilawan opts for the routine teaching method that she has always used and is reluctant to try anything different. Time is an undeniable constraint for all educators especially in overcrowded classrooms:

> *I have 45 learners…I can't. I wouldn't think of trying something new…45 learners with 45 different emotional states, different backgrounds…I can't grasp trying something new. I do more talking to them and explaining and trying to get that over with.*

It is evident that the large classes dampen the very thought of introducing a new method. It appears that Mrs Ramkilawan is so frustrated that is not interested in being innovative and adventurous in her teaching style. She explains that much of the restricted time period is spent ensuring the subject matter is understood by each learner through talking, explaining and providing examples.

Mrs. Ramkilawan did not provide much information on her professional development or pedagogy. She focused on her feelings toward the profession, learners and parents. Mrs. Ramkilawan does not attempt innovation or supplementing lessons with any new method. She sticks to the routine she has always followed and attributes this decision to all the challenges she faces as an educator. Mrs Ramkilawan has taught in both private and public schools; therefore, it can be assumed that she has been exposed to various teaching methods, resources and environments. This variation in exposure would have contributed to her pedagogic content knowledge. Consequently, it can be assumed that Mrs Ramkilawan has the knowledge base but does not choose to use it to inform her teaching choices. My conclusions have been based on assumptions as Mrs. Ramkilawan did not provide depth or insight in her responses. Holthuis *et al.* (2014) suggest that student interaction (rather than just listening intently) is an important factor in learning. Unfortunately, Mrs Ramkilawan is missing out on this crucial avenue to ensure learning takes place in her classroom.

Case 5: Mr Shaik

The selfhood of Mr Shaik

Mr Shaik is a novice in his career, with only 3 years of teaching experience. He is currently teaching in his fourth school. Coming from a family of educators, he has always loved the profession and is enjoying his journey in acquiring experience along the way. Mr Shaik is a sports specialist but teaches any subject as is a requirement at primary school level.

Obstacles faced by Mr Shaik

When asked about any efforts to introduce a new teaching method, Mr Shaik identifies the challenge of time:

> *Time is an issue. There's too many time constraints so to try something new takes up a lot of time, we try but we stick to what we know best.*

Life Skills seems to receive the least effort or priority when compared to subjects such as Mathematics or English. A similar remark was made by Mrs Ramkilawan who said that she would not go the extra mile for a subject like Life Skills whereas she would for Mathematics or Science. This perception of educators on teaching Life Skills is important in understanding the effort and attention given to the subject. Both educators, Mrs Ramkilawan and Mr Shaik, do not regard Life Skills as important as core subjects such as English or Mathematics. This could be a common perception of many educators who teach Life Skills and the core subjects. Environmental education requires and deserves pedagogic attention but if educators think otherwise, then it will be marginalised.

In discussing the assessment book, Mr Shaik explains:

> *It was exciting for the kids and for me. They were happy doing it. I think the activities that were given were fun and they enjoyed it. For me it was something different, I'll try and use it as I'm going along. You'll see in the booklets, they did do the water cycle, they did a poster, a mini-poster. It shows that they did understand the lesson.*

The intervention was enjoyable for both the learners and Mr Shaik. As a novice educator, Mr Shaik welcomed the intervention. He had a positive attitude towards the intervention and assessment book and reported favourable experiences of the learners. As a novice educator, this participation may prove beneficial to Mr. Shaik in accumulating pedagogical content knowledge and teaching techniques:

> *It showed me how well they took to it. The next time if I have time to do this stuff I'll try it out but the problem is the time and big classes. So if we have the time, I'll do it.*

Once again, the willingness of the educator is outweighed by the daily challenges of the classroom. Mr Shaik enjoyed the support given through the intervention. It is encouraging to know that he would integrate such methods into his future teaching as he is already practising the routine traditional teaching method.

Mr Shaik's Knowledge of teaching methods

Discussion

Mr Shaik tries to make the lesson as enjoyable as possible, highlighting that learners show little interest in learning if something is read from a book or if it is boring.

> *Well we have discussions, you bring up jokes. If you doing something outside, you have to show them that you can also do it. You not only teach them, you have to do it with them so they respect you more and they understand it better.*

These simple efforts have proven effective for Mr Shaik in his short teaching career. In doing activities with the learners, he gains their respect and motivates them to learn from the activity. Although Mr. Shaik has just commenced developing his PCK, he is already aware of the knowledge of the learner. He is able to assess the methods which yield favourable results for certain content or activities. Being a young educator, he uses humour to get through to the learners and gain respect and acceptance from them.

Group work

Group work is a common method he uses for his Life Skills lessons.

> *We've got such big numbers it's easier to work with that. Because we have 46, to individually assess each person takes up a lot of time. Worksheets, assessments and discussions are mostly with English. Maths it's content knowledge. Life Skills it's more outdoors you teaching dancing, singing, sports, things like that.*

Mr Shaik's reasoning for choice of teaching methods confirms his thoughts on the importance of the subject. It seems that the methods requiring little to no preparation or pedagogic effort is reserved for the subject of Life Skills whereas, for English and Mathematics methods such as worksheets, assessments and discussions are used. This may be an outdated perception of subjects and it is necessary for educators to reconsider Life Skills as equally important because it educates learners on issues of life and living.

Pedagogic content knowledge

Knowledge of the learner

It is important for the educator to understand the background of the children:

> *Most of them are from poor backgrounds so sometimes we don't understand they may not come for weeks and we don't know why. So you got 46, each of them with a different story so that's why it's hard.*

This reiterates the need for careful selection of a Life Skills educator who has the character, ability and skills to take these factors into consideration. Mr Shaik is quickly developing his pedagogic knowledge, particularly his knowledge of the learner as an individual.

Obstacles faced by Mr Shaik

Time and the social realities of schooling are quite overwhelming for a novice educator. According to Nkambule and Amsterdam (2018), educators in South Africa displayed the apparent need for support, particularly relating to delivering the new curriculum post-apartheid. Within the last 15 years, 1997 to 2012, South Africa has experienced four curriculum reviews. Currently, CAPS is the current system and provides clear guidelines for educators. However, the only support educators, in South African schools, receive are through workshops.

Educators in the intervention school seem to experience the same challenges as those in the control school. Time constraints and lack of resources are factors that pose the greatest challenge for educators. These time-constrained, administrative-burdened, resource- restricted educators explain that they can barely complete their syllabus let alone introduce innovation into their teaching. Two of the three educators mention the low ranking of Life Skills on the scale of important subjects. Mathematics and Science are perceived as more valuable subjects that require more effort in teaching. Therefore, Life Skills is not allocated much investment in time or personal interest by these educators.

In providing answers to the research questions of the study, a rich source of data has been offered by the three participating educators in the intervention school. A variation in attitudes and pedagogy have been noted that affords a deep insight into the thinking and reasoning of the educator and the major role of self in the professional role of the educator. The information provided by the three educators enabled an understanding of their realities. The experiences, backgrounds and personalities of each educator was highlighted as a key influence in the teaching methods and practice of the individual educator. Three very different educators were involved in the intervention. Each one showed a variation of how their teaching method stems from their professional choices, personal experiences and intrinsic beliefs on the content or subject.

The educators who were passionate about the learners and the environmental content made an extra effort to supplement their lessons, to introduce innovation and to ensure learning takes place. For the educator that did not see Life Skills as significant, dedicated less time to the subject and did not make an effort in teaching the subject. These differences provided a wealth of understanding into the selfhood of the educator and the associated factors regarding teaching Life Skills in Grade 5.

Overall, the intervention worked well for the school. It introduced an innovation that was welcomed by all educators and enjoyed by all learners. The intervention was implemented with ease by all educators with no challenges. The challenges arose for some learners in completing the word search intervention and the assessment book. This was due to their misunderstanding of certain questions and general difficulty experienced.

5.5 Table 4: Summary of qualitative results

	Intervention Group	**Control Group**
Practices/Teaching methods	- Outdoor education and observation -Case studies and real life, everyday situations - Teaching supplements (Worksheets, tape recorder, newspaper articles and tv news) - Group work	- Case studies and real life, everyday situations - Teaching supplements (Worksheets, tape recorder, newspaper articles and tv news) - Group work, panel discussion, quizzes and debates - Community Survey
Challenges	- Lack of resources - Large classes - Poor infrastructure in classrooms prevent group work - Administrative tasks - Lack of parental support and involvement	- CAPS document and limitations - Large classes - Lack of resources and/or availability thereof - Lack of technology i.e. internet and audio-visual equipment

5.6 Educators' Input

All participating educators are currently making the best use of resources that are available and using innovative teaching methods. The common method used is chalk and talk. Some educators use more hands-on approaches, thought provoking discussions and everyday real life situations to teach Life Skills content. The latter method may be most favourable for such a subject as the content is intended for improving their lives. Other educators use more hands-on approaches such as surveys, motivation and case studies as complementary teaching methods. In doing so, a sense of ownership and accountability is developed in these learners as they see the consequences of such issues in their day to day lives. In all the participating educators, a sense of restriction was noted. In some educators the challenges are perceived to outweigh the passion for innovation.

Other educators do not employ innovation or creativity for intrinsic reasons. A certain element of disdain was detected amongst some educators regarding the importance of Life Skills, particularly Mrs Ramkilawan. Other core subjects such as Mathematics, Sciences and English are allocated greater merit than Life Skills which is not considered important. Many may disagree as Life Skills at the Grade 5 level is the initial stage of environmental education for learners. If there is no emphasis on environmental content, there is a risk that such attitudes and marginalisation of environmental factors may be transferred to the learners.

Educators in the intervention school displayed a greater passion for teaching which is evident in their effort in incorporating innovation and excitement through quizzes, worksheets and discussions. The intervention school educators gave the impression that the system had diminished their love for the profession and their responsibilities as educators. Being in an under-resourced school makes it difficult to do more than is required. In the hope of developing an environmentally literate and proactive generation, more importance must be attributed to all areas of environmental education which should be integrated in a multidisciplinary way, where possible.

The attitudes of educators are crucial in the manner in which the content is viewed and delivered. Educators require sufficient knowledge on environmental issues to enable them to integrate environmental aspects in their delivery of subjects apart from Life Skills. This interdisciplinary approach will train learners to identify the environmental link between other facets of education and life. Educators may not have been adequately trained and equipped to teach environmental concepts as many educators themselves have misconceptions about

the environment as seen in their assistance in the completion of the assessment book with learners. An investment into professional development is much needed to refresh those educators that have lost their passion and for the novice educators in maintaining theirs.

5.7 The challenges experienced by the educators

Time-constrained teaching periods, under-resourced schools, large classes and poor parental support are some of the challenges experienced by these educators. None of these challenges seem to be easily resolved. The conversations and accounts of participating educators have provided sufficient information to answer the initial research questions and to develop an understanding of why educators teach the way they do. Similar results have been found for research conducted in schools in developing countries. Challenges included overcrowded curricula, overcrowded and small classrooms, focus on traditional subject examinations, short and superficial cascade model of educator training, high educator workload, inadequate teaching approaches, lack of supervision, lack of mentoring, feedback and support amongst others (Unicef 2012; Mugambi 2013; Chirwa and Naidoo 2014).

As important as the pedagogical method may be for effective delivery of environmental education, the findings illuminate the numerous factors and contributing elements that prevent the ideal situation from being implemented in a typical South African pubic school. A major finding of the study has highlighted that effective knowledge transference and understanding of learners is largely dependent on the intrinsic motivation of educators. Simply explained, educators who are passionate about teaching and learners will find ways to use available resources as optimally as possible. Educators that lack this motivation may revert to focusing on the lack of resources when placed in the same situation. It can be noted that the pedagogical method comes second to an educator who is able to educate innovatively stemming from his/her passion for teaching and contentment.

5.8 The view of the educators regarding learners

The educators provided their reports on how learners experienced the intervention and assessment books. The intervention school enjoyed the activities and completion of the book. One educator described it as a “good exercise”, but the other, Mr. Moodley, reported that the learners found it challenging to complete the word search based on water. He said that learners enjoy drawing and colouring rather than writing. At the Grade 5 level, learners are

expected to have developed a sense of critical thinking and reasoning with the ability to discuss and debate. A word search of medium difficulty should ideally not challenge them as it did.

The control school learners had different responses. Mr Maharaj explained that his learners were “lost” and “confused” in completing the assessment book and advised that it should have been more learner-friendly, although it was a good exercise. Mrs. Pillay reported good results, stating that her learners enjoyed the activity and did not find it difficult as the content was already covered in the syllabus. The mixed responses by educators are cause for f concern because Grade 5 learners in both schools are covering the same content, according to CAPS, but display different levels of understanding and intellectual abilities. The level of understanding differs from class to class and between schools. It is evident that more effort is required to enable learners to develop these important skills for future academic use and for application in their daily lives. Individuals who are unable to reasonably and critically assess a situation to make a well-informed decision will experience great difficulty in preserving the environment through lifestyle and behavioural choices.

5.9 The challenges in schools

The control school services a slightly higher socio-economic community as opposed to the intervention school. However, the resources in both schools remain a problem. All participating educators mentioned resources, time and large classes as challenges. The difference identified is that the educators in the control school make an effort to source supplementary activities such as surveys and worksheets to enhance their lesson. –. The intervention school educators remain stagnant due to their challenges.

The schools and the Department of Education offer little or no support in resolving problems experienced by these educators. Parental support is a challenge in the intervention school as there is no communication between parent and educator or parent and school. A plea should be made to governing bodies and the Department of Education to explore avenues of sourcing additional materials to assist educators in implementing inexpensive, accessible forms of innovation for their lessons. These constricted and time-constrained educators are trapped in the routine of their work and see no light at the end of their professional tunnel.

5.10 Summary

Sub-Saharan Africa has emphasized the need for educator development in policy implementation and curricula. The standard of education can be improved through the professional development of educators (Hennessy, Harrison and Wamakote 2010). Formal development through training and workshops is a factor that must be considered by government to ensure educators are improving their skills and knowledge to deliver a high standard of education. This will also allow educators to share and enhance their pedagogic knowledge. Educators in Mpumalanga felt empowered and enabled on the subject of environmental education following an EnviroTeach program. The educators in this study display a sense of willingness to deliver environmental education and other lessons in the most efficient way possible to achieve knowledge retention but their challenges seem to make the task impossible. A point worth noting is that despite these challenges, some educators manage to incorporate innovation and excitement into their lesson. The greatest resource a school has is its educators. A concerted effort is needed to motivate educators to aspire to a greater level of education in our country.

Life Orientation/Life Skills is a life-centred subject that teaches learners how to manoeuvre their way successfully through life. With the environmental changes presently facing society, environmental education should be incorporated with seriousness into this subject. Life Skills educators need to possess a certain skillset to deliver the content in a sensitive manner. Efforts should be made towards allocation of educators to subjects of specialisation or interest. It is evident that some participating educators did not enjoy or see the importance of Life Skills. Therefore, their attitude translated into their lack of effort to go the extra mile. The encouragement of parental involvement and support is an ongoing campaign that requires the efforts of the educators, schools and the Department of Education. The work of the educator will be augmented where parents assist with homework follow-up, revision at home and communication between the parent and educator.

Using the theoretical frameworks, the study provided an understanding of the two facets which inform teaching method choices, namely, the pedagogical content knowledge of the educator and the selfhood of the educator. These are the professional and personal aspects of the educator which inform the educator's choice of teaching method. Through Shulman's Theory we were able to evaluate the experiences, professional development, beliefs and selfhood. The selfhood factor lends itself to Parker Palmer's Theory. This theory was used to

understand the selfhood of the participating educators. According to Shulman's Theory, it was found that the participating educators needed development in certain constituents of PCK. PCK comprises subject matter knowledge, knowledge of the learner, knowledge of the curriculum, knowledge of the context and knowledge of the pedagogy. Majority of participating educators had limited subject matter knowledge. For this study, their knowledge was on environmental education. The educators were unable to explain question four to the learners, namely, that both pictures were true for the effects of climate change.

Educators also mentioned that they were not receiving any form of professional development on environmental education. All environmental learning was solely upon their own efforts through reading. The knowledge of the learner was limited in most educators. Only two of the six were able to use the most appropriate teaching method for environmental education based on the type of learners. One educator used outdoor observation based on his knowledge that learners better understand through observation and discussion. The second educator opted for a community survey based on her knowledge of the learner that learning takes place through involvement in an activity. Parker Palmer's Theory provided a "background" to the educator. We were able to understand the personal story behind the educator leading up to the type of educator that is practicing in the classroom. This directly answered the first research question.

The qualitative findings provided an insight into the reasons the participants entered the profession, their view of the profession and their teaching experience. It was evident that for those educators that opted for teaching based on a calling to service the community were more devoted to going the extra mile. They displayed a greater intrinsic motivation and dedication to teaching which was visible in their teaching method choices (source and supplement lessons with activities). For those educators that got into the profession because of a family history of educators or spousal persuasion, their personalities and personal strengths were applied to the teaching profession. This was illustrated through their sensitivity towards the learner and willingness to strive towards no learner being left behind academically.

One educator who provided a good comparison to others, opted for teaching for personal benefits. Her years of experience in the profession has caused her to t dislike teaching and "tolerate" it. One may never fully understand the personal reasoning for her behaviour or view but it can be assumed that, because her professional path was not out of love or personal

interest, her heart is not in the profession. Parker Palmer explains that good teaching involves the heart of the educator. The attitude and view of this educator is reflective of the state of her heart towards teaching.

It is understood that South Africa has many challenges and issues regarding education. However, small efforts can assist in improving the situation and overcome challenges that are identified along the journey. A subject, perceived as basic and general, requires a degree of training and skill to equip the educator to effectively teach the content. However, programs for professional development of educators are scarce if not non-existent. Specific components of educator development have been identified in the South African context. Weak content knowledge, particularly for science and mathematics, is a problem highlighted in the President's Education Initiative Research Project (Taylor and Vinjevold 1999). However, revision of content alone is not the solution to this problem. Adler and Reed (2002) describes effective educator development as the ability of the educator to integrate learning in a way that students acquire subject knowledge. This requires educators to learn "subject knowledge for teaching".

CHAPTER SIX

DISCUSSION AND CONCLUSION

The aim of this research was to determine how the selfhood of teachers of Life Skills influence curriculum delivery and learning in environmental education. This study focused on exploring Grade 5 educators' selfhood and pedagogic choices for environmental education lessons. The intervention was designed to evaluate the knowledge and understanding of the learners relating to the lessons on water (environmental education) as introductory lessons on climate change education. The key in achieving the objectives of the study was to understand the experiences shaping educators' choices for teaching environmental education and to understand their methods of teaching used for environmental education. The teaching intervention for the Life Skills lessons on water was assessed using activity booklets administered to all participating Grade 5 learners. The assessment tool provided a tangible evaluation of the intervention through measuring knowledge retention in environmental education.

The findings from learner and educator responses elicited the factors at play in the classroom environment which assisted in a better understanding of the Environmental Education level of Grade 5 learners in a typical South African public primary school. The research study offered a nuanced perspective of Environmental Education at primary school/intermediate phase within KZN. The issue of climate change has become the forefront of many political and health deliberations. It is a global concern, one which requires unified commitment towards mitigation. This study was of great significance in the light of contributing to a scarce body of literature involving South African schools and climate change education. Research has been done evaluating educators and their environmental awareness and preparedness; however, this study differs in providing a glimpse into the pedagogic reasoning of educators and contributing to the effectiveness of environmental education. An increased interest has been noted in research pertaining to educators and environmental education therefore this study offers useful contribution to this growing body of knowledge.

The quantitative and qualitative aspects of the study provided a glimpse of the educator and learner aspects regarding environmental education in Grade 5. The approach offered the 'why' of educator's pedagogical choices and the quantifiable data of learner's knowledge on environmental education. The quantitative findings of this study suggest that there is no statistical significance regarding the knowledge and understanding between the intervention

and control school learners for the lessons on water. Upon analysis of the findings and conducting of statistical tests, the results did not show evidence that the intervention enhanced learning amongst learners in the intervention school. There is no evidence to support a variety of research studies that suggest that innovative and interactive teaching methods yield better learning. It can be deduced that regardless of the method of teaching employed, knowledge and understanding of learners remained similar and may be influenced by other factors. This answered the second research question exploring the learning of pedagogical content knowledge of participating learners. One of the factors that was chosen to study was the teacher. The teacher is the greatest determinant of knowledge delivery in the classroom and their beliefs on content such as environmental education is crucial in teaching the subject. It is with the interest in investigating the selfhood of the teacher that directed the qualitative aspect of this study.

6.1 Learnings from the study:

6.1.1 Committed educators

Research Question 1: How does the selfhood of teachers of Life Skills influence teaching in environmental education?

Educators are a critical component which influenced the similar results for learners of both schools. This led to the exploration of educators and their pedagogy through a qualitative approach. The educators of the intervention and control schools differed greatly in their methods of teaching, attitude towards teaching, lesson preparation and personal professional development. Their teaching experience, history and reasons for entering the profession, contribute to understanding the pedagogic knowledge of the educator. All of these factors constitute one's selfhood. Every educator is entirely unique in his/her experiences, backgrounds, personalities and pedagogical choices and these differences may be the greatest determinant of knowledge retention and understanding (Plutzer *et al.* 2016). The findings of this study have revealed similar results regarding the influence of the educator in environmental education and learning in the classroom.

The findings of the qualitative data through interviews with educators, suggest that the selfhood of the educator plays a major role in the delivery of subject matter. This is explained by Parker Palmer's Theory. This has been the theoretical lens through which the qualitative

findings have been explained. The personal factors which shape an educator, informs the way educators teach and the basis from which their teaching stems. Parker Palmer explains that "*good teaching cannot be reduced to technique; good teaching comes from the identity and integrity of the educator*" (Palmer 1997). This refers to all the aspects of one's life that has influenced an educator as a person and the use of those experiences and learning along the way, to inform the professional choices of the educator. The theory can be used to understand the educators participating in this study. It is their different backgrounds, unique experiences and individuality that has shaped them into the 'who' they are today as educators. A South African study found that variables such as specialisation and teaching experience were found to have significant influence on the content delivery of the teacher regarding environmental education. These variables are interlinked with the selfhood of the teacher (Anyanwu and Le Grange 2017). It is of great importance to understand the educator behind the teaching method and the factors which influence their teaching choices.

6.1.2 It's not about the methods!

Research Question 2: How does the selfhood of teachers of Life Skills influence learning in environmental education?

One of the key learnings of this study was that, regardless of the available resources of the school, those educators that were passionate about teaching were able to make the most of the resources that were readily available to them such as newspapers, the outdoors and the community. These educators recognised the significance of the intrinsic belief in the content and taught these lessons from a place of genuine concern. This can also be explained by the intrinsic motivation and selfhood of the educator. This may be the factor which encourages innovative behaviour and the eagerness to develop one's self. These are some of the aspects which contribute to good education (Klaeijsen, Vermeulen and Martens 2018).

For the lessons on water, two of the six participating educators made a notable effort to integrate outdoor education and community surveys in ensuring learners understood first-hand the importance and impact of water. The availability or scarcity of resources does not provide an adequate measurement to determine the pedagogic reasoning of an educator. The participating educators are an example of this. One educator from the intervention school and the other from the control school were able to identify the most effective method of lesson delivery based on the needs of the learners, their professional experience and largely on their understanding of environmental education and the importance of climate change. Educators

in the control school were already practising similar teaching methods to that of the intervention. Learners enjoyed their methods of lesson delivery as it introduced innovation and excitement to the content.

The methods employed by the control school educators were not costly, did not require any external assistance and adhered to the time constraints of the CAPS prescribed curriculum. Although educators listed them as challenges, they were able to work around them. They found innovative ways to creatively deliver the lesson beyond the classroom while achieving environmental literacy. Zhang (2008) reiterates that educators should consider the needs of learners and their different learning styles. The optimum learning technique differs for each learner. Some learners may learn visually while others audibly. Educators should consider these differences when utilising the resources available to ensure that all learners in the spectrum have an opportunity to engage effectively with the curriculum.

An informed and committed educator will undoubtedly develop mastery of the art and science of teaching, and challenging concepts such as climate change. Participation in research, such as the present one, provides educators with a means of professional development and informal training in being exposed to current research in their field. A well-informed, knowledgeable educator is able to offer a valuable balanced facilitation of all content taught. Through revised teaching methods in the inquiry-based approach administered, the participating educators, in this study, were exposed to simple and innovative teaching methods and lesson delivery approaches. Numerous options were identified for teaching and learning enhancement with the key objective of ensuring optimal learning. Educators are expected to be oracles of information who teach environmental education. Khalid (2001) states that educators should equip students with the knowledge and information of relevant natural phenomena to prevent misconceptions.

Educators who are well-equipped with environmental knowledge can confidently deliver environmental knowledge accurately. They are able to employ the most effective method of teaching for positive knowledge, attitude and behaviour development toward the environment (Moseley, Reinke and Bookout 2002; Khalid 2003; Pekel 2005). Studies on assisting pre-service educators in teaching environmental problems (Paul and Volk 2002) and extracurricular activities demonstrated an increase in self-competency in environmental education in the classroom (Moseley, Reinke and Bookout 2002). In South Africa, primary school educators teach a range of subjects apart from their area of specialisation, which

necessitates ongoing support and training to improve and update their knowledge of subject matter.

6.1.3 Content based learning

The intervention stimulated learners through unconventional learning. The assessment provided a medium to evaluate learning in the classroom through critical-thinking and application. The freedom to express themselves in the assessment indicated learners' practical and personal relation to the subject of water and environmental education. One of the factors which emerged from the research was that socio-economic status of a learner may be one of the contributors to poor knowledge or willingness to learn environmental concepts. The background of a learner is an important indicator of what the learner deems as more valuable information for learning. A learner from a low socio-economic family with parents barely understanding or placing value on environmental education, is more likely to echo the same values (McInerney 2013). This was evident from educators' responses in interviews. The learners presented a challenge as indicated by some participating educators. Their disinterest in learning and the poor support and cooperation of parents further discouraged educators. One would expect the participants who were exposed to the "better" teaching methods to attain higher scores in the assessment but this was not the case. Learners with passionate and self-driven educators displayed similar knowledge retention to that of learners with educators who offered minimal innovation or passion for teaching. Learners mentioned greater enjoyment in the intervention lessons. Therefore, knowledge retention cannot be associated with the teaching method, thus more research is required to investigate this hypothesis.

There is a dire need for professional development workshops and training for educators. Based on participants' responses, very few educators invest in themselves professionally. An avenue for networking, idea sharing and dissemination of new information through conferences or workshops may be a good platform for educators to keep abreast of the profession and provide personal development. Such workshops will also be a welcome break from the routine of teaching and good for the attitude and mental health of the educator. Professional development is often a challenge for the educator because of time constraints. A well-informed, knowledgeable educator can offer a valuable and effective delivery of all content taught.

Educators admitted to revising lesson content with learners prior to administration of the booklets. The South African education system requires drastic transformation to achieve the critical thinking and understanding needed by learners in the environmental education arena. Educators, as indicated in other South African studies, were reluctant in engaging students on environmental education topics. This could be attributed to their own pedagogical insecurities (Satchwell 2013). Educators involved in an EnviroTeach training session mentioned that they did not know about integrating the environment with the curriculum and acknowledged the importance of using a variety of teaching methods (Vogel, Schwaibold and Misser 2015). Through revised teaching methods in the inquiry-based approach administered, the participating educators in this study were exposed to simple and innovative teaching methods and lesson delivery approaches affording them numerous options for teaching and learning enhancement with the focus on ensuring optimal learning. This has been the key driver in achieving the objectives of the study. The assessment tool provided a tangible evaluation of learners' experiences of the intervention through knowledge retention.

Recommendations and Limitations

The limitation of the study was a small sample population was used therefore results cannot be generalised. Further research on a larger study scale is suggested to confirm the results of this study. A similar study including a greater number of schools across provinces may provide a better understanding of the context of environmental education. Including more educators in such a study will enable a diverse exploration into the educator as a critical factor in environmental education.

Another limitation of the study was the influence of educators on the learners during the completion of the assessment books. The process of revision in the classroom is a common practice. Educators often revise content previously covered in class to refresh learners' knowledge on subject matter. In this study the revision process did not allow for accurate quantitative results to establish true knowledge retention. The transfer of knowledge to learners should yield the desired outcomes of revised beliefs, values and inevitable behaviours for an environmentally literate generation. Curriculum reform and pedagogical redress is a start to the change needed to assist teachers. Teaching approaches that induce "*deep-level thinking, multiple enquiry and collaborative constructions of knowledge"* must be explored in taking account of the unique challenges of our education system. (Vogel,

Schwaibold and Misser 2015). The educator requires adequate training, continuous professional development, and must be allocated to teach his/her subject of specialisation and interest to achieve optimal learning and teaching.

A recommendation is that educators should use technology to assist with their professional development and teaching methods. Activities and tasks can be designed by curriculum specialists to provide educators with up-to-date information on content and offer lesson supplements and ideas. Professional development points could be offered with completion of certain tasks to encourage the utilisation of the online tool. Online collaboration would be more feasible in terms of access and flexibility of the educator. An online classroom can be created for educators to chat about specific challenges or issues experienced. Educators will also be comfortable enough to collaborate with educators of their choice who are experts or more learned in a specific subject area. This will allow for sharing of knowledge, experiences and for educators to assist each other in developing professionally. South Africa must prioritize equipping educators with up-to-date information and training to ensure this is filtered down to the learner. Quality education should support learning for a sustainable future. This type of learning will ensure a deep understanding of context, practices and concepts (Lotz-Sisitka 2013) and align environmental education in South Africa with the SDG goals and the Paris Agreement. It has been evident from the findings of this study that educators in the same school with exposure to the same resources possess different pedagogical skills and knowledge with respect to environmental education.

The National Curriculum Statement (NCS) explains that it is the aim for Grade R-12 learners to acquire the following skills, amongst others: the ability to identify and solve problems, use critical and creative thinking to inform decisions, teamwork, collect, analyse and critically evaluate information and through the use of science and technology, effectively and critically show environmental responsibility (South Africa Department of Education 2016). These attributes, as described by the NCS, may be exactly what learners need to become environmentally literate citizens of tomorrow. These teaching methods are important and may yield favourable results, but this study has shown that the educator, who is employing the teaching method, is far more crucial in the classroom than the method itself in ensuring environmental learning is taking place. Workshops offered by the Department of Education are often generic and a ‘one size fits all’ approach to professional development of educators. A more personal and interactive form of professional development could be offered in the

form of an online program. Technology has evolved and must be optimally used in professional development of educators.

The challenges of time, restricted resources and poor professional development must be addressed in achieving the holistic view of an academic society that is confident and knowledgeable on climate change. It is impossible to remove all the obstacles mentioned by the participating educators but it is useful to know and understand the issues and challenges experienced by educators in the field and provide relief and solutions where possible.

The foundational hypothesis of the study was that the teaching method affects learning particularly in environmental education. This is of importance in the environmental education arena as learning in environmental education must yield change in behaviour and attitude for it to be effective in ensuring a pro-environmental future generation. Environmental education should translate to a change in lifestyle. It is not knowledge to be stored, and therefore, the method of information delivery is crucial in ensuring the learner completely understands, becomes knowledgeable and actions the content. “Understanding” and “knowledge” must both coexist for effective learning to take place. For learners to be able to make environmentally sustainable choices, they must know the effects of their choices, the science or geography principles involved and other relevant content-based knowledge (Chawla and Cushing 2007). It is from this statement that the pivotal role of the educator is highlighted. It is evident through the findings of the study that, regardless of the teaching method employed, it is the educator who is the greatest determinant of learning in the classroom.

This study has highlighted that the pedagogical knowledge of the educator is a fundamental knowledge base. It is this knowledge that informs educators’ teaching choices such as teaching methods. At the end of the study, educators realised the effects of introducing a simple pedagogical change and the impact it has on the learner and on themselves. This study provided educators with a fresh perspective of their knowledge base by developing their pedagogical content knowledge.

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APPENDIX 1: KZN DEPARTMENT OF EDUCATION RESEARCH ETHICS COMMITTEE APPROVAL LETTER

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma | Tel: 033 392 1004 | Ref.:2/4/8/883

Mrs M Ruthanam
7 Greyridge Drive
Stanger
Kwadukuza
4450

Dear Mrs Ruthanam

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"A COMPARATIVE ASSESSMENT OF A CLIMATE CHANGE PEDAGOGIC INTERVENTION AMOUNGST GRADE 5 LEARNERS IN KWADUKUZA",** in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 15 August 2016 to 01 December 2017.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Connie Kehologile at the contact numbers below
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report / dissertation / thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

ILembe District

Adv. MB Masuku
Acting Head of Department: Education
Date: 23 August 2016

KWAZULU-NATAL DEPARTMENT OF EDUCATION

POSTAL: Private Bag X 9137, Pietermaritzburg, 3200, KwaZulu-Natal, Republic of South Africa ...dedicated to service and performance
PHYSICAL: 247 Burger Street, Anton Lembede House, Pietermaritzburg, 3201. Tel. 033 392 1004 **beyond the call of duty**
EMAIL ADDRESS: kehologile.connie@kzndoe.gov.za / Phindile.Duma@kzndoe.gov.za
CALL CENTRE: 0860 596 363; Fax: 033 392 1203 WEBSITE: WWW.kzneducation.gov.za

APPENDIX 2: GATEKEEPER PERMISSION FROM PRINICIPALS

DUT DURBAN UNIVERSITY OF TECHNOLOGY

To: Mr Reddy

Request for permission to conduct research study

Good day Mr Reddy,

My name is Melishnee Ruthanam, a student at the Durban University of Technology. I am currently completing my Master's Degree in Environmental Health. I have undertaken a research study which involves the exploration of Grade 5 teachers' professional knowledge on climate change education with the involvement of applying a new and exciting teaching intervention on the two lesson plans covering the subject.

I seek your permission for access to Stanger Manor Primary at which I wish to conduct my research study. The research will require all Grade 5 teachers to participate in an initial discussion session at which basic information will be collected regarding their years of teaching experience and preferred teaching methods. There are two schools involved in the study one of which will receive the intervention. The intervention will revise the methods of teaching used to deliver two Life Skills lessons at which climate change education is initiated. An evaluation at the end of the intervention to evaluate the intervention and a discussion will be held to gather the experiences of all teachers following the intervention.

All meetings with teachers will be schedules for after school hours to ensure normal class times and teaching proceed as normal. Life Skills periods will be adhered to and if any changes may arise, you will be informed with ample notice. The learners' school work will not be affected by the study activities and will be considerately schedules to not impose on their time.

I have attached a Letter of Information stating the details of the study. This letter will also be provided to all parents of student participants accompanied by an informed assent form permitting their child's participation. All discussions and activities will be scheduled cautiously to prevent imposing on academic learning.

Ethical approval has been sought from the Durban University of Technology Ethics Committee and the research will be conducted under the supervision of a DUT supervisor from the related faculty. The Department of Education has been provided with information of the research study and has approved commencement.

I, L. REDDY, principal of STANGER MANOR PRIMARY

agree to Mrs Ruthanam conducting research in the above mentioned school. She will engage teachers over the September and October.

Activities	Agree with a tick
First round interviews with Grade 5 Life Skills teachers	✓

Second round interviews with Grade 5 Life Skills teachers again	✓

Signature:

School stamp:

PROVINCE OF KWA-ZULU NATAL
DEPT. OF EDUCATION & CULTURE
STRINGER MANOR PRIMARY SCHOOL
P.O. BOX 638, STANGER 4450
PHONE/FAX: 032-5514622
UMNYANGO WEMFUNDO NAMASIKO
DEPT. VAN ONDERWYS & KULTUUR

Please contact me for any queries or further information and thank you for your time.

Kind regards,

Mrs. M. Ruthanam (0766169810)

Supervisor

Name: Prof Poovendree Reddy

Durban University of Technology

Contact details: (031) 3732808

poovier@dut.ac.za

DUT DURBAN UNIVERSITY OF TECHNOLOGY

To: Mr Harilal

Request for permission to conduct research study

Good day Mr Harilal,

My name is Melishnee Ruthanam, a student at the Durban University of Technology. I am currently completing my Master's Degree in Environmental Health. I have undertaken a research study which involves the exploration of Grade 5 teachers' professional knowledge on climate change education with the involvement of applying a new and exciting teaching intervention on the two lesson plans covering the subject.

I seek your permission for access to Glenhills Primary at which I wish to conduct my research study. The research will require all Grade 5 teachers to participate in an initial discussion session at which basic information will be collected regarding their years of teaching experience and preferred teaching methods. There are two schools involved in the study one of which will receive the intervention. The intervention will revise the methods of teaching used to deliver two Life Skills lessons at which climate change education is initiated. An evaluation at the end of the intervention to evaluate the intervention and a discussion will be held to gather the experiences of all teachers following the intervention.

All meetings with teachers will be scheduled for after school or free hours to ensure normal class times and teaching proceed as normal. Life Skills periods will be adhered to and if any changes may arise, you will be informed with ample notice. The learners' school work will not be affected by the study activities and will be considerately schedules to not impose on their time.

I have attached a Letter of Information stating the details of the study. This letter will also be provided to all parents of student participants accompanied by an informed assent form permitting their child's participation. All discussions and activities will be scheduled cautiously to prevent imposing on academic learning.

Ethical approval has been sought from the Durban University of Technology Ethics Committee and the research will be conducted under the supervision of a DUT supervisor from the related faculty. The Department of Education has been provided with information of the research study and has approved commencement.

I, MR HANSRAJH HURILAL, principal of GLENHILLS PRIMARY SCHOOL

agree to Mrs Ruthanam conducting research in the above mentioned school. She will engage teachers over September and October in the following:

Activities	Agree with a tick
First round interviews with Grade 5 Life Skills teachers	✓

Meeting with teachers to discuss and develop intervention teaching method	✓
Teachers deliver the Life Skills lesson using the intervention method	✓
Teacher administer the workbook to all Grade 5 Life Skills students during their Life Skills lesson	✓
Final interviews with all Grade 5 Life Skills teachers	✓

Signature:

School stamp:

PROVINCE OF K.Z.N.
DEPT. OF EDUCATION & CULTURE
GLENHILLS PRIMARY SCHOOL
P.O. Box 287, KwaDukuza, 4450
Tel: 032-552 1670

Please contact me for any queries or further information and thank you for your time.

Kind regards,

Mrs. M. Ruthanam (0766169810)

Supervisor

Name: Prof Poovendree Reddy

Durban University of Technology

Contact details: (031) 3732808 / poovier@dut.ac.za

APPENDIX 3: LETTER OF INFORMATION AND INFORMED CONSENT FOR PARENTS

LETTER OF INFORMATION

Warm greetings! Welcome to my research study

Title of the Research Study: A comparative assessment of a climate change teaching intervention amongst Grade 5 learners in KwaDukuza

Principal Investigator/s/researcher: Mrs. Melishnee Ruthanam (BTech)

Co-Investigator/s/supervisor/s: Prof. P. Reddy
Dr. D. Pillay

Brief Introduction and Purpose of the Study: We all have heard about climate change at some stage, whether it is from TV or newspapers and it is a hot topic all over the world. One point that is being brought up is that our children will be the ones to experience the true effects of climate change. Climate change is a change in weather patterns and the environment as seen over a long period of time therefore we will not be the ones to bear the changes to come, our children will! Most children will learn what they need to know about saving the environment, from school, their teachers and the subjects they do. What is also important is how they learn this important information. If children learn in an exciting and interesting way, they are more likely to remember and take interest in what they learned. When they learn to take care of the environment and understand what our actions are doing to the climate, there is a better chance that they will change their habits and attitudes too.

I want to do this research to see if teachers can improve ways of teaching climate change so that they can teach and explain the topic of climate change to students. This is planned for 2 Life Skills lessons and will cover climate change and water in Term 3. From the study I hope that other teachers in the school will see the benefits of teaching in more interesting ways and how it may encourage children to learn and understand better.

Outline of the Procedures: Two schools will be participating. Teachers from one school will teach the lessons in the normal teaching way as it was done before. The second school will teach the same topics but use a different way of teaching. The "new" way will include experiments and more learner participation. The teacher and I will talk about more interesting ways to teach the 2 lessons and he/she will teach the lessons. I will not be in class while she/he is teaching. One week after the lessons have been done in both schools, the children will complete a workbook, it is not a test. It will be designed to see if they understood what was taught and to see what they know about climate change. The selection of which school will use the new method, will be done in a fair and random selection process. Neither school is at an advantage nor disadvantage over the other, all results will be shared to both school's teachers after the study so the teachers can make a choice to change.

Risks or Discomforts to the Participant: None

Benefits: The teacher will become an example of how teaching something in a different and exciting way helps children understand more and want to learn more on a topic. It is hoped that teachers will think about this and also change their way of teaching especially for subjects that may be boring or difficult to understand. Teachers will benefit by experiencing different teaching methods to better their teaching. Learners will also benefit from the exciting and interesting lesson plans used by the teachers with more interest in the subject while learning environmental topics. The results of the research study will be shared with both schools involved and an article will be published in a research journal.

Reason/s why the Participant May Be Withdrawn from the Study: You have the choice on whether to allow your child to participate in the study or not. You are also allowed to withdraw your child from the research study at any time you wish to do so. There will be no penalties on you or your child.

Remuneration: None

Costs of the Study: There will be no charges placed on any child/ parent or teacher.

Confidentiality: Learners names will not be needed or asked for at any point. Codes will be used instead of names for collecting information. Your child's name will not appear on any report.

Research-related Injury: None

Persons to Contact in the Event of Any Problems or Queries:

Please contact the researcher (0766169810), my supervisor (0313732808) or the Institutional Research Ethics Administrator on 031 373 2900. Complaints can be reported to the Director: Research and Postgraduate Support, Prof S Moyo on 031 373 2577 or moyos@dut.ac.za

Explanations:

Climate change
Changing weather, temperature (hot/cold), wind and rain (more or less) because more of certain gases are being put into the atmosphere

General:

Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population e.g. isiZulu.

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Melishnee Ruthanam, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: REC 84/16,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, Melishnee Ruthanam herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

APPENDIX 3: LETTER OF INFORMATION AND INFORMED CONSENT FOR PARENTS

(ISIZULU)

INCWADI YOLWAZI

Ngiyakubingela! Wamukelekile ocwaningweni lwami

Isihloko socwaningo: Ukuhlola okuqhathanisayo kokungenelela ukufundisa ngokuguquka kwesimo sezulu kubafundi bebanga lesi-5 KwaDukuza

Umcwaningi omkhulu: Nkk. Melishnee Ruthanam (BTech)

Um/abacwaningi/ o/abakhombisa a/babuye a/babheke umsebenzi womcwaningi ngokubambisana: Sol. P. Reddy
Dkt. D. Pillay

Isingeniso esifishane kanye nenhloso yocwaningo: Sonke sesike sezwa ngokuguquka kwesimo sezulu ngesinye isikhathi, kungaba ku-TV noma emphephandabeni kanti yisihloko esivuthayo umhlaba wonke jikelele. Iphuzu elivezwayo ukuthi izingane zethu yizona ezizozwa imiphumela yangempela yokuguquka kwesimo sezulu. Ukuguquka kwesimo sezulu ukuguquka kwendlela izulu elenza ngayo nezemvelo njengoba kusuke kubonakala ngokuhamba kwesikhathi ngakho-ke ngeke kube yithi esiyothwala lo mthwalo wezinguquko ezizayo, kodwa kuyo yizingane zethu! Iningi lezingane zizofunda ukuthi zidinga ukwazini ngokonga ezemvelo, esikoleni, kothisha bazo kanye nasezifundweni abazenzayo. Okunye futhi okubalulekile ukuthi zilufunda kanjani lolu lwazi olubaluleke kangaka. Uma izingane zifunda ngendlela ethokozisayo nehehayo, kungenzeka zikhumbule futhi zibe netshisekelo kwezikufundayo. Uma zifunda ukunakekela imvelo futhi ziqonda ukuthi izenzo zethu zenzani esimweni sezulu, kunamathuba angcono okuthi zingaguqula imikhuba yazo nezindlela ezicabanga ngayo futhi

Ngifuna ukwenza lolu cwaningo ukubona ukuthi othisha bangenza kangcono yini ezindleleni zokufundisa ukuguquka kwesimo sezulu ukuze bafundise futhi bachaze isihloko sokuguquka kwezindlela zezulu kubafundi. Lokhu kuhlelelwe izifundo ezi-2 zamaKhono eMpilo futhi kuzokhuluma ngokuguquka kwesimo sezulu namanzi esigamini sesi-3 sonyaka. Ngalolu cwaningo ngethemba ukuthi abanye othisha esikoleni bazobona imihlomulo yokufundisa ngezindlela ezinentshisekelo nokuthi izingane kuzingakhuthazwa kanjani ekutheni zifunde futhi ziqonde kangcono.

Incazelo efingqiwe yezinqubo: Zimbili izikole ezizobamba iqhaza. Othisha kwesinye isikole bazofundisa izifundo ngendlela eyejwayelekile njengoba bekwenzeka ekuqaleni. Isikole sesibili sizofundisa izihloko ezifanayo kodwa sisebenzisa indlela eyehlukile yokufundisa. Indlela "entsha" izobandakanya ukuhlola kanye nokubamba komfundi iqhaza kakhulu. Uthisha kanye nami sizokhuluma ngezindlela eziheha kakhulu ukufundisa izifundo ezi-2 bese yena efundisa izifundo. Ngeke ngibe segunjini lokufundela ngesikhathi efundisa. Esontweni elilodwa emva kwezifundo kade zifundiswa ezikoleni zombili, izingane ziyogcwalisa incwadi yokusebenzela, akusona isivivinyo. Siyobe senzelwe ukubona ukuthi ngabe bakuzwile yini ebebekufundiswa nokubona ukuthi yini abayaziyo ngokuguquka kwesimo sezulu. Ukukhetha ukuthi yisiphi isikole esizosebenzisa indlela entsha, kuyokhethwa ngendlela eneqiniso futhi engalandeli indlela ehleliwe. Akukho sikole esizoba sendaweni engcono noma

endaweni engengcono kunesinye, yonke imiphumela yezikole zombili othisha bayokwabelwana ngayo emva kocwaningo ukuze othisha bathathe isinqumo sokushintsha.

Ukuba sengcupheni noma ukungaphatheki kahle kubabambiqhaza: Akukho

Imihlomulo: Uthisha uzoba yisibonelo sokuthi kuzisiza kanjani izingane ukufundisa into ethile ngendlela eyehlukile nethokozisayo ukuqonda ngokwedlulele nokufuna ukufunda okunye okuningi ngesihloko. Kwethenjwa ukuthi othisha bazocabanga ngalokhu futhi baguqule izindlela abafundisa ngazo ikakhulukazi izifundo ezingafaki mdlandla noma okulukhuni ukuziqonda. Othisha bazohlomula ngokuzwa izindlela ezehlukene zokufundisa ukwenza ngcono ukufundisa kwabo. Abafundi bazohlomula futhi ngezinhlelomfundo ezithokozisayo nezihehayo ezisetshenziswa othisha ngokuba nentshisekelo enkulu esifundweni ngesikhathi befunda ngesihloko zezemvelo. Imiphumela yocwaningo izikole zombili ezibandakanyekile ziyokwabelana ngayo bese kuthi umbhalo ushicilelwe emibhalweni yocwaningo.

Isi/zizathu esi/zingadala ukuthi umbambiqhaza ahoxiswe ocwaningweni: Ungakhetha ukuthi ngabe uyayivumela yini ingane yakho ukuthi ibambe iqhaza ocwaningweni noma cha. Uvumelekile futhi ukuhoxisa ingane yakho ocwaningweni noma nini uma ufisa ukwenza njalo. Ngeke kube khona nhlawulo kuwe noma enganeni yakho.

Ukukhokhelwa: Ngeke ukhokhelwe

Izindleko zocwaningo: Akukho zindleko ezizoba khona kunoma iyiphi ingane/umzali noma uthisha.

Ubumfihlo: Amagama abafundi ngeke adingeke noma acelwe noma nini. Kuyosetshenziswa amakhodi esikhundleni samagama ukuqoqa ulwazi. Igama lengane yakho ngeke livele kunoma yimuphi umbiko.

Ukulimala okuphathelene nocwaningo: Ngeke kube khona kulimala

Abantu abathintwayo uma kukhona noma zinkinga zini noma imibuzo:

Uyacelwa ukuthi uthinte umcwaningi kule nombolo (0766169810), ongikhombisa nobheka umsebenzi wami kule nombolo (0313732808) noma uMphathi Wenkambisonhle Yocwaningo Lwesikhungo obizwa nge-Institutional Research Ethics Administrator kule nombolo 031 373 2900. Izikhalazo zingabikwa kuMqondisi wophiko lwe- Research and Postgraduate Support, uSol S Moyo kule nombolo 031 373 2577 or moyos@dut.ac.za

Izincazelo:

Ukuguquka kwesimo sezulu
Ukuguquka kwezulu, izinga lokushisa/lokubanda, umoya nemvula (uma kulinganiselwa) ngoba amagesi amaningi athile aya phezulu emoyeni

Okwejwayelekile:

Labo abazobamba iqhaza kufanele baqinisekiswe ukuthi ukubamba iqhaza kungukuzithandela ngokwabo futhi inani okulinganiselwa kulo lababambiqhaza abazobandakanyeka kufanele livezwe. Ikhophi yencwadi yolwazi kufanele inikezwe ababambiqhaza. Incwadi yolwazi nefomu yemvume kufanele kuhunyushe bese inikezwa ngolimi olukhulunywa umphakathi wocwaningo, isibonelo isiZulu.

IMVUME

Isitatimende semvume yokubamba iqhaza ocwaningweni:

- Ngiyaqinisekisa ngalokhu ukuthi ngazisiwe umcwaningi, u-Melishnee Ruthanam, ngohlobo, okwenziwa, imihlomulo nezingcuphe kwalolu cwaningo – Inombolo egunyazayo yenkambisonhle yocwaningo eyaziwa ngokuthi yi-Research Ethics Clearance Number: REC 84/16,
- Ngilutholile, ngafunda futhi ngaqonda ulwazi olubhalwe ngenhla (Incwadi yombambiqhaza yolwazi) olumayelana nocwaningo.
- Ngiyazi ukuthi imiphumela yocwaningo, kuhlanganisa nemininingwane yami ephathelene nobulili, iminyaka yobudala, usuku lokuzalwa, izinhlamvu zokuqala zamagama nokutholakala kwesifo kuyocutshungulwa ngokungalivezi igama lami embikweni wocwaningo.
- Ngokubheka izimfanelo zocwaningo, ngiyavuma ukuthi imininingwane eqoqwe ngesikhathi salolu cwaningo ingacutshungulwa ngohlelo lwekhompyutha umcwaningi.
- Noma nini, ngaphandle kokwahlulelwa okungafanele, ngingahoxisa imvume yami nokubamba kwami iqhaza kulolu cwaningo
- Ngiye ngaba nethuba elanele lokubuza imibuzo futhi (ngokuzithandela kwami) ngasho ukuthi ngikulungele ukubamba iqhaza ocwaningweni.
- Ngiyaqonda ukuthi lokho okusha okutholakele okubalulekile ngesikhathi socwaningo okungahambelana nokubamba kwami iqhaza ngiyokwaziswa khona

Igama eliphelele lombambiqhazi isithupha sesokudla	**Usuku**	**Isikhathi**	**Isiginesha/Ukuginqa**

Mina, Melishnee Ruthanam, ngalokhu ngiyaqinisekisa ukuthi umbambiqhaza ongenhla wazisiwe ngokugcwele ngohlobo, okwenziwa nezingcuphe kocwaningo olungenhla

Igama eliphelele lomcwaningi	**Usuku**	**Isiginesha**
Igama eliphelele lofakazi (uma ekhona)	**Usuku**	**Isiginesha**
Igama eliphelele lombheki osemthethweni (uma ekhona)	**Usuku**	**Isiginesha**

APPENDIX 4: LETTER OF INFORMATION AND INFORMED CONSENT FOR TEACHERS

LETTER OF INFORMATION

Title of the Research Study: A comparative assessment of a climate change teaching intervention amongst Grade 5 students in KwaDukuza

Principal Investigator/s/researcher: Melishnee Ruthanam
BTech: Enviromental Health

Co-Investigator/s/supervisor/s: Poovendhree Reddy
Associate Professor – PhD

Daisy Pillay
Doctorate

Brief Introduction and Purpose of the Study:

The research study involves the exploration of Grade 5 educators' teaching knowledge on climate change education and an assessment of teaching methods through application of a new and exciting teaching intervention on two Life Skills lesson plans.

The study requires all Grade 5 educators that teach Life Skills to participate in an initial discussion session. The session is designed to acquire basic information regarding your years of teaching experience and preferred teaching methods amongst others. There are two schools involved in the study, one of which will receive the intervention and the other will form the comparison school. The intervention school educators will revise their methods of teaching used to deliver two Life Skills lessons which involves an introduction into climate change education. A list of various intervention options will be provided by the researcher with final method choice by the participating teachers. At the end of the intervention, an assessment will be administered to evaluate the intervention amongst the learners. This is to determine their knowledge retention and experience of the intervention. A final discussion will be scheduled thereafter with all teachers to gather their experiences and for information sharing.

All meetings with teachers will be scheduled for the most convenient time according to you to ensure normal class times and teaching proceeds as normal. Life Skills periods will be adhered to and if any changes may arise, you will be informed with ample notice. The learners' school work will not be affected by the study activities and will be considerately scheduled to not impose on their time.

Outline of the Procedures:

All Grade 5 educators teaching Life Skills will be interviewed and encouraged to answer freely on teaching experiences. Every interview session will be audio-recorded for analysis and field notes will be taken during the interview sessions for additional information. Demographic information will be collected in the initial interview. Each interview will be allocated approximately one hour in length. The interviews will take place after school,

during lunch breaks or on the weekend depending on the availability and preference of the teacher interviewed and scheduled during a convenient time for the teacher as to not impose on your duties. A private classroom or other appropriate venue will be used to conduct the interview and will be chosen with consideration of noise and interruption factors. You will be informed if you are included in the intervention or comparative school.

According to the CAPS document for the Intermediate Phase, an introduction into environmental education is presented in Grade 5 in Term 3 and has been designated two Life Skills lessons. One of the topics covered is the subject of Water and related information on environmental conservation. The intervention seeks to collaboratively design an interactive and inquiry-based teaching approach in delivering the lesson on Water.

A meeting will be scheduled for all teachers of the intervention school (3 teachers) to discuss and develop the intervention teaching methods according to a list of teaching plan options which will be provided by the researcher. One suitable intervention technique will be chosen by intervention teachers for each lesson involved. A mutually consented approach will be decided on and resources will be provided by the researcher. The intervention will be delivered by the teachers with no assistance or attendance by the researcher.

A post-intervention assessment will be developed according to the intellectual level and language skills of Grade 5 students and will comprise of questions designed to assess climate change knowledge construction, attitudes and views on the intervention. The assessment will be administered to all students during a Life Skills lesson a week after the intervention is carried out.

The types of questions will range from explanatory required answers, diagrams and drawings specifically developed to extract the information required to assess the desired outcomes. The assessment will be administered as an evaluation activity by the teacher in a non-test environment to ensure that students are not restricted with regards to creativity and freedom to share. The teacher will be present during the classroom activity and will be advised to reiterate to the students that it is not a test, there will not be allocation of marks and it will not affect their grade.

The researcher will not be present during the activity. Students will be supplied with colouring pencils and other creative materials which may be required to express their ideas effectively. The teacher will be provided with an explanation of the assessment and the expected outcomes and equipped to assist students in the event of a question or query however leading answers or assistance altering the results of the study will be prohibited.

A post-intervention discussion will be held between 1 – 3 days after the administration of the assessment. The session will preferably be done during a lunch break or after school to avoid further imposition on the academic schedule and will be digitally recorded by the researcher. Predetermined questions will be posed to teachers of the both schools to gain an understanding of their experiences of the respective teaching method used and their sentiments when comparing the intervention to the conventional teaching methods exposed to. Teachers who were not involved in the intervention will be asked to discuss their findings and reactions of students to the conventional teaching method particularly on environmental issues. Teachers will also be invited to share his/her experiences and opinions on the intervention approach and the willingness to revise current teaching methods for a more interactive student-centred method.

Risks or Discomforts to the Participant: None

Benefits: As a teacher, you will benefit from the exposure to a range of different teaching methods which will allow you the opportunity to experience the reaction of students toward these new methods. Teachers who do not participate in the intervention will also benefit from sharing of this information by the intervention teachers. All results of the study will be shared with both schools and an article will be published in an academic research journal.

Reason/s why the Participant May Be Withdrawn from the Study: None

Remuneration: None

Costs of the Study: There will be no charges placed on any child/ parent or teacher.

Confidentiality: Teachers names will not be needed or asked for at any point. Codes will be used instead of names for collecting information

Research-related Injury: None

Persons to Contact in the Event of Any Problems or Queries:

Please contact the researcher (0766169810), my supervisor (0313732808) or the Institutional Research Ethics Administrator on 031 373 2900. Complaints can be reported to the Director: Research and Postgraduate Support, Prof S Moyo on 031 373 2577 or moyos@dut.ac.za

General:
Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population e.g. isiZulu.

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Melishnee Ruthanam, about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: REC 84/16,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Full Name of Participant	**Date**	**Time**	**Signature / Right /Thumbprint**

I, Melishnee Ruthanam, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name of Researcher	**Date**	**Signature**
Full Name of Witness (If applicable)	**Date**	**Signature**
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

APPENDIX 5: LETTER OF INFORMATION AND ASSENT FORMS FOR LEARNERS

LETTER OF INFORMATION

Warm greetings! Welcome to my research study

Title of the Research Study:

To find out Grade 5 teachers knowledge on climate change, try a new teaching method and afterwards gather the views of the teachers and students.

Hi, my name is Melishnee Ruthanam. I am a student at the Durban University of Technology. I want to do a research study dealing with climate change knowledge in teachers and to help your teacher try a new way of teaching the topic. You will be asked about your views at the end of the study.

There will be no harm or discomfort to you and the research will not affect your normal marks. The lessons will take place during your Life Skills periods. Your name will not be asked for during the study and will not be used after the study.

Please ask if you have any questions or you do not understand anything about the study.

Thank you for your time!

Persons to Contact in the Event of Any Problems or Queries:

Please contact the researcher (0766169810) or the Institutional Research Ethics Administrator on 031 373 2900. Complaints can be reported to the Director: Research and Postgraduate Support, Prof S Moyo on 031 373 2577 or moyos@dut.ac.za

Please ask if you do not understand anything, before signing.

Child Informed Assent

Title of research project:

A comparative assessment of a climate change pedagogic intervention amongst Grade 5 learners in KwaDukuza

Please circle your answer:

1. Have you understood the subject information sheet? YES / NO
2. Did you discuss the study with anyone? YES / NO
3. Who did you discuss it with? _____
4. Do you have any questions about the study or about your role in the study? YES / NO
5. Are you worried about any part of this study? YES / NO
6. Have you received enough information about this study? YES / NO
7. Do you understand how you will be involved in this study? YES / NO
8. Do you understand that you are free to withdraw from this study:

a) At any time and:

b) Without having reason to withdraw YES / NO

9. Do you agree to voluntarily take part in this study? YES / NO

I, _____hereby give assent to be involved

(SUBJECT'S NAME)

In the above- mentioned project.

_____ _____

(PRINTED NAME OF WITNESS) **(SIGNATURE)**

APPENDIX 5: LETTER OF INFORMATION AND ASSENT FORMS FOR LEARNERS (ISIZULU)

INCWADI YOLWAZI

Ngiyakubingela! Wamukelekile ocwaningweni lwami

Isihloko socwaningo

Ukuthola ulwazi lothisha bebanga lesi-5 mayelana nokuguquka kwesimo sezulu, ukuzama indlela entsha yokufundisa bese kuthi emva kwalokho ngiqoqe imibono yothisha neyabafundi.

Sawubona, igama lami ngingu-Melishnee Ruthanam. Ngiwumfundi waseNyuvesi Yezobuchwepheshe yaseThekwini eyaziwa nge-DUT. Ngifuna ukwenza ucwaningo olubhekene nolwazi lokuguquka kwesimo sezulu lothisha nokusiza uthisha wakho ukuthi azame indlela entsha yokufundisa lesi sihloko. Uzobuzwa ngemibono yakho ekupheleni kocwaningo.

Ngeke ulimale noma ungaphatheki kahle futhi ucwaningo ngeke lube nomthelela emamakini akho ejwayelekile. Isifundo sizoba ngezikhathi zesifundo samaKhono eMpilo (Life Skills). Igama lakho ngeke libuzwe ngesikhathi socwaningo futhi ngeke lisetshenziswe emva kocwaningo.

Ngicela ubuze uma unanoma yimuphi umbuzo noma kukhona ongakuqondi ngocwaningo.

Ngiyabonga ngesikhathi sakho!

Abantu abathintwayo uma kuba khona izinkinga noma imibuzo:

Uyacelwa ukuthi uthinte umcwaningi kule nombolo (0766169810), ongikhombisa nobheka umsebenzi wami kule nombolo (0313732808) noma uMphathi Wenkambisonhle Yocwaningo Lwesikhungo kule nombolo 031 373 2900. Izikhalazo zingabikwa

Ngicela ubuze uma kukhona ongakuqondi, ngaphambi kokuthi usayine.

Imvume eyakhelwe olwazi

Isihloko somsebenzi wocwaningo:

Ukuhlola okuqhathanisayo kokungenelela ukufundisa ngokuguquka kwesimo sezulu kubafundi bebanga lesi-5 KwaDukuza

Ngicela ukokelezele impendulo yakho:

1. Ngabe uliqondile iphepha lolwazi lesifundo? YEBO / CHA

2. Uke waxoxa ngocwaningo nanoma ubani? YEBO / CHA

3. Uxoxe nobani ngalo? _____

4. Ngabe ikhona imibuzo onayo ngocwaningo noma iqhaza okufanele ulibambe ocwaningweni? YEBO / CHA

5. Ngabe ukhathazekile nganoma iyiphi ingxenye yalolu cwaningo? YEBO / CHA

6. Ngabe uthole ulwazi olwanele ngalolu cwaningo? YEBO / CHA

7. Uyaqonda ukuthi uzobandakanyeka kanjani kulolu cwaningo? YEBO / CHA

8. Uyaqonda ukuthi ukhululekile ukuthi ungahoxa kulolu cwaningo:

a) Noma yinini futhi:

b) Ngaphandle kokuba nesizathu sokuhoxa YEBO / CHA

9. Uyavuma ukubamba iqhaza ngokuzithandela kwakho kulolu cwaningo? YEBO / CHA

Mina, _____ngalokhu ngiyavuma ukubamba iqhaza

(IGAMA LOMBAMBIQHAZA)

kulo msebenzi obalulwe ngenhla.

_____ _____

(IGAMA LOFAKAZI ELIPHRINTIWE) **(ISIGINESHA)**

APPENDIX 6: INTERVIEW SCHEDULE

Teacher Interview Questions

(Greeting and introduction of the researcher)

1. Tell me about your life as a teacher from the time you started? Why did you choose to study teaching?

2. What makes your teaching in the classroom enjoyable?

3. Tell me about an exciting experience teaching Life Skills?

4. Tell me about any bad experiences?

4. Which teaching methods or styles do you prefer?

5. Why do you prefer this/these methods?

6. Have you tried other methods?

- If not, why?

- If yes, what methods did you try?

-What were the outcomes?

APPENDIX 7: INTERVENTION OPTIONS

Intervention Options – Teaching ideas for teachers to choose from

- Water word search as a fun take-home activity

- Conduct an experiment in class and make a mini-water cycle using household items

- An animated Powerpoint presentation/slide show on the water cycle

- Design a poster in groups illustrating water conservation

- Write a poem or song encouraging others to save water

- A video on the current state of water availability in South Africa followed by a debate

- Discussion on water pollution and its sources

- Student-taught lesson where students present different aspects of a topic as a group

- Make a watershed to understand water movement on land and pollution

- An experiment to illustrate water purification by evaporation and condensation

- A video on the relationship between climate change and the water cycle followed by discussions and/or debate

APPENDIX 8: ACTIVITY BOOK

THE ENVIRONMENT AND ME

I AM A BOY ☐

I AM A GIRL ☐

In your own words, explain why is water important? You can use stories or examples to explain.

_____

_____

_____

_____

_____

Complete the sentence:

Water pollution is caused by

_____

_____

_____

Draw a diagram or picture illustrating the water cycle

What is your understanding of the above picture regarding climate change and water? Which do you think is true?

_____

_____

_____

_____

_____

How can you save water in your own home?

_____

_____

_____

_____

_____

_____

Design a mini-poster showing ways to save water

What **did** you like about the teaching method?

_____
_____
_____
_____
_____

What **didn't** you like about the teaching method?

_____
_____
_____
_____
_____
_____
_____
_____

THANK YOU!!!

APPENDIX 9: POST-INTERVENTION INTERVIEW QUESTIONS (INTERVENTION SCHOOL)

Post-Intervention Teacher Interview Questions (Intervention School)

(Greetings by the researcher)

1. What has been your experience of the study journey?

2. Did you enjoy delivering the intervention?

3. Did you find the implementation of the intervention challenging?

- Please explain?

4. Did you experience any other challenges?

5. What were the highlights or positive findings for you from the study?

6. Do you think the learners took well to the intervention?

- Why do you think this was so?

7. Which method do you NOW prefer?

- Why?

8. How do you feel about the understanding of the learners on the topics covered?

- Can you discuss further?

9. How was the interaction and responses of learners during lessons?

10. Do you think you will be revising your teaching methods in the future?

- Why?

11. Would you recommend a revision in teaching methods to other teachers?

- Can you explain why?

12. Would you advocate for this study if needed?

Thank you for your time and participation!

APPENDIX 10: POST-INTERVENTION INTERVIEW QUESTIONS (CONTROL SCHOOL)

Post-Intervention Teacher Interview Questions (Non-intervention School)

(Greetings by the researcher)

1. For the lessons on water, do you think the approach used (conventional) was appropriate?

2. Do you think the teaching method was effective in delivering the knowledge and understanding to learners?

3. How did learners respond to the lessons according to your perception?

4. How do learners generally respond to the teaching methods used?

5. Do you think a revision of teaching methods will be effective in improving learner understanding and knowledge retention?

6. Would you consider revising your teaching methods?

Thank you for your time and participation!

APPENDIX 11: DUT IREC ETHICAL CLEARANCE CERTIFICATE

Institutional Research Ethics Committee
Faculty of Health Sciences
Room MS 49, Mansfield School Site
Gate 8, Ritson Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2900
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www.dut.ac.za

31 August 2016

IREC Reference Number: **REC 84/16**

Mrs M Ruthanam
7 Greyridge Drive
Stanger
4450

Dear Mrs Ruthanam

A comparative assessment of a climate change pedagogic intervention amongst Grade 5 learners in KwaDukuza

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tools for review.

We are pleased to inform you that the questionnaires have been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Yours Sincerely,

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2016 -08- 31
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
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