

**Environmental education through sustainable school food waste  
management in the Vhembe District, Limpopo**

By

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## DECLARATION

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I declare that Environmental education through sustainable school food waste management in the Vhembe District, Limpopo is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and this work has not been submitted before for any other degree at any institution.



SIGNATURE

10 /08 2020

DATE

## **DEDICATION**

I would like to dedicate this work to my two beautiful daughters, Mpho Confort Maphaha and Netshedzo Chriseldah Maphaha.

## ACKNOWLEDGEMENTS

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## SUMMARY

This qualitative case study focuses on identifying factors that could either enable or constrain sustainable food waste management as a form of environmental education (EE) in the participating schools. The study was motivated by the observation that the National School Nutrition Program (NSNP) that was introduced by the Department of Basic Education to support learners from disadvantaged backgrounds with nutritious food was causing pollution in some schools due to inadequate discarding of food leftovers. The purpose of the study was to develop recommendations towards a sustainable means of managing this food waste in the schools. As an Agricultural Science educator, I wanted to explore the possibilities of enhancing environmental education in schools through sustainable food waste management.

While research has been conducted about food waste management and how this is an environmental concern, little has been written about it as it relates to environmental education and sustainability in schools. Hence, this study sought to contribute knowledge to this gap. To achieve this aim, this study followed a descriptive case study design, framed by the value-belief-norm (VBN) theory. Three schools in Vhembe district, Limpopo, were conveniently selected, and the NSNP food coordinator of each selected school, one food handler, two learners, two educators and two SGB members from each sampled school were purposively sampled to get rich information from them about sustainable school food waste management. Data were collected through semi-structured, face-to-face interviews and observations. The findings indicate the various ways in which food waste could be managed in these schools, such as recycling through composting, reusing by community farmers, and reducing the amount of possible food waste. The study also found environmental education to be a key element in which the schools could invest to sustainably and effectively manage food waste.

### **Key words**

Food waste, recycling, reuse, reduce, environment, environmental education, food waste management, school food waste management, education for sustainable development, community involvement, leftover foods

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## LIST OF ABBREVIATIONS

CEDU	College of Education
CIWMB	California Integrated Waste Management Board
CSIR	Council for Scientific and Industrial Research
DANIDA	Danish International Development Agency
DBE	Department of Basic Education
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DEFRA	Department of Environmental, Food and Rural Affairs
DSM	District Senior Manager
EE	Environmental Education
EEASA	Environmental Education Association of Southern Africa
EECI	Environmental Education Curriculum Initiative
EEPI	Environmental Education Policy Initiative
EPA	Environmental Protection Agency
ESD	Education for Sustainability
FAO	Food and Agriculture Organisation
GFEESC	Gold Fields Environmental Education Service Centre
GHG	Greenhouse Gas
HLPE	Higher level of experts on food security and nutrition
IUCN	International Union for Conservation of Nature and Natural Resources
LEAP	Local Environmental Action Plan
MWMMG	Metropolitan Waste Management Group
NCS	National Curriculum Statement
NEAC	National Environmental Awareness Council
NGO	Non-Governmental Organisation
NSNP	National School Nutrition Program
NWMS	National Waste Management Strategy
RCL	Representative Council for Learners
RCRA	Resource Conservation and Recovery Act
REEP	Regional Environmental Educational Program
SADC	South African Development Community

SGB	School Governing Body
SIDA	Swedish International Development Agency
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational Scientific and Cultural Organization
Unisa	University of South Africa
USA	United States of America
UVP	Umgeni Valley Project
WESSA	Wildlife Environmental Society of South Africa
WRAP	Waste and Resource Action Plan
WWF	World Wildlife Fund

# CHAPTER 1: ORIENTATION OF THE STUDY

## 1.1 INTRODUCTION

Food waste is a significant threat to sustainable development across the world. Therefore, environmental education's (EE) role in addressing this threat cannot be overemphasised. Food waste particularly threatens food security in developing countries, while polluting the land and air, with implications for people's health in all contexts. According to Ishangulyyev, Kim and Lee (2019:1), about "one-third of all food produced for human consumption (1.3 billion tonnes of edible food) is lost and wasted across the entire supply chain every year". These authors estimate the monetary value of food loss and waste to be USD \$936 billion, a sum that could be used to address other environmental problems such as poverty. The concern with the effects of food waste is also shared by the Food and Agriculture Organisation (FAO) (2011).

Friedrich and Trios (2013:2521) state that food that is discarded in waste bins ends up in landfills and produces significant amounts of methane gas and other more powerful greenhouse gases (GHG) than carbon dioxide. The amount of GHG, such as methane and carbon dioxide, absorb radiation and heat the earth's surface to cause global warming and climate change. The authors (Friedrich & Trios 2013:2521) also state that "with agriculture accounting for 70% of water used throughout the world, food waste represent a great waste of fresh water and ground water". This information alludes to the fact that food waste requires people's attention as much as other environmental challenges. It also calls to attention the values, beliefs and norms that influence people's behaviour towards the environment.

There are several ways to manage food waste. For example, Spooner (2012:272), Varroto and Spagnolli (2017) mention recycling, reducing and reusing as being useful in preserving natural resources and reducing pollution. Loubser et al. (2005:7) also discuss recycling as an alternative to "conventional waste disposal strategies", which can save some materials that are useful in lowering GHG emissions. Recycling can reduce energy consumption, air pollution (from incineration) and water pollution (Loubser et al. 2005:7). However, there are global concerns about the negative

behaviours that still contribute to the increase in these environmental problems due to different values, beliefs and norms.

Having reviewed the literature on food waste and the possible ways of managing it, in this study I focus on this phenomenon as it relates to schools, a topic that is neglected in the field of EE. I realised that literature on this topic is about general food waste management and not school food waste management; that is, the sustainable management of food waste generated in schools. This chapter introduces the study by first presenting the background and rationale for the study. Second, a problem statement and the research questions are discussed. Third, the purpose of the study is presented, followed by the research aims and research objectives. The fifth section presents the research methodology of the study, before its trustworthiness is considered. In section seven, the ethical considerations of the study are discussed. The eighth section reviews the limitations and delimitations of the study. In the ninth section, the definitions of concepts are presented before the chapter outline.

## **1.2 BACKGROUND AND RATIONALE**

South Africa has several families that live in poverty, with food insecurity and unemployment. Research suggests that learners from such families are affected in terms of behaviour and performance in schools (Kwatubana & Makhalemele 2015; Langsford 2012). In other words, some learners that come to school hungry tend to misbehave and do not to perform well academically. To contribute to the welfare of such learners, in 2004, the South African Department of Basic Education (DBE) introduced a National School Nutrition Program (NSNP) in primary schools and in secondary schools in 2009. The purpose of the programme was to enhance the learning capacity of learners from disadvantaged backgrounds by providing them with healthy and fresh meals daily to reduce absenteeism associated with hunger and poverty. Graham et al. (2015:7) identify several benefits and contributions of school nutrition programmes in such contexts. These include improvement in children's health and well-being, a reduction of "short-term hunger", and improvement of "children's food security". Such programmes, according to Graham et al., can also address the worldwide problem of obesity among children of school-going age.

In some schools, an undesired situation resulted from the NSNP; food leftovers would be discarded everywhere, which was not good for the environment. Learners would throw away cooked food leftovers and fruit peels. Food handlers would also discard vegetable peels and some of the cooked food. As a teacher in one of the schools with this programme, I observed that food leftovers were thrown all over the schoolyard during lunch breaks and the excessively full waste bins spilt over from all the food waste. Municipal collectors were not available to assist schools in solving this problem. This was unpleasant and not environmentally friendly. As an Agricultural Science teacher, who understood the possible benefits and negative impacts of such food waste on the environment, I realised that some EE was required in these contexts. However, I needed to first conduct research to gain a better understanding about this identified problem.

### **1.3 PROBLEM STATEMENT**

Researchers identify various ways in which food waste can be managed. For example, Painter, Thondhlana and Kua (2016) suggest that if food waste is reduced, food insecurity can also, in turn, be reduced. They also mention landfills as another possibility, but that the cost of planning and managing such landfills can be high. Nahman et al. (2012) also mention the issue of costs and the estimated amounts are up to billions of Rands.

While much has been written about food waste management and its advantages to the environment (see also Section 1.1), it is unclear how food waste can be managed sustainably in schools where it can potentially affect teachers, learners, support staff and school governing bodies (SGB). As indicated in the background section, the provisions of food to support learners who come from challenged backgrounds have created this problem of food waste in selected schools. Schools get polluted and individuals sometimes contract pollution-related diseases.

### **1.4 RESEARCH QUESTIONS**

This study thus intended to determine how food waste could be managed in schools, and it was guided by the following question:

*How can food waste be sustainably managed as a form of environmental education in selected schools in Vhembe district, Limpopo?*

The sub-questions were:

- (a) What factors can enable the sustainable management of food waste as a form of environmental education in schools?
- (b) What factors can constrain the sustainable management of food waste as a form of environmental education in schools?
- (c) How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools?
- (d) How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?

#### **1.4.1 The purpose of the study**

The purpose of the study was to develop recommendations towards the sustainable means of managing food waste as a form of environmental education in the participating schools.

#### **1.4.2 Research aim**

The aim of the study was to examine how food waste could be sustainably managed as a form of environmental education in selected schools in Vhembe district, Limpopo.

#### **1.4.3 Research objectives**

The main objectives of the study were to:

- identify factors that could enable the sustainable management of food waste as a form of environmental education in schools;
- identify factors that could constrain the sustainable management of food waste as a form of environmental education in schools?
- To explore the ways in which the enabling factors could be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools
- To explore the ways in which the constraining factors could be addressed to facilitate the management of food waste as a form of environmental education in schools.

## **1.5 THE SIGNIFICANCE OF THE STUDY**

In a country where most people live in poverty, a study that can provide information on how to improve the ways of living can be valued. As indicated above, this study intended to provide information about the sustainable means of managing food waste as a form of environmental education in the participating schools. Teachers often say they do not know how to integrate EE in their lessons; the information developed through this study can be valuable in this regard, especially in terms of addressing forms of pollution.

Among the study's recommendations is the inclusion of compulsory practical lessons in the schools. The study has provided insights on how such EE lessons can be organised to assist in addressing the problem of food waste or even the related pollution problems in the schools. Thus, the study provided some insights that could be considered when designing programmes towards the sustainable management of food waste in the participating schools and, possibly, those that are in similar contexts.

## **1.6 DELIMITATION OF THE STUDY**

The focus of this study was to understand the factors that could enable and constrain the sustainable management of food waste as a form of EE in schools. The study was

confined to selected members of the chosen schools, which were the educators, NSNP coordinators, food handlers, learners and the SGB in each of the selected schools.

## **1.7 DEFINITION OF CONCEPTS**

### **1.7.1 Food waste**

For the sake of this study, food that is discarded, spoiled or thrown away rather than consumed is referred to as food waste (FAO 2014).

### **1.7.2 Leftover foods**

Food that is produced for consumption can sometimes be left over. Ardhna (2019:15) provides a detailed explanation that leftover foods are food that remains unconsumed after taking a meal for the day, to be eaten later or thrown away. In this study, food leftovers include the cooked food that remains after all the learners have been supplied with a meal for the day as well as that which was not cooked and can be donated.

### **1.7.3 Reducing**

When it comes to food waste, reducing means discarding less than consuming or using food in positive ways. LaRue (1995:1) defines 'reducing' as a way to create less waste to be recycled or thrown away.

### **1.7.4 Reusing**

Instead of discarding or throwing away, food waste can be reused. Mills (2012:1) defines 'reusing' as using a product again and again for the intended purpose. In the case of food, other means may be found to use food rather than throwing it into the rubbish bins.

### **1.7.5 Recycling**

Spooner (2012:272) defines 'recycling' as the way in which waste materials are sent back to the beginning of the waste stream and are used to produce new products. In

this study, I use this concept to refer to how the leftover food in schools can be re-utilised.

### **1.7.6 Sustainable development**

According to Hoffmann and Siege (2018:3), sustainable development is “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations”. Therefore, in the case of this study, sustainable development refers to a situation where food is produced in ways that will support the present consumers and not compromise the supply for future consumers.

### **1.7.7 Education for sustainable development**

Educational practices that are meant to provide knowledge regarding the present use of resources in ways that will not compromise the supply for the future is education for sustainable development. In the case of this study, education on possible ways of managing food for sustainability falls under this form of education.

### **1.7.8 Sustainable management**

Tregidga and Milne (2006:227) define sustainable management as “managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety...”. Thus, in this study, sustainable management entails ensuring that food waste is adequately tackled to address and contribute to the socio-economic and health matters of the communities where schools are located.

### **1.7.9 Environmental education**

Environmental education entails educating people about, for, and in the environment (Robottom 2014; Zwelibanzi 2016). In this study, it should be understood as referring

to the direct and indirect provision of knowledge about the possible use and dangers of food waste in schools.

## **1.8 CHAPTER OUTLINE**

The study consisted of six chapters, as discussed next.

### ***Chapter 1***

This chapter introduces the study by presenting the background and motivation, the purpose of the study, aims and objectives. It also introduces the research methodology.

### ***Chapter 2***

The chapter reviews literature related to waste management, solid waste management, food waste management, and food waste recycling in schools.

### ***Chapter 3***

In this study, EE is regarded as an essential component of sustainable food waste management. Thus, in this chapter, EE, with its dimensions and the international perspective of EE are reviewed; the origin of EE in South Africa is presented, and EE and sustainable development, together with the theoretical framework, is discussed.

### ***Chapter 4***

The chapter provides the details of various aspects of the research methodology, including the research design, research approach, research paradigm, sampling, data collection, data analysis and ethical considerations. The issues related to trustworthiness are also presented in this chapter.

### ***Chapter 5***

An analysis of data and the research findings are discussed in detail in this chapter.

### ***Chapter 6***

This chapter consists of the discussion of findings and also presents the recommendations in relation to the findings.

## **1.9 CONCLUDING REMARKS**

In this chapter, I introduced the research topic. I presented the background to the study, explaining the rationale for embarking on this research. I also presented the problem statement, the purpose of the study, as well as the aim and objectives. I discussed the research methodology by looking at the research paradigm that this study employed. I then presented the research design and research approach that was used in this study. Next, I explained the sampling methods this study followed, together with the data collection methods and how the collected data were analysed. I also explained the trustworthiness of the study, the ethical considerations that were maintained, as well as the limitations and delimitations of the study. Finally, I defined the key concepts and also indicated how the chapters of this study are outlined. Next, the literature review related to food waste as an environmental problem is discussed.

## CHAPTER 2: FOOD WASTE AS AN ENVIRONMENTAL PROBLEM

### 2.1 INTRODUCTION

This study was premised on the notion that EE could be an answer to addressing food waste in the participating schools. However, this chapter is dedicated to reviewing literature on various issues, factors and/or strategies that can be considered in developing EE lessons or integrating the topic of food waste management in school curricula. The topic of EE is discussed in detail in Chapter 3.

For consistency, in this chapter and beyond I deliberately use the concepts 'factors' and 'strategies' interchangeably. The chapter is focused on reviewing literature related to:

- (a) Food waste as an environmental problem: This section provides perspectives on the issue of food waste as one of the greatest environmental problems across the globe. It lays a foundation for the need for EE regarding food waste.
- (b) Causes of food waste: This section presents the various sources of food waste, including the domestic, cultural, political and behavioural. These aspects are important for this study as they may explain the reason for food waste in schools.
- (c) Food waste in schools: This section looks at literature on the trends regarding food waste in schools, both internationally and locally. It further connects with (b) by looking at the causes of food waste in schools.
- (d) Recycling, reusing and reducing as strategies to manage food waste: This section presents research on the different forms of recycling as a foundation to analyse which one can be considered in this study's research context.
- (e) The dynamics of recycling, generally and in schools: This section presents a review of literature on the benefits of recycling as an environmental practice in communities and schools. I also discuss the challenges related to this practice.

## 2.2 FOOD WASTE AS AN ENVIRONMENTAL PROBLEM

Food waste is among the most concerning solid waste problems in the world. Thyberg and Tonjes (2016:1) note that the United States of America (USA) disposes of nearly 15% of food waste compared to all other municipal waste. This rate is calculated to “0.6 pounds of food waste per person per day”, a problem that “has been increasing over time” (Thyberg & Tonjes 2016:1). However, according to Vidanaarachchi, Yuen and Pilapitiya (2006), this problem is more of a concern in developing countries due to rapid population growth and urbanisation. These authors argue that while the problem of food waste and other solid waste is regarded as a simple municipal service in the developed world, developing countries are struggling to ensure proper management of such waste. While collection may help to remove waste from generators, collected waste is often disposed of in open dumps without regard to environmental degradation or human health impacts (Vidanaarachchi, Yuen & Pilapitiya 2006:920).

According to Thyberg and Tonjes (2016:3), there have been developments on the definition of ‘food waste’ over place and time, yet no universal agreement has been reached about these definitions. Thyberg and Tonjes (2016:3) illustrate these developments, as shown in Table 2.1. They note that different words are used interchangeably to refer to food waste, including “food loss” are used interchangeably to refer to food waste, food loss, bio-waste and cooking waste. The same words are sometimes used, but with different meanings (Thyberg & Tonjes 2016:3). The meanings of food waste can vary as the definition of food waste varies between people. Thyberg and Tonjes (2016:9) argue,

*Culture and personal choice affect decisions regarding what is too good to throw away ... Therefore, food waste generation is a function of cultural, personal, political, geographic, and economic forces that influence behaviour in specific ways ... and it may differ from person to person, year to year, or from society to society.*

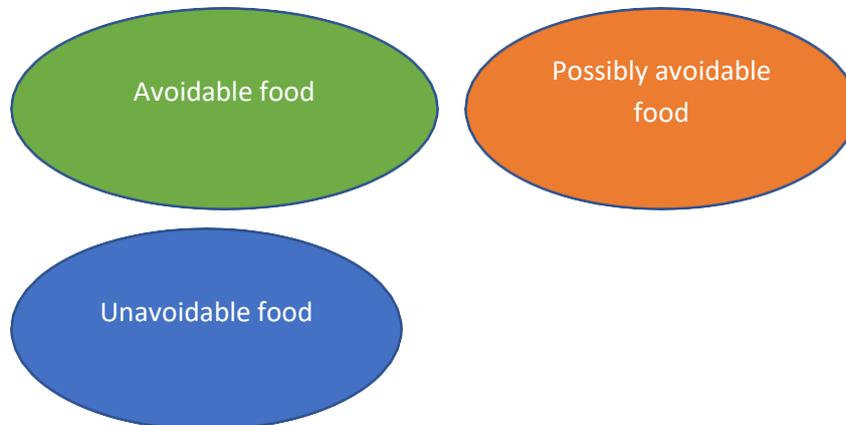
**Table 2.1: The definitions of food waste (Thyberg & Tonjes 2016:3)**

Author	Year	Definition
Kling	1943	Food waste is the destruction or deterioration of food or the use of crops, livestock and livestock products in ways which return relatively little human food value.
Food and Agriculture Organization (FAO)	1981	Food waste is all food products allocated for
Organization (FAO)		human consumption that are instead discarded, lost, degraded, or consumed by pests at any stage of the food chain.
FAO	2013	Food waste is food appropriate for human consumption that is discarded (generally at retail and consumption stages).
European Commission	2014	Food waste is food (including inedible parts) lost from the food supply chain, not including food diverted to material uses such as bio-based products, animal feed, or sent for redistribution.

Author	Year	Definition
United States Environmental Protection Agency (USEPA)	2014	Food waste is uneaten food and food preparation wastes from residences, commercial, and institutional establishments. So, food wastes from homes, grocery stores, restaurants, bars, factory lunchrooms, and company cafeterias are included. Pre-consumer food waste generated during food manufacturing and packaging is excluded.
United States Department of Agriculture (USDA) (Buzby et al. 2014)	2014	Food waste is a subset of food loss and occurs when an edible item goes unconsumed. Only food that is still edible at the time of disposal is considered waste.
World Resources Institute (WRI)	2015	Food loss and waste refer to food, as well as associated inedible parts, removed from the food supply chain.

The South African Department of Environmental Affairs and Tourism (DEAT) (1996c) defines 'food waste' as food that is no longer useful and can be disposed of. Some researchers define it as "any food that is brought home" but "is not consumed by humans" (Department of Environmental, Food and Rural Affairs (Defra 2010:1375). Ramukhwatho, Du Plessis and Oelofse (2017:254-265) define 'food waste' as "unconsumed or unwanted food materials...".

Food waste, according to Salomone et al. (2017:1) "is receiving growing attention due to its negative environmental, social and economic impacts". Similarly, Sreekanth and Sahu (2015) note that the problem of food waste is experienced both in urban and rural areas. According to Ramukhwatho (2016:6), food waste is categorised into three categories: the category to be avoided: the food to be eaten; the possibly avoidable food; and unavoidable food. In addition, Ramukhwatho (2016:6) and the Wrap (2009b) clarify that food that can be avoided is that which is bought and not used for its intended purpose (see Figure 2.1). Some of this food is wasted during preparation, while some of this food is considered inedible, such as bones and eggshells (Imbert 2017).



**Figure 2.1: Food waste management (WRAP 2009B)**

The FAO (2011) explains that edible food waste refers to food that can be consumed by human beings, such as bread, meat and fruits. Possible avoidable food waste, including bread crusts, potato peelings and apple peelings, are waste generated because of people's choices; some people do not enjoy eating these parts of foods and discard them. Unavoidable food waste is referred to as food that is not consumable by human beings, such as bones, eggshells, fruit and vegetable peelings (Wrap 2009b). Edible food waste falls under avoidable and possible avoidable groups, while

inedible food waste falls into the unavoidable food waste group.

According to Lin et al. (2013:428), food waste has been a problem worldwide, particularly in developing countries such as China and India. Oelofse, Muswema and Ramukhwatho (2018:1) argue that an estimated amount of “between a third and a half of all food produced globally never reaches the point of human consumption” and gets wasted. The European Union estimated a 40% increase of this problem by the year 2020, from about 100 million tonnes per annum to 126 million tonnes (Salomone et al. 2017). Similarly, Ogola, Chimuka and Tshivhase (2011:108-110) conducted a study about waste management in Limpopo, South Africa, and the findings showed that there was more food wasted than any other type of waste in that area.

Limited research on food waste has been conducted in South Africa (Oelofse & Nahman 2013:83). They argue that even waste characterisation studies are limited in the country. In their discussion of limited research on this topic, Nahman, Lange, Oelofse and Godfrey (2012:82) refer to Sibernagl (2011) who stressed that few studies had been conducted on this topic in South Africa: two in Johannesburg, two in the Western Cape, and a few in Rustenburg, Bloemfontein and Limpopo. Yet this problem is extensive and observable in schools worldwide.

### **2.3 CAUSES OF FOOD WASTE**

Gustavsson, Cederberg, Sonesson, van Otterdijk and Meybeck (2011) posit that the causes of food waste are contextual to the different parts of the world and depend on each country’s specific conditions. According to the HLPE (2014), food waste results from interrelated causes. However, these causes fall under three different levels, namely the micro-level, the meso-level, and the macro-level. The micro-level causes occur during the food production and consumption period. The meso-level causes occur due to a lack of equipment, coordination and communication, and infrastructure. However, it focuses on the infrastructure where food is stored. The causes of food waste at macro-level include malfunctioning food systems, a lack of policy and the adoption of good practices. In the following section, I discuss these causes, focusing on the various aspects of the micro-level.

### 2.3.1 Households food waste

Studies identify five aspects that generate food waste at homes. These are food preparation, food purchase, food consumption, the way food is handled, and people's attitudes, knowledge and behaviour towards food (Diaz-Ruiz, Costa-Font & Gil 2015:4; Teng & Trethewie 2012; Giroto, Alibardi & Cossu 2015:33). The problem with household food waste is evident in both developed and developing countries. According to Rozin (2014), in Brazil and the United Nations, consumers enjoy dishing large amounts of food on their plates and end up not finishing their meals. The unfinished meals get disposed of into waste bins. Porpino, Parente and Wansink (2015) observe that some families in Brazil tend to prepare a lot of food with the intention to save time and have meals prepared for later consumption, yet these meals are seldom eaten. Such food becomes contaminated and ends up in waste bins. This habit, according to Porpina et al. (2015), Parfitt, Barthel and Macnaughton (2010:3074) also happens because having food on the table in low-income countries is regarded as wealth.

Diaz-Ruiz, Costa-Font and Gil (2015:3074) and the Wrap (2008; 2009b) claim that the amount of food that is wasted in the United Kingdom (UK) has reached a stage where people do not know how much of this waste has accumulated, with more than eight thousand tonnes of food and drinks being wasted annually. The total amount of food waste estimated in UK households is 25% of the food that is bought. Similarly, Griffin, Sobal and Lyson (2009:68) state that in the USA, more than 25% of food is wasted in the household and discarded in landfills. The same is true for Australia, where the food that is disposed of in landfills is estimated to amount to 20 million tonnes per annum (Morgan 2009:16).

Sociological studies of food waste describe how food is prepared in everyday households. Evans (2011:1123) also explains how cultural and social factors, along with food practices, determine if food is edible or inedible. Food waste occurs due to poor planning, shopping, storage, preparation, and consumption. Poor planning in shopping leads to buying bulk food of little importance. Sometimes, consumers purchase food, not knowing how or when to use it (Mavrakis 2014; Gustavsson et al. 2011), which is a contributing factor to food waste. The storing of food in refrigerators

for a longer time than intended also contributes to food waste (Quested & Johnson 2009).

According to Guerrero, Maas and Hogland (2013:231), households make wrong choices related to waste disposal because of “inadequate supply of waste containers and longer distance to these containers increase the probability of waste dumping in open areas and roadsides relative to the use of communal containers”. These authors also mention insufficient financial resources and the absence of legislation as other contributing factors to this cause (see also Pokhrel & Viraraghavan 2005).

### **2.3.2 Industrialisation and urbanisation**

In many parts of the world, the number of people employed in agricultural sectors has decreased as a result of the rural-urban migration, which is caused by industrialisation and which, in turn, causes urbanisation (Parfitt et al. 2010:3067). Urbanisation creates the need to increase the food supply chain to feed the people living in urban areas as a result of high population growth. Strasser (1999) explains that people living in the industrialised or developed world prefer meals that are prepared in advance and processed, such as canned and frozen foods (see also Thyberg & Tonjes 2016:10). Some, according to Sobal (1999), prefer to eat at restaurants; in developed countries, there is a high number of people eating in restaurants. It is also observed that people from the USA spend half of their income on food at restaurants (Thyberg & Tonjes 2016:10). Moreover, people in urban areas purchase groceries that stay in their refrigerators for extended periods because they actually prefer to eat at restaurants; meaning, food that is being stored will rot and end up being disposed of.

### **2.3.3 Higher incomes**

As a result of increased income, individuals' and communities' dietary patterns can change. Dietary changes can cause people to, for instance, eat less starch and more perishable foods, such as fruits, vegetables and different kinds of protein (Oelofse & Nahman 2013; Parfitt et al. 2010; Thyberg & Tonjes 2016). As a result of the short lifespan of these foods, they easily become spoiled and end up being disposed of (Gustavonsson et al. 2011; Parfitt et al. 2010). Parfitt et al. (2010:3067) also argue that

“the shift towards vulnerable, shorter shelf-life items is associated with greater food waste and a greater draw on land and other resources”.

According to Pearson, Minehan and Wakefield-Rann (2013:119), in countries like the USA, food is inexpensive compared to commodities like housing. As a result of higher incomes, people can waste food because they do not consider food expenditure as impacting on their income. Gustavsson et al. (2011) suggest that the careless attitude of consumers who can afford to waste food is a significant contributor to household food wastage. The price of food can also influence food waste; if the price is low or retailers have promotions, people buy more of these products (Parfitt et al. 2010:3079).

#### **2.3.4 Increased globalisation of trade**

Exporting and importing food can pose a threat to the production of food in domestic markets (Oelofse & Nahman 2013). As competition becomes high with globalisation of buying and selling, difficulties in the supply chain also increase. These difficulties include transport distances, extended storage of food, and extended food shelf-life. These issues lead to food being disposed of as it gets spoiled.

#### **2.3.5 Cultural behaviours, norms and attitudes**

Social norms, social class, attitude, and cultural upbringing can contribute to food waste. Moreover, Schneider and Obsterner (2007) suggest that age, time spent at home, and income are factors that must be taken into consideration when examining behaviours in relation to food waste. In a family where there are adults and children, food is bought to suit each member within the family, and this may lead to some food being wasted. Interestingly, Quested et al. (2013) found that British people over the age of 65 consume less than other age groups; scholars (Lyndhurst 2007; Quested et al. 2013) explain that people over the age of 65 are influenced by the past, wherein food was scarce and saving food was a priority. Conversely, young people waste more food (Cox & Downing 2008; Wasteminz 2014). In Australia, people between the ages of 18 to 24 waste more than 38% of purchased food, compared to people older than 70 years. According to Quested et al. (2013:44), it is not yet clear if the younger generation will change and waste less as their knowledge, attitudes, and lifestyles

change as they grow.

Pearson et al. (2013:120), Cox and Downing (2008) further found that families with children waste more food than families without children. In Sweden, waste is generated as a result of children not finishing their meals (Wasteminz 2015). According to Graham-Rowe, Jessop and Sparks (2014:20) women feel guilty when throwing food away because they feel they are not appropriately providing for their family. The main reason women take good care of food is because they are responsible for its purchasing (Cronje van der Merwe & Muller 2018:4). According to the World Bank (2013) women are also increasingly heading families or becoming breadwinners.

Diaz-Ruiz, Costa-Font and Gil (2015:4) identifies three factors that are related to food waste, namely purchasing behaviour, price importance, and dietary importance. Purchasing behaviour may impact on the management of food, leading to poor preparation, handling and use (Mallison, Russel & Barker 2016; Wrap 2007). Therefore, food waste results from a combination of behaviours such as cultural, political, economic, values and attitudes (Quested et al. 2013:45). However, some studies indicate that there is no consensus on attitudes towards food waste; only a lack of concern and food waste awareness as far as reducing such waste (Pearson et al. 2013:120).

Guerrero, Maas and Hogland (2013) mention the expenses required to provide food waste removal services for communities, and these expenses may be exacerbated by the lack of willingness from the communities to pay for the removal of their refuse. The people's attitudes in this regard can be that the local municipalities have a sole duty to manage such waste (Vidanaarachchi, Yuen & Pilapitiya 2006), yet "the operational efficiency of solid waste management depends upon the active participation of both the municipal agency and the citizens..." (Guerrero, Maas & Hogland 2013:222).

Guerrero, Maas and Hogland (2013) and Vidanaarachchi, Yuen and Pilapitiya (2006) also identify other attitudes that contribute to the problems of food and other solid wastes. They argue that solid waste removal workers are categorised as being of low social status, and this attitude demotivates people to work in this industry. In addition, the authors argue, "Politicians give low priority to solid waste compared to other municipal activities ... with the end result of limited trained and skilled personnel in the

municipalities” (Guerrero, Maas & Hogland 2013:222). Therefore, this undermining attitude is also caused by those in authority, a situation that may spill over to the communities and schools.

According to Thyberg and Tonjes (2016:12), culture has a significant role in determining the food types, eating habits and nutrition of societies. They argue, “People from different cultures regard different foods and food parts as edible and throw different parts away” (Thyberg & Tonjes 2016:12). This cultural difference also speaks to the issues of food quality versus quantity. For instance, Rozin (2005 in Thyberg & Tonjes 2016) identified the French as having an attitude that emphasises quality and moderation related to food rather than abundance that may end up being discarded.

### **2.3.6 Institutional and commercial behaviour**

Retailers tend to overstock goods to generate the excess effect, which is thought to increase sales (Gunders 2012). Additionally, retail stores must sell a range of items and stock enough to satisfy the demands of consumers. The fear of running out of stock and the significant revenue-loss fines result in overstocking, over-cutting, and excessive turnover of stock (Gunders 2012; Gustavsson et al. 2011). Moreover, customers tend to make choices on where they want to purchase based on the quality of perishables foods (Gunders 2012). This forces retail groups to deliver quality products with the perfect shape, size, and colour (Gunders 2012; Gustavsson et al. 2011). This trend results in a large percentage of perfectly good food not being sold because of external cosmetic appearance (Gunders 2012). The food supply chain further determines a minimum order quantity according to case size to simplify the ordering and delivery of products. The inflexible case and unit sizes will result in more than they plan to sell being ordered (Gunders 2012). Furthermore, the packaging of bulk products leads to the problem of food ending up in landfills (Gunders 2012; Gustavsson et al. 2011).

## **2.4 FOOD WASTE IN SCHOOLS**

According to Bagherzaden, Inamura and Jeong (2014:6), it is vital first to understand

the causes of food waste in low-income countries to be able to understand food waste in schools. As discussed above, these causes, according to Parffit et al. (2010:365), may include cultural, political and economic forces. Emanating from these and other possible factors, schools in many parts of the world also experience food waste. For example, Wilkie, Graunke and Cornejo (2015:25) note that schools in Florida, USA, experience significant problems with food waste. The primary sources of food waste in these countries are cafeterias, where learners buy food for lunch. Learners tend to waste food, which ends up in landfills, and it is difficult for the municipalities to collect.

The unavailability of enough literature focusing on food waste management in schools in South Africa can be seen as testimony to the fact that food waste management is not considered a priority, despite all the health and environmental challenges it poses. More work still needs to be done to find solutions in dealing with food waste in schools. The available literature on food waste in the country has primarily been conducted in universities, and few have focused on schools. According to the 2012 research conducted at the University of Cape Town, students prefer high-quality food. Students were not happy with a specific meal being served every day (Marais, Smit, Koen & Lotze 2019:21), and this situation led to food being wasted. Similarly, students at the University of Stellenbosch also decided not to eat their meals for different reasons, such as the way food was being served and the untidiness of the cafeteria. They disliked the menu, and this led to food being wasted. In Grahamstown, food waste was minimised by taking some food waste produced at the Rhodes University residence kitchen and selling it to pig farmers outside Grahamstown. The rest of the food waste was composted in pit behind the students' residence, even though it is not allowed according to legislation (Swanepoel, Knott, Nkonki, Zondi, Ngcwayi & Webster 2011:27).

## **2.5 FOOD WASTE IN SOUTH AFRICA**

Oelofse (2013) states that the amount of food wasted in South Africa from local production amounts to 9.4 million tonnes per annum. The amount of food wasted during production, imports and exports are 10.2 million tonnes per annum. Inadequate planning was found to be a significant contributing factor to discarded food, purchasing in bulk and buying products that are not necessary. This type of food can rot very fast

and end up been discarded in waste bins. Leftovers were identified as the most discarded food (Cronje, van der Merwe & Muller 2018:4).

According to the Council for Scientific and Industrial Research (CSIR) (2004), a State of the Environment Report was conducted in East London. This Environmental Report identified problems in relation to waste management in different municipalities as well as other causes of soil degradation. After the Environmental Report, the Makana Municipality conducted research based on environmental issues within the municipal area in 2004/2005 and created a Local Environmental Action Plan (LEAP). The implementation of the plan was mainly based on addressing illegal dumping sites and preventing waste material from entering rivers and streams. In schools, LEAP will encourage learners and teachers not to discard leftovers everywhere but to dispose of the leftovers in bins. The Makana Municipality decided to engage the community, changed bylaws and collection systems, and also initiated awareness campaigns (Makana municipality 2005:3). Hence, the implementation plan focused on recycling.

## **2.6 THE EFFECTS OF FOOD WASTE**

Food waste is regarded as a problem since it may have various consequences if it is not effectively managed. Thyberg and Tonjes (2016:9) argue, “In landfills, food waste converts to methane, a greenhouse gas with a global warming potential times greater than carbon dioxide on a 100-year time scale”. If such methane is not adequately managed, it may lead to “fugitive emissions” which may “cause landfills to be the third-largest source of anthropogenic methane” as is the case in the USA (Thyberg & Tonjes 2016:9).

Apart from the direct effect of food waste on humans’ health, it also has effects on both wild and domestic animals, some of which are food to humans. Newsome and Van Eeden (2017:1) note:

*The availability of food waste to wildlife can have dramatic effects on ecological communities and humans. This can manifest when wildlife ecology and behaviour is altered by accessing food waste, and when wildlife access to food waste affects other species and ecological processes, which in turn increases conflict between wildlife and*

*humans.*

Not only can wildlife be affected by food waste, but also domestic scavenging animals. Newsome and Van Eeden (2017:4) mention that “In scavenging food waste, animals are at risk of consuming plastic and other non-digestible waste ...”. This is a worrying situation because, in addition to their right to healthy living, such animals become human food despite being contaminated. Therefore, food waste deserves to be taken more seriously.

There are also socio-economic effects of food waste, which are more prevalent in affecting people who experience food insecurity. According to Rutten (2013), if the consumable food is wasted, there will be a need to produce more food. In turn, the food prices will increase, and this will affect underprivileged communities. The farming industry may also be affected. For example, Canali et al (2016:8) note the unavoidable factors that often demand the over-production of food, such as “weather, pests, phytopathogens, and alternate bearing characters”. These authors argue that where these factors exist, farmers are compelled “to overplant in order to avoid risks of not fulfilling contract conditions for deliveries in terms of final products’ quantities and grading characteristics”. While not directly, food waste can contribute to these demands and to the increase in production and market prices.

It goes without saying that food waste may have aesthetic and health effects in cases where such food is discarded in open spaces. This may lead to bad smells, attract rats and cockroaches which, in turn, may cause diseases to the affected communities.

## **2.7 WASTE MANAGEMENT**

Kawai and Tasaki (2014:560) define ‘waste’ as materials that are discarded and not resold or reused by companies or institutions. Formal waste collection in South Africa was first implemented in 1786 in the Cape Colony, and back then people used to manage waste using traditional methods, such as incineration, storing waste like leftovers, and by storing waste in rock cavities underground. As the socio-political situation in South Africa changed, the methods of managing waste also improved following those changes.

Waste management measures refer to “measures implemented to reduce the effect of waste on health or aesthetics and recover resources” (Bosman 2009:701). These measures “include waste minimization, waste separation, collection, transport, processing, recycling, treatment and disposal, discharge of emission of waste materials” (Bosman 2009:701). Poor waste management practices result in severe impacts on the environment and the implementation of remedial measures. Integrated waste management is implemented to monitor and review these “waste management measures to ensure sustainability and to prevent detrimental impacts on human health and the environment” (Dlamini, Rampedi & Ifegbsan 2017). Furthermore, Dlamini et al. (2017) stated that sustainability could be achieved if energy and resources are conserved by minimising waste, preventing and controlling natural resources. Waste management is seen as a way of making decisions on how to deal with specific waste (Bosman 2009:707). Furthermore, Shan, Wee and Chen (2015) indicated that waste management deals with ways of minimising the amount of waste generated and managing disposal residue waste streams. Waste management is based on two broad important objectives, namely reducing the “amount of waste produced” by making “the best possible use of” that waste product, and implementing “management measures in accordance with the cradle to grave” principles; this minimises damage to human health and the environment (Bosman 2009:703).

Waste management can be roughly divided into three broad categories: (1) programmes that are entirely voluntary; (2) programmes that use the threat of future regulations or energy/GHG emissions taxes as motivation for participation; and (3)

programmes that are implemented in conjunction with an existing energy/GHG emissions tax policy or with strict regulations.

In 2000, the waste management hierarchy approach was developed to help in waste management. The DEA (2011:279), in the National Waste Management Strategy (2011:279), emphasises the following key elements of the waste management hierarchy:

- Avoidance and reduction
- Reuse – material can be used for a different or similar purpose without changing form
- Recycle – separate material from the waste stream and process as raw material or new product
- Particular components of material, or waste, being used as fuel
- Treatment and disposal. This one is the last resort within the waste hierarchy. This treatment is referred to as processes designed to minimise the environmental impact of waste by destroying toxic components of waste.

According to Papargyropoulou, Lozano, Steinberger, Wright and Ujang (2014:106), there is also a food hierarchy that arranges the preferences to food waste management. This hierarchy transposes the meanings of the prevention, recycling and discarding of food. First, food waste generation should be prevented. Second, if food waste is accumulated, it should be diverted into humus. Third, if food cannot reach people to be consumed, it should be diverted into animal feed (reuse). Fourth, utilising whatever cannot be recycled for energy recovery. Last, whatever is not going to be utilised, should be disposed to landfills. Papargyropoulou et al. (2014:106) supported the initiative of donating food to pig farmers and feeding the hungry to reduce food waste. They (Papargyropoulou et al. 2014:108) claim that the best way of dealing with the food waste issue is not to focus on the consumption stage in the food supply chain, but as human beings, we should implement sustainable production processes. The way in which we consume food and then reduce food surplus and waste along the global food supply chain should be considered.

## Food Recovery Hierarchy



**Figure 2.2: Food recovery (Papargyropoulou et al. 2014)**

### 2.8 FOOD WASTE MANAGEMENT

In all parts of the world where food waste is a problem, strategies need to be identified to address it. This is because food waste is not a standalone problem, but affects other sectors in a country. For example, Thyberg and Tonjes (2016:1) argue, “By wasting edible food, all of the resources spent growing, producing, processing, and transporting that food are also wasted, resulting in potentially needless environmental impact”. This problem is also identified by Gustavsson et al. (2011:1) who emphasise “Food losses have an impact on food security for poor people, on food quality and safety, on economic development and on the environment”. Gustavsson et al. (2011:1) further mention “Reduced food waste and proper waste management can also save economic resources, contribute to food security, and minimize negative impacts of food waste on waste management systems”. According to Newsome and Van Eeden (2017), the statistics regarding food waste are shameful when considering “that globally roughly 1 in 8 people are lacking access to sufficient food”.

Salomone et al. (2017:1) note that the popular focus of discussion when it comes to food waste is how it should be prevented, “through improvement in the efficiency of supply and consumption chains”. These authors note, however, that some have started looking at other ways of managing food waste, primarily because of its energy and nutrient content. In addition, Ericksson, Bissailon, Haraldsson and Sundberg (2016:33) state that “the management of solid waste is an efficient method to increase as well as to replace fossil fuel with renewable energy”. At the same time, Oliveira et al. (2018:70) argue that if food waste (and other solid waste) is not adequately managed, it may

pollute the soil, subsurface waters, as well as air, “due to the high content of biodegradable organic matter”.

There are various ways in which food waste can be managed. The South African Department of Environmental Affairs (2013), for example, encourages composting as a way of diverting organic and garden waste from landfills in order to produce products that will be helpful or benefit communities. As stated, Papargyropoulou et al. (2014:106) mention examples of donating food to pig farmers. Similarly, Ericksson et al. (2016:33) argue that converting food waste to safe animal feed and other useful forms for farm use is another option of managing food waste.

Apart from reducing it, food waste can be managed in several other ways, including policy and management strategies.

### **2.8.1 Policies to prevent food waste**

As a result of food waste internationally, some countries started taking initiatives to prevent food waste. According to Halloran et al. (2014:297), the European institution established waste prevention initiatives wherein the food waste problem was brought forward to the state members and households by the European Parliament and European Commission. The first regulation brought to state members was that of reducing food waste by half by 2020. The European commission noticed that there was a lack of knowledge among state members concerning European food waste, which was a significant problem. In 2011 Denmark started considering the problem of food waste by establishing solutions. The government of Denmark and civil society engaged in a private initiative campaign called ‘against food waste’ as a movement for consumers. The campaign involved members of the parliament, top Danish chefs and food personalities to address the problem of food waste (Halloran et al. 2014:297).

According to Halloran et al. (2014:297) another public initiative included a stakeholder’s conference, joining public and private stakeholders to raise awareness of food waste in Denmark. A voluntary initiative, known as ‘group against food waste’ was also established in 2012 by the Danish Ministry of the Environment. This initiative was established for all stakeholders to work together to reduce food waste. The major

stakeholders established a “character on less food waste” which included different supermarkets, restaurants, hotels and ministries. Moreover, the zero-waste vision was established by Denmark’s largest dairy producer and Arla Foods to reduce food waste by 50% by 2020.

## **2.8.2 Recycling as a strategy to address food waste**

According to González-Torre and Adenso-Díaz (2005), recycling is a habit that can be influenced by socialisation, legislation and resource provision to communities. Guerrero, Maas and Hogland (2013:223) also argue that “people who frequently go to the bins to dispose of general refuse are more likely to recycle some product at home, and in most cases, as the distance to the recycling bins decreases, the number of fractions that citizens separate and collect at home increases”. Some scholars (such as Malinska et al. 2017; Pagan & Steen 2004) identify various strategies to recycle food waste, including composting, vermicomposting and bio- digesting. These strategies are discussed in this section.

### **2.8.2.1 Composting**

Zucconi and de Bertoldi (1987:109) define ‘composting’ as an oxidation process leading to organic matter’s mineralisation and transformation due to the bacteria living in the soil. It involves the decomposition of organic, plant-based materials into nutrient-rich substances that can be utilised as organic fertilisers to grow more food (Singh et al. 2011:721). The final product of composting is regarded as stabilised and not harmful to plants, and does not contain micro-organisms that cause disease to plants (Wichuk & McCartney 2007:573). The final product of composting plays a vital role in the improvement of physical, chemical and microbiological properties of the soil. Food waste can be used for the purpose of composing and become useful for the production of food for the needy rather than adding to pollution (Ogola et al. 2011:108-110).

### **2.8.2.2 Vermicomposting**

Vermicomposting is defined as a garden-related environmental practice that utilises worms to break down organic scraps such as vegetables and fruits, adding nutrients back to the soil (Pagan & Steen 2004:70). According to Lleo et al. (2013: 72), worms used in vermicomposting create a type of fertiliser known as worm castings which are beneficial to plants due to the nutrients from decomposed scraps. Furthermore, vermicomposting speeds up the process of decomposition. This vermicomposting process should be monitored because the worms have an effect on the rate of decomposition, the quality of the final product and the amount of GHG released (Lleo et al. 2013:72). Therefore, vermicomposting is one of the best ways to recycle food waste.

### **2.8.2.3 Bio-digestion process**

Bio-digesting is the decomposition of food waste in an enclosed structure that converts food waste primarily into water and carbon dioxide (Metropolitan Waste Management Group (MWMG) 2014:3). In this case, Oliveira et al. (2018:70), Sreekanth and Sahu (2015) give an example of the utilisation of anaerobic digestion to treat organic solid waste, such as food. This decomposition process requires oxygen and micro-organisms that occur naturally in the soil (MWMG 2014:3). Furthermore, in the process, scraps are buried 40cm deep into the soil, hence, bio- digesting utilises naturally occurring worms. The bio-digesting process is not the same as vermicomposting (MWMG 2014:39). Bio-digesting utilises the green cone, which is a unique environmentally friendly solution used to dispose of cooked and uncooked food waste such as bones, vegetable scraps and organic materials (MWMG 2014:41); the worms feast on these food scraps. The green cone needs to be placed in full view of the sun in a well-draining area. The worms feast on food scraps during winter, adding microbes in the form of liquid to speed up the decomposition process.

### **2.8.3 Managing food waste in schools**

Schools should establish strategies for managing their food waste. According to MWMG (2014:2), food waste in schools can be managed through recycling by using composting bins, worm farming and bio-digesting. Organic waste materials are naturally broken down in a heap or containers by tiny organisms like earthworms, millipedes, fungi and bacteria. Worm farming is done using containers where vegetable and fruit peelings are placed inside, and worms develop; the worms depend on fruit and vegetable peelings. Bio-digesting is another option, as indicated in Section 2.7.1.3.

According to Hertwitch and Peters (2009:43), learners should learn that composting is one of the ways of reducing methane emission and the carbon footprint. Composting is regarded as the natural way of recycling since the compostable organic materials return soil nutrients that will conserve natural resources. Decomposed organic materials produce bacteria which will break down waste to make organic fertilisers that can be used in school gardens. Schwarz and Bonhotal (2017:5) state that before the school can implement a waste management tool, learners and educators should present their ideas to the principal, and composting is one of the recycling strategies that schools can adopt. Starting this programme of composting in schools can create changes within the school environment. When using bin composting, schools should make sure they place their bins inside school grounds out of the way or in a convenient location where learners are not disturbed. According to Schwarz and Bonhotal (2017:5), some schools use turning units built from treated wood for composting, however, its use is determined by space, time and money.

In Candor elementary schools, learners started learning more about decomposition and they thought composting was the only way to speed up the process of decomposition (Schwarz & Bonhotal 2017:9). Learners, with the assistance of educators, decided to mix food scraps with brown and carbon-rich materials to create a home for decomposers; these learners wanted to see the micro and macro organisms and do their part for sustainability.

In Seneca Falls Middle School Campus, the Seneca Green Team built composting bins with educators and learners interested in the programme (Schwarz & Bonhotal 2017:10). The school started this programme in 2014, and educators and learners began to observe the amount of food wasted in the cafeteria during lunchtime. The High School Learner Council decided to fund the programme. After checking, they decided to build their own bins and start on-site composting. Educators and learners would oversee the composting programme.

The other method of managing food waste in school is sorting, as mentioned by Schwarz and Bonhotal (2017:10). According to these authors, in 2012 one of the schools in Bethlehem Central School District, New York, started a programme of separating food in the school cafeteria. The school also used the Green Team to assist in the programme. The school has a recycling station in all cafeterias within the school with separate slots for compostable material, recyclables and garbage. The primary aim of starting this programme was to reduce and manage waste in schools in order to save the environment (Schwarz & Bonhotal 2017:9).

The biggest issue with recycling at schools is the difficulty of paying for collecting compost and composting containers. Therefore, another way is to dump food waste into landfills, reuse it, or use it as animal feed (Boonen 2015). Lin et al. (2013:429), however, note that food waste can be used to provide end-products of high added value that can be sold in markets.

Learners in California, USA, are expected to use classroom recycling bins or containers to separate food, cans, plastics and glass. To recycle, learners participate through the supervision of educators or environmental or recycling clubs. Educators and learners are engaged in the education component of food waste management to learn how waste can be managed in schools (California Integrated Waste Management Board (CIWMB) 2002:5).

Supporting teachers, like those teaching agricultural science, should receive training and allow learners to be part of the training. Training will assist educators and learners to manage food waste and take care of the environment. According to CIWMB (2002:6), educators and learners should undertake field trips to the waste

transfer station, recycling centre, and landfills to see how institutions operate as far as food waste management is concerned.

As indicated above, one way of managing food waste is vermicomposting. Stanton (2015:20) claims “currently there is a gap in research concerning the benefits of vermicomposting in schools ...”. Schools can use vegetable and fruit scraps to produce vermicompost. Schwarz and Bonhotal (2017:5) agree that vermicomposting is a good option for schools with limited space as it is odourless.

According to Moczygamba (2001:3), schools should start a recycling programme and educate learners on how to reduce food waste within the school. However, Moczygamba (2001:8) and Schwarz and Bonhotal (2012:2) emphasise that there are steps to be followed when designing recycling programmes in schools. These entail:

- Forming a team
- Assessing the idea
- Deciding on the type of strategy
- Developing the system to be used
- Starting the programme
- Using the product

Furthermore, schools should also consider the cost of the recycling programme and the amount of food waste the school produces.

Schools should involve the community in recycling programmes; the MWMG (2014:2) stated that the community could benefit from school recycling. The communities have been urged by people living in Victoria, and the National Curriculum guided them to participate in food waste management. The community’s participation gives learners a chance to acquire knowledge from community members with more knowledge of food waste management. The community can also bring expertise to teach learners how to compost and vermicompost. A management team should be organised to ensure that the recycling programme is running smoothly.

The MWMG (2014:6) stated that, to start food waste recycling in schools, all stakeholders must be involved. Firstly, a team of people who are willing to assist with recycling can be organised. Secondly, a site should be identified where food waste recycling bins will be placed for learners to discard their leftovers. Thirdly, several food waste bins should be installed to see how much the school is producing. Lastly, plan on how to identify and report the amount of food wasted in the school environment. In other words, a concerted effort by all affected stakeholders is required to deal with the problem of schools' food waste and strengthen EE in schools.

## **2.9 THE BENEFITS OF RECYCLING**

As one of several biowaste types, food waste has several benefits. Banks, Salter, Heaven and Riley (2012:72) note the possible contribution of biowaste in the production of biogas in Europe. They argue, "...around 2% of the EU's overall renewable energy target could be met if all biowaste was converted to energy, with economic gains estimated at between €1.5 and €7 billion depending on the scale and effectiveness of recycling and waste prevention policies". This is an example of the economic value that food waste can contribute. Recycling is also regarded as an economic booster because it creates potential job opportunities for community members.

## **2.10 CONCLUSION**

This chapter started by looking at food waste as an environmental problem. I then discussed the causes of food waste. Food waste in schools was then considered, along with food recycling, reusing and reducing strategies to manage such waste. Food waste management was also discussed in detail. The chapter suggests that food waste is one of the environmental problems on which EE should focus. Thus, the next chapter offers a review of EE as a possible solution to the problem of food waste.

## **CHAPTER 3: ENVIRONMENTAL EDUCATION AS A POSSIBLE SOLUTION TO THE FOOD WASTE PROBLEM**

### **3.1 INTRODUCTION**

The FAO (2018) notes the need to educate people about the vast quantities of food that get discarded from homes and other dining establishments. The FAO acknowledges that education about food waste should be focused on children and young people in order to create a culture of change for sustainable food waste management. Thus, the topic of this study, namely the management of food waste in schools, can be seen as responding to this call. It is for this reason that this chapter is focused on environmental education (EE). It is imperative that literature on EE be reviewed to contextualise it to the topic of food waste. Thus, this chapter reviews literature related to:

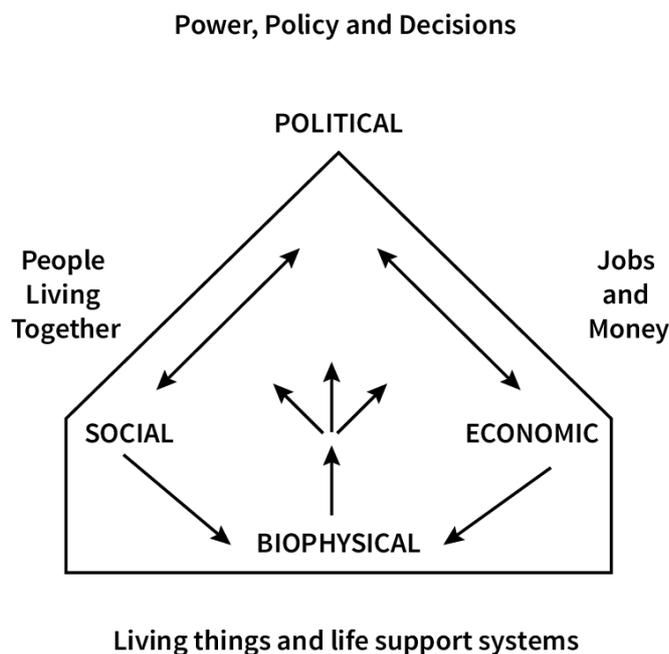
- (a) The conceptualisation of EE. In this section, I focus on defining the concept 'environment', indicating the different aspects of this concept in education.
- (b) The history of EE. I trace the background of EE, both internationally and in South Africa.
- (c) Education for sustainable development. In this section, I locate the relatedness of education for sustainable development to EE, and relate this to the problem of food waste. I also present the different forms of green and brown environments to locate food waste as an environmental problem.
- (d) Theoretical framework: I present the Value-Belief-Norm theory as an analytical lens for this study. This section includes the discussion of the theory and then presents its relevance to this study.

### **3.2 ENVIRONMENT AS A CONCEPT OF ENVIRONMENTAL EDUCATION**

In the discussion of EE, it is imperative that 'environment', as a complex phenomenon, is conceptualised. Kimaryo (2011:24) states that defining the environment depends on individual and societal views. She further claims that society's view of the environment influences people's interaction with it and their

response to environmental problems. Zwelibanzi (2016:33) reviewed literature in which Tani (2006) identified at least three different ways in which people and societies perceive the environment. First, some individuals and societies “view environment as an entity, as something which is not linked to man” (Kimaryo 2011:26). Second, the environment is “an experienced phenomenon - a space which surrounds the individual who is at the centre of the environment”. In this way, the individual is separated from the environment, but the environment surrounds the individual. Third, the environment is perceived as “a socially or culturally produced or constructed phenomenon”. This third view, according to Zwelibanzi (2016: 33), is the one that Tani (2006) accepts as the comprehensive definition of what the environment is about.

According to O’Donoghue (1993), it is of great importance that learners understand the term ‘environment’ as an interdisciplinary and integrated term. To illustrate this interdisciplinarity, O’Donoghue developed the model presented in Figure 3.1.



**Figure 3.1: Model of the environment (O'Donoghue, 1993:10)**

In the diagram, O’Donoghue illustrates that the environment comprises the biophysical dimensions, which is the living organisms and the life support systems. In addition, the environment is composed of the social (people and interactions), political (policies and

decision-making by the authorities) and economic (jobs and money) dimensions. These three dimensions allow formal education systems to approach its processes in various ways regarding the environment. As such, EE has been understood as a focus on three aspects, namely education *about* the environment, education *in* the environment, and education *for* the environment (Robottom 2014). According to Zwelibanzi (2016:40), these EE aspects “differ in goals and approaches, but they complement each other”.

### **3.2.1 Education about the environment**

In the late 1960s, organisations like the Wildlife Environmental Society of South Africa (WESSA) recognised the importance of educating people about their environmental responsibility, and how to take care of their environment. This realisation was, and remains, based on the fact that the environment and its ecosystems “provide many of the material building blocks for human well-being” (Russell et al. 2013: 473), realised through education. According to Robottom (2014; see also Gough 2013; Jickling & Spork 1998), education about the environment is the most dominant practice and Kimaryo (2011:27) claims it is the “traditional view” of EE. Zwelibanzi (2016:41) agrees that “education about environment is about transmission of information on environmental issues”. According to Kimaryo (2011:27), at the beginning of EE movements, EE was developed with the primary aim of “developing knowledge and understanding about the environment and creating awareness among people about the environment”. Citing Robottom (1987) and Mellville (2007), Zwelibanzi (2016:14) notes the predominance of a cognitive focus in this dimension, where learners are taught and develop cognitively “without action taken to promote sustainable living”. Robottom (2014:6) provides practical examples of education about the environment, such as “nature trails and field studies” for primary school learners, and the provision of generalisations such as ecological principles for high school learners.

Teaching learners about how they should manage food waste in schools and why it is important would be one way of educating them about the environment. The teacher can use food waste as an example of the cause of land and air pollution, as

discussed in Chapter 2. This knowledge can protect the environment from degradation.

### **3.2.2 Education in the environment**

Kimaryo (2011) asserts that while education about the environment was (and remains) useful, scientists realised that it was not enough. There is a need for the use of “real life situations” in the teaching of EE to develop “knowledge through enquiry” (Kimaryo (2011:28). The concept of ‘education *in* the environment’ thus came to the fore. According to Zwelibanzi (2016:41), education about the environment is “any form of education which is conducted outside the classroom using the environment as a medium of teaching”. Some researchers refer to this dimension as outdoor or experiential education (James & Williams 2017) or environment-based learning (Bjorge et al. 2017). Kimaryo (2011:28) summarises this view by stating, “The stage or context for learning about the environment is the environment itself. In this case, the environment is used as a learning resource, a medium for enquiry and discovery, which may enhance deep learning”. This statement suggests that both education about and education in the environment are necessary; they complement each other for a broader understanding of the environment. In my study’s context, education in the environment would be easy because food waste is already polluting the environment. Therefore, teachers already have that situation as a resource when educating in the environment, for the environment. That action would be a practical example of combining the two dimensions of EE. However, these two aspects of EE are still not enough, hence the next dimension is presented.

### **3.2.3 Education for the environment**

While it is necessary to learn and teach about the environment in the environment, the environment itself may be destroyed or damaged in the process. That is why these two actions should take place *for* the environment. According to Zwelibanzi (2016:42), education for the environment is the type of education which makes learners fully aware of the problems related to their environment. Moreover, “learners will be able to solve the problems with the sense of responsibility and also have solutions on what to do if problems arise”. According to Jickling and Spork (1998:311), “In many contexts, ‘education for the environment’ has generated powerful images which have resonated

with educators seeking empowerment for themselves and their students and new directions to enable inquiry into socio- political dimensions of environmental education itself". Fien (2000) views this dimension of EE as "the critical pedagogy of education for the environment [which] provides a professionally-ethical way of teaching".

Zwelibanzi (2016:42) states that authors such as Kimaryo (2011:28) and Loubser et al. (2012) agreed that contemporary EE has to do with "learning about the environment and in the environment". Education for the environment, on the other hand, is about learning with the primary aim of conserving and improving the environment by making sure that individuals develop necessary skills and concerned attitudes for the environment (Kimaryo 2011:28). Some regard education for the environment as "more activism than education" (Håkansson, Kronlid & Östman 2017); activism is about readiness to take action in favour of a certain cause. In this regard, Robottom (2014:5) identifies seven characteristics of education for the environment and regard these as distinguishing the other two dimensions from this one. Citing Fensham (1979), Robottom (2014:5) argues that the concern will be for the environment if EE:

is oriented towards a problem; is concerned with realistic situations; aims to elaborate the alternatives that exist for situations and the skill of choosing between them; includes action as an integral component; uses the real environment of the school and its surroundings as a context; involves the clarification of values; aims to manifestly increase the mastery students have over their own environments.

Robottom (2014) even posits that any programme that does not include these characteristics cannot be called EE. Thus, this dimension of EE can be seen as comprehensive enough to include the other two, rather than refuting them. On a similar note, Zwelibanzi (2016:42) states that, to achieve their goals, educators should use all dimensions when teaching their respective classes. Educating learners about the effects of food waste *on* and *in* the environment, is educating *for* the environment. Therefore, sustainable food waste management cannot be overlooked as a valuable part of EE.

### **3.3 THE HISTORY OF ENVIRONMENT EDUCATION**

#### **3.3.1 An international perspective**

One of the most identifiable definitions of EE is that provided by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1971. The IUCN (in Loubser 1992) defines EE as, “the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings”. This definition is a guide to understanding the place of values and attitudes, which have a bearing on whether sustainable food waste programmes are followed or not in communities. The values and attitudes, in turn, determine the ways in which people behave in the environment and the change in unsustainable behaviours is one of the key components of EE. For example, according to Sihna, Jangira and Das (1985:9), “EE also entails practice in decision-making and self-formulating of a code of behaviour about issues concerning environmental quality”. Environmental quality is adversely affected by unsustainable food waste management. Loubser et al. (2005:37) mention that EE’s earliest origin was recorded from ancient Egypt, Greece, and China prior to the 20<sup>th</sup> century. Farmers in Egypt were taught not to plant crops near riverbanks. Furthermore, they were also taught how to take care of the environment to prevent the soil from degrading. In China, EE was introduced to protect natural resources and encourage people to protect the forest and sustainable production. EE is also bound by social, political, economic and ecological considerations (Irwin & Lotz- Sisitka 2005:35-37).

The Second World War (1939-1945) was a time for incubating ideas and plans for a better world as far as environmental management was concerned (Loubser et al. 2005:39). Furthermore, there was a need to educate people about environmental issues and the environment for people to recognise the importance of the environment (Carter & Simmons 2010; Tilbury 1995). Following the Second World War was the formation of the IUCN, established in 1948, which was concerned with the diminishing natural resources and wildlife. The World Wildlife Fund (WWF) was also established in 1961 to “raise funds for wildlife conservation” (Loubser et al. 2005: 39). Irwin and Lotz-Sisitka (2005:39) state that the “United Nations Educational Scientific and Cultural Organization (UNESCO) was established in 1946 as part of United Nations (UN) enterprise”. UNESCO was concerned with education in the development context.

Furthermore, UNESCO, together with IUCN, engaged in environmental awareness, conservation awareness and conservation education to develop EE.

According to Irwin and Lotz-Sisitka (2005:39), Carter and Simmons (2010), in 1972 the UN held a conference about the human environment in Stockholm that saw developed and developing nations coming together to discuss issues pertaining to environmental concerns. Challenges experienced by developing countries were also placed on the agenda for discussion. Irwin and Lotz-Sisitka (2005:40) state that the conference was fruitful, and led to the establishment of United Nations Environment Program (UNEP) which was the first agency to have headquarters outside Europe and North America. Following the international conference, the first intergovernmental conference on EE took place at Tbilisi in the USSR in 1977.

- The Tbilisi Principles that were declared during the conference, according to Irwin and Lotz-Sisitka (2005:41), state that EE should:
- Consider the environment in its totality - natural and built, technological and social (economic, political, cultural-historical, moral, aesthetic);
- Be a continuous lifelong process starting from preschool continuing through formal and non-formal stages;
- Be interdisciplinary in its approach, drawing on the specific content of each discipline in creating a holistic and balanced perspective;
- Focus on current and potential environmental situations while taking the historical perspectives into account;
- Promote the value and necessity of local, national and international cooperation in the prevention and solutions to environmental problems;
- Examine major environmental issues from local, regional, national, international points of view for students to receive insight and gain knowledge of environmental conditions in other areas;
- Enable learners to have a role in planning their learning experience; it provides an opportunity for them to make decisions and accept their consequences;
- Explicitly consider environmental aspects in plans for development and growth;
- Help learners discover the symptoms and real causes of environmental problems;
- Emphasise the complexity of environmental problems and thus the need to develop

critical thinking and problem-solving skills; and

- Utilise diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment, with due stress on practical activities and first-hand experience.

These principles were adopted as a foundation of EE internationally, including South Africa.

In the 1980s, a number of other international commissions and studies influenced people's views of the environment, environmental issues and the EE. According to Herodin and Zuhlsdorff (2014:5), the Southern Commission produced a report in 1990 which supported the findings and recommendations of the 1983 Brandtland Report (see Le Grange 2017). From the EE perspective, the results of the Brandtland and Brundtland Reports have been advocated and integrated in holistic form in EE (Loubser et al. 2005:42). The Brandtland and Brundtland Reports heightened international and public awareness of environmental problems.

The other important EE development forum was the 1992 Earth Summit, which concentrated on EE's role in reacting to the environmental crisis (Grubb, 1993; Herodin & Zuhlsdorff 2014:5). The establishment of the Environmental Education Treaty for a Sustainable Society was related to the success of the 1992 Earth Summit, which was adopted in plenary by the Rio de Janeiro International Forum of NGOs and Social Movements (Herodin & Zuhlsdorff 2014:5; Pérez, Gamez, Briones, Viteri & Molina 2018). The Treaty on Environmental Education put emphasis on understanding the causes of poverty as it is regarded as the dominant socio-economic system. Furthermore, it also emphasised the full participation of individuals in making choices related to the environment. The treaty has also developed principles for an equitable and sustainable society (Loubser et al. 2005:43):

- Education is the right of all; we are all learners and educators.
- EE, 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.
- EE is both individual and collective. It aims to develop local and global citizenship

with respect to self-determination and the sovereignty of nations.

- EE is not neutral but value-based. It is an act for social transformation.
- EE must involve a holistic approach and interdisciplinary focus in the relation between human beings, nature and the universe.
- EE must stimulate solidarity, equality and respect for human rights involving democratic strategies and an open climate of cultural interchange.
- EE should treat critical global issues, their causes and interrelationship in a systematic approach and within their social and historical contexts. Fundamental issues in relation to the development of the environment, such as population, health, peace, human rights, democracy, hunger, degradation of flora and fauna, should be perceived in this manner.
- EE must facilitate equal partnerships in the processes of decision-making at all levels and stages.
- EE must recover, recognise, respect, reflect and utilise indigenous history and local cultures, as well as promote cultural, linguistic and ecological diversity. This implies acknowledging the historical perspective of native people as a way to change ethnocentric approaches, and encourage bilingual education.
- EE should empower all people and promote opportunities for grassroots democratic change and participation. This means that communities must regain control over their own destinies.
- EE values all different forms of knowledge. Knowledge is diverse, cumulative and socially produced, and should not be patented or monopolised.
- EE must be designed to enable people to manage conflict in just and humane ways.
- EE must stimulate dialogue and cooperation among individuals and institutions in order to create new lifestyles, which are based on meeting everyone's basic needs, regardless of ethnicity, gender, age, religious, class, physical or mental differences.
- EE requires democratisation of the mass media and its commitment to the interest of all sectors of society. Communication is an inalienable right and the mass media must be transformed into one of the main channels of education; not only by disseminating information on an egalitarian basis, but also through the exchange of means, values and experiences.
- EE must integrate knowledge, skills, values, attitudes and actions. It should convert every opportunity into an educational experience for sustainable societies.

- Education must help develop an ethical awareness of all forms of life with which humans share this planet, respect all life cycles, and impose limits on humans' exploitation of other forms of life.

According to Dube (2012:85), “these principles show a greater concern on issues of social justice, equity and social transformation”. Five years after the Rio Earth Summit, policy-makers and environmentalists from around the globe gathered in Rome to see if there had been any progress since the 1992 Earth Summit. Sadly, the deliberations indicated that there had been limited progress towards reducing the human effect on the environment and enhancing quality of life.

According to Underwood (2013:2), EE in Australia was implemented in 1970 with the Australian Academy of Science Conference aiming to highlight the importance of EE in schools. Since its implementation in Australia, EE has been expanding in schools and it is also integrated with different learning areas in schools. EE has been valued in schools with gardening, energy programmes and waste management systems. Similarly, Tasmanian schools taught EE “as an interdisciplinary subject in many areas” (Underwood 2013:3). Furthermore, schools in Tasmanian learning areas like Geography and Sciences use hands-on lessons to teach about sustainable choices in EE. Hence, the government has its own ways and roles to play in facilitating collaboration and providing an eco-friendly environment (Underwood 2013:2). According to UNESCO (1978:6), EE has various concepts, as presented in Table 3.1.

**Table 3.1: Objectives of EE**

<p><b>Awareness:</b> “help individuals and groups” to “acquire an awareness of and” sensibility “to the total environment and its allied problems”.</p> <p><b>Knowledge:</b> It helps “individuals and social” group “gain a variety of” experience “with total environment and acquire basic understanding of the environment” and</p>
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“its” problem.

**Attitude:** To assist individual “and social” groups to “acquire social values, strong” feelings that “concern the environment and” actively participation and “motivation” to improve and protect the environment.

**Skills:** To help people to “acquire the skills for working toward the solution of” problems related to the environment.

**Participation:** This one helps social groups and individuals to “develop a sense of responsibility and urgency regarding environmental problems and ensure appropriate action to help solve problems” related to the environment.

### **3.3.1.1 Implications of environmental education principles and objectives on sustainable school food waste management**

If the principles discussed in Section 3.3.1 and the objectives presented in Table 3.1 were to be adequately followed, food waste would be managed sustainably in schools through EE. School curricula would be organised for learners to understand the effects that inadequate discarding of food has on the aesthetics of the environment. The whole school community and the surrounding communities could also receive informal and formal EE through the adequate sustainable management of food waste in schools.

The Tbilisi principle that indicates the need for the interdisciplinarity of EE can be viewed as suggesting that problems such as food waste in schools can be regarded as a teaching resource in all subjects, including agricultural sciences. Teachers may use such problems to teach about, in and for the environment. In addition, the existence of food waste in schools can be a current problem which can be tackled in the present EE practices to avoid future problems. This would be in line with the Tbilisi principle that is about “focus on current and potential environmental situations while taking the historical perspectives into account”. It would also assist in the applicability of the principle of enabling “learners to have a role in planning their learning experience; it provides an opportunity for them to make decisions and accept their consequences” (Loubser 2005:43).

The objectives of EE can be guidelines in the integration of sustainable food waste

management in school curricula. In this case, curricula may not necessarily be formal, but the school practices may be conducted to ensure that by the time they leave school, learners have the necessary awareness, knowledge, skills, attitudes and can participate in practices that will ensure sustainable management of food and food waste for the benefit of the present and future generations. This can even be practical in agricultural schools where learners can participate in recycling inedible food or be made aware of its usefulness in enriching the soil and the production of more food.

Having traced and discussed the history and state of EE internationally, the following section is narrowed to the South African context and the implications presented in the above section apply to this context as well.

### **3.3.2 Environmental education in South Africa**

According to Irwin and Lotz-Sisitka (2005:47), EE first reached South Africa in the 1970s, stimulated by the Belgrade Charter of 1975 and the Tbilisi Principles of 1977. Before the Belgrade Charter and Tbilisi Principles, the focus was on conservation education (Irwin 1990:1). Conservation education focuses primarily on the use of natural resources, the fundamental knowledge of ecology, and ecological processes; thus, it affects the political, social and even the built environment (Irwin 1992:21). Conservation education was also included in EE, since EE continued to be the most important and fundamental part of education. According to Loubser et al. (2014:47), the development of EE was not easy. There were debates about it, with some taking place in conferences. The first international conference on EE in South Africa was held in 1982 at Treverton College, Mooi River, in Natal (Irwin & Lotz-Sisitka 2005:48). This was a landmark of EE in South Africa. The conference saw the formation of the Environmental Education Association of Southern Africa (EEASA), which played an important role in the development and growth of EE in Southern Africa (Loubser et al. 2014; Milupi, Somers & Ferguson 2017). Several workshops, seminars and conference were conducted dealing with different topics and issues related to the environment. Furthermore, EEASA started publishing on EE in Southern Africa in 1984, and started to work with government and environmental NGOs from South Africa and neighbouring countries. The association promotes people from Southern Africa's common interests in environmental issues.

The NGOs and “former provincial conservation agencies” played an important role in the development of EE in South Africa (Loubser et al. 2005:49). Organisations such as Wilderness Leadership Schools, Wildlife Society of South Africa (WESSA) and others, recognised the importance of educating people about their environmental responsibilities and began to establish programmes to put the ideas of EE to practice (Loubser 2005:49). The Umgeni Valley Project (UVP) was started in 1975 in Natal and has played a vital role in the development of EE in South Africa. Furthermore, UVP hosts the Southern African Development Community (SADC) Regional Environmental Education Programme (REEP), which continues to contribute to the growth and development of EE in Southern Africa, in different ways. The UVP also supports and cooperates with the Natal Education Department and Natal Parks Board in EE (Dube 2012). According to Loubser et al. (2014:55), EEASA, together with WESSA, developed the practice of “critical” evaluation within the field of EE.

Before 1994 there were several initiatives in former homelands in South Africa to help people in disadvantaged areas deal with environmental problems as they lacked finances. Bophuthatswana, KwaZulu and Kangwane were the ones with well-established and existed education programmes in South Africa (Irwin 1990:5). Furthermore, Bophuthatswana, the National Environmental Awareness Council (NEAC) and NGOs in Soweto became the most successful at presenting EE programmes in South Africa. The NEAC was started in 1974 with the aim of defending the political and social turmoil. This programme assisted learners and educators in Bophuthatswana to learn about and understand their responsibilities towards the environment.

EE is now offered at tertiary levels, for example, at the University of Bophuthatswana (now known as North-West University), the University of South Africa (Unisa), Rhodes University, and the University of Stellenbosch. From 1980 to the and early 1990s, all institutions established EE within the faculties of education and EE. Rhodes University developed a strong interdisciplinary environment in Economics, Law and traditional, environmentally oriented disciplines. Unisa, together with Stellenbosch University, also played an important role in promoting EE research and development. Furthermore, the business community offered support to enhance universities’ capacity to offer EE courses to the community (Irwin & Lotz-Sisitka 2005:51).

The Gold Fields Environmental Education Service Centre (GFEEESC) was established in 1992 in South Africa to support EE around the country; especially in the provision of an Environmental Education Field Centre. Irwin and Sisitka (2005:51) state that some of the businesses that supported EE included Mazda, international donors such as the Swedish International Development Agency (SIDA), and the Danish International Development Agency (DANIDA), which funded the development and expansion of SADCREEP. The MacArthur Foundation for Peace and Justice offered scholarships for African students to conduct research in EE (Irwin & Lotz-Sisitika 2005:51).

In 1990 there was vast improvement in EE, which gained attention from political parties and NGOs (Loubser et al. 2014). Lack of participation by the political parties in the 1987 White Paper led to the formation of the Environmental Education Policy Initiative (EEPI). Some EEPIs opted for the 'neat' and efficient management hierarchical approach and political development, whereas others opted for participatory and open approaches (Clacherty 1993b). Furthermore, the EEPI presented political alignment and a democratic approach. Le Grange (2002:83-87) claims that the EEPI also changed focus and opted to become the "Environmental Education Curriculum Initiative (EECI) with its focus on formal education curriculum policy development". By participating in policy-making, environmental educators working in EECI established themselves as stakeholders in the curriculum development process in South Africa. Environmental educators were thus participants in the development of Curriculum 2005 (DoE 1997a). They were also involved in strengthening this curriculum and in the development of the revised National Curriculum Statement (NCS) (DoE 2002).

The history of EE in South Africa shows that EE did not begin in the classrooms, but outside in places such as nature reserves and national parks (Mathenjwa 2014:16). EE was therefore more focused on the dimension of education in/through the environment. After 1994, EE was introduced into the school curriculum of South Africa (Irwin1990). Moreover, after the revision of Curriculum 2005, all educators in South Africa were required to consider an environmental focus for each school subject (Loubser et al. 2014). Since then, EE has been integral for all learning subjects in South Africa. However, this seems to have not led to education towards the sustainable management of food waste in some schools. It is likely that the sustainable

management of food waste has not been regarded as a component of EE in such schools.

Over the years, since the formalisation of EE, there have been several developments in the field; these include the establishment of concepts related to sustainability. In the following section, I discuss these developments.

### **3.4 ENVIRONMENTAL EDUCATION AND EDUCATION FOR SUSTAINABLE DEVELOPMENT**

One of the key approaches to EE is education for sustainable development (ESD). There has been debates about the relatedness of EE to ESD, with some trying to understand the difference between the two while others see no justification in trying to identify the difference (McKeown & Hopkins 2007). According to Hoffmann and Siege (2018:3), sustainable development is defined as “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations”. These authors critique this definition, highlighting that it is not inclusive. As such, they refined the definition to include “... the process of individuals and/or social groups to achieve sustainability”. Education that encourages and promotes this process of sustainability is ESD (Nousheena, Zai, Waseem & Khan 2020). ESD was adopted upon the realisation of the human ecological footprint, based on reports from meetings and summits, such as the Brundtland Commission (1988), and Agenda 21 (1992) (Bonnett 1999; Hoffmann & Siege 2018).

ESD was first developed by people who were not part of the education community and was first described in Agenda 21 Chapter 36 (Hopkins & Mckeown 2002:14). According to Herodin and Zuhndorff (2014:5), Agenda 21 was developed during the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro on 14 June 1992. Kanyimba (2009:58) states that the major outcome of UNCED was Agenda 21, and the document serves as a prototype for sustainable development for the 21<sup>st</sup> century. As a result, it was recommended by 170 heads of

states and government. Since then, policymakers and scholars have engaged widely with this concept, and its description points to the manner in which people act in and around the environment. In describing this concept, Boeve-de Pauw et al. (2015:15693) argue “Perhaps the most important issue for survival in our times is how to sustain the natural environment and our planet’s resources at the same time as developing wealth and well-being for a growing population”. Olsson, Gericke and Chang Rundgren (2016) and Boeve-de Pauw et al. (2015:15963) further describe sustainable development as a complex concept that encompasses interconnected environmental, economic, and social dimensions. Because of this complexity of sustainable development, a specific approach to teaching it was developed and called ‘ESD’ (Olsson, Gericke & Chang Rundgren 2016:176).

The support of ESD in the South African context was articulated in the National Curriculum Statement (2003:4) where it was stated that “all newly developed learning areas are infused with the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa”.

As a component of EE, ESD views the environment as a whole, thereby acknowledging the need for attending to both green and brown environmental concerns.

### **3.4.1 The green environment**

According to Ramey (2009:2), “green is often used as a synonym for environment or ecology”. This is because the green environment refers to the living environment, that which forms the biophysical dimension (O’Donoghue 1993). Many schools across the world engage in projects towards the green environment’s education, and they are labelled as ‘green schools’. James (2016:443) explains that to become a green school means “taking and introducing and reinforcing conservation concepts that create a conducive environment”. Chan (2013:7) states that “green environment of a school cuts costs on utility and fosters healthy and productive classrooms by minimizing the risks of environmental pollution”. Furthermore, Barr (2011:30) found that the combination “green school design, a green organizational culture and curriculum aligned with green practices and methodologies sets the stage for schools to utilize

their facilities and grounds as a teaching tool". Barr (2011:29) further indicates that a green school is not only regarded as the pride of a school district and community, but also serves as an educational tool; these are tools that will help learners to learn how to keep the environment clean. Kopochinski (2012b:14) and Sims (2012:17) agree that many educational programmes have proven that green school training can change learners' and teachers' behaviour.

There is also the brown environment (discussed next) which, if not effectively managed, may cause the deterioration of the green environment. In other words, both types require EE. Furthermore, the green environment focuses on delayed ecological effects of human activities at different scales, as well as land restitution and the protection of threatened species, living and non-living organisms (Du Plessis 2009:1850). According to Strydom and King (2009), the green environment addresses the green environmental agenda, referring to living and non-living elements, including the recycling of matter through biochemical cycles in a closed system.

### **3.4.2 The brown environment**

The brown environment concerns issues related to land pollution, sanitation, health issues and general livelihood, especially in the urban environments. In terms of sustainability, Du Plessis (2009) describes the brown environment as "pro-poor urban development" and the green environment as "ecologically sustainable development". According to Khan (2014:5), Macdonald (2002:2), and Du Plessis (2009), the brown environment is observed in informal settlements. The issues of the brown environment are catered for in the South African Constitution, where it is stated that:

- Everyone has the right to an environment that is not harmful to their health or well-being; and
- Everyone has the right to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that:
  - (a) prevent pollution and ecological degradation;
  - (b) promote conservation; and
  - (c) secure ecological sustainable development and use natural resources while

promoting justifiable economic and social development.

This study, which looks at the issue of food waste management in schools, was concerned with both the green and brown environment. Food waste may be an example of the brown environment, but if it is well managed, it becomes a resource for the enrichment of the green environment.

When or if ESD is offered in schools, there would be no question of how it might contribute to EE for the sustainable management of food waste in schools. It would provide an avenue for the provision of knowledge, awareness, positive attitudes and values towards education about, in and for the environment. This statement leads to the presentation of this study's theoretical framework, which explicates the role of values and attitudes in the environment.

### **3.5 THEORETICAL FRAMEWORK OF THE STUDY**

Food waste management is a pro-environmental activity which requires positive attitudes and behaviours towards the environment. Pro-environmental behaviours are actions that are post humanist in nature, where the non-human world is understood as equally important as humans are (Bolter 2016; Haraway 1991; Mauthner 2019). For this study, which looks at food waste and environmental education, value-belief- norm (VBN) theory is relevantly used as a lens to interpret the responses to the research question.

#### **3.5.1 Value-Belief-Norm theory**

The VBN theory was proposed by Stern, Dietz, Abel, Guagnano, and Kalof (1999) to explain the role of values, beliefs and norms in environmental movements in the United States. It has since been used in various studies throughout the world. VBN draws from the Norm-activation theory (NAT), which was developed by a social psychologist, Shalom Schwartz, in 1977, to explain the behaviours related to helping. Ibtissem (2010: 130) explains that in the NAT personal norms play a central role. He states,

The individual adopts altruistic behaviours out of a feeling of moral obligation.

Furthermore, the personal norms are determined by the individual's awareness of the positive consequences of the resulting acts and responsibilities [...] [N]orms activation is more likely when the actor has two types of beliefs. First, the acting individual should be aware of the consequences of his act towards the subject of norm (A.C). Then, the individual has to feel responsible for causing or preventing these consequences (AR) [...].

Environmental education is, therefore, important in developing that positive awareness and personal norms. However, it is not only the personal norms that matter in pro-environmental, but also beliefs and values, hence the adoption of VBN in this study.

Stern et al. (1999: 85) state, “[VBN] holds that pro-environmental actions occur in response to personal moral norms about such actions and that these are activated in individuals who believe that environmental conditions pose threats to other people, other species, or the biosphere (awareness of consequences, or AC) and that actions they initiate could avert those consequences (ascription of responsibility to self, or AR).” They argue, in addition, that pro-environmental behaviour (PEB) is often linked to at least three types of values: “self-interest, altruism towards other humans, and altruism towards other species and the biosphere” (Stern et al. 1999: 85). Using this theory to explain PEB, Ajaps and McLellan (2015: 4) posit, “PEB is stimulated by the activation of norms; and these norms stem from three factors: personal values, beliefs that these values are under threat and beliefs that the individual can take action to reduce the threat and restore these values”.

VBN advocates that the environment should be protected for its own value and people should value protecting the environment. People “need to know enough about environmental issues to understand consequences for themselves and the people and places that matter to them (taking ownership of issues) [...] they need to believe that they can have an effect on these issues and that social norms prescribe that they should act (empowerment)” (Chawla & Cushing 2007: 439).

VBN theory has been used for EE related studies in schools. For example, Bilir and Özbaş (2017: 26) used the theory to evaluate “values, beliefs and norms on conserving biodiversity amongst Turkish Cypriot high school students.” This study found that

“students pay more attention towards the “self-administration” value, believe that their responsibility towards protecting the local and global biodiversity is more than their perception of talent to manage it and their personal norms regarding the conservation of biodiversity is very similar to each other.” In other words, their personal interests and values were more important for the protection of biodiversity than the protective approach. Similarly, Menzel and Bögeholz (2009: 31) tested VBN theory to identify factors that influenced promote commitment to the protection of biodiversity for sustainable development. These authors found that adolescents had more “personal norms and commitment to protect biodiversity”. In their study, which assessed factors influencing sustainability behaviour of college students, Whitley et al. (2016) similarly found that personal values play an important role in environmental decision making. They argue, “Those who adhere to biospheric and altruistic values were more likely to engage in a range of sustainability behaviors whereas those who adhere to egoistic values were less likely to engage in most behaviors”. What is common in these studies is that personal values and learner centred education for sustainable development produce positive response towards PEB.

Unlike many studies that use VBN as a framework, this study did not intend to test this theory, but to use it to interpret the findings in order to make recommendations in relation to values, beliefs and norms towards relevant EE for food waste management.

### **3.6 CONCLUSIONS**

This chapter represented, firstly, the environment as a concept of EE, followed by the history of EE from an international perspective. Next, the history of EE was narrowed to the South African perspective. EE and sustainable development (ESD) were then described, before the green and brown environments were discussed. In the next chapter, the research methodology is presented.

## **CHAPTER 4: RESEARCH METHODOLOGY**

### **4.1 INTRODUCTION**

In the previous three chapters, this study was introduced, and literature related to its various aspects was reviewed. In Chapter 1, the problem statement, rationale and research questions for this study were presented. In this chapter, the methodology that was followed to address these research questions and pursue the aim and objectives of the study are discussed. The chapter consists of the following sections: the research paradigm, research design, research approach, sampling, data collection, and data analysis. It also includes an explanation of how issues of trustworthiness and research ethics were observed during the research process.

### **4.2 RESEARCH PARADIGM**

Denzin and Lincoln (2000) define a 'research paradigm' as a human construction that indicates the researcher's background in terms of attaching meaning embedded in data. Kivunja and Kuyin (2017:28) note the four components of the research paradigm, namely ontology, epistemology, methodology and axiology. Scotland (2012:9) considers the ontological assumption as assumptions that are concerned with that with which reality comprises. Scotland (2012:9) clarifies epistemology is an assumption about how knowledge is gained by applying particular techniques, strategies, ideas and theories. Similarly, Cohen, Marion and Morrison (2011:7) define 'epistemology' as an interpretation about the nature and aspects of current information. The methodology comprises the research design, methods, approaches and procedures used in an investigation that is well organised to reach the final stage (Guba & Lincoln 1994:109). Axiology refers to ethical issues that need to be considered when organising the research, for the right decisions to be taken (Kivunja & Kuyin 2017:28).

The primary objectives of a research paradigm are to give the researcher a framework for exploring their own assumption on how to conduct research, and what the research is all about (Hatch 2002:11). Mertens (2015:76) identifies at least four research paradigms, namely the positivist paradigm, pragmatic paradigm, transformative

paradigm, and constructivist paradigm.

First, the positivist paradigm represents the traditional form of research. This paradigm is also known as the scientific method or doing research (Creswell et al. 2016:3). Ontologically, post-positivists believe in the existence of a single reality. Kivunja and Kuyini (2017:31) expressed that positivism shows that there is naïve realism, which means some objects can be seen as true through experiments and the use of common sense. In post-positivism, the object of the study is independent, and it depends on direct observation and estimations of the phenomenon (Krauss 2005:759). The epistemological assumption of post-positivism captures the knowledge of reality that exists outside individuals. Researchers in this paradigm follow quantitative design and data collection methods.

Second, is the pragmatic paradigm. According to Creswell (2014), the pragmatic paradigm is raised out of actions, situations and consequences rather than antecedent conditions like post-positivism. Furthermore, pragmatism focuses mainly on evaluations that will provide outcomes to be used by stakeholders to inform decision-making. Pragmatic researchers often use mixed methods to collect data (Mertens 2015:79).

The third paradigm mentioned by Mertens (2015:80) is the transformative or critical paradigm. This is followed when research focuses mainly on marginalised groups like women, children and gender issues through questioning systematic power structures (Offermans & Glasbergen 2017:1081; Olesen 2011:129). The objective is to promote social justice and human rights (Offermans & Glasbergen 2017:1081). This study is embedded within the interpretivist paradigm, which is discussed in detail below.

#### **4.2.1 Interpretivist paradigm**

The worldview (ontology) of Interpretivism is that knowledge of the world is attained through interpretation of either the language or the actions (or both) of the people (Denzin & Lincoln 1998; Thanh & Thanh 2015). “The inquirer must elucidate the process of meaning construction and clarify what and how meanings are embodied in the language and actions of social actors” (Denzin & Lincoln 1998: 222). Interpretivism

is traced back to as early as the 1930s and its history is associated with philosophical traditions such as hermeneutics, symbolic interactionism, phenomenology, ethnomethodology (Cohen & Manion 1994; Potrac, Jones and Nelson 2014). It provides a different epistemological view of how knowledge can be acquired because it brings experiences and perceptions to the centre rather than observable and testable knowledge (Potrac, Jones & Nelson 2014). Interpretivists are relativist (Semerci & Batdi 2015:171), which implies believing in studying a situation which has multiple realities and meanings. Furthermore, meanings should be constructed between the researcher and participants. In this study, the researcher and participants, who are learners, teachers, and food handlers, engaged in conversations to construct and interpret reality concerning sustainable food waste management in the schools.

### **4.3 RESEARCH DESIGN**

The study employed a descriptive case study design, which fits well within the constructivist paradigm. Yin (2002:13) defines a 'case study' as a contemporary phenomenon within its real-life context. The researcher has limited control over the context and phenomenon if boundaries are unclear.

According to Baxter and Jack (2008:544), the case study design is used to facilitate the study or observation of a phenomenon using different sources of data within its context. Yin (2002:13) also explains that the prospective case study design is viewed as a flexible way of inquiry that is used to investigate the phenomenon within its natural context. However, Baskaranda (2014:5) and Yazan (2015:138) assert that the researcher will treat the case as a "bounded structure" and examine it as an entity rather than a procedure. Merriam (1998:27), like other authors (Macmillan & Schumacher 2010; Creswell 2008) viewed case studies as a delimitation of a case. They further consider the case study as a (a) thing, (b) single entity, and (c) unit that consists of boundaries.

There are different types of case study designs, namely the explanatory case study design, collective case study design, exploratory case study design, and the descriptive case study design. First, the explanatory case study design. As indicated by Baxter and Jack (2008:547), researchers employ explanatory case study designs

when casual links in real-life phenomena are too complex for survey or experimental strategies. Second, the collective case study design. Macmillan and Schumacher (2010:344) explain that the collective case study design is employed when some individual cases are combined in a single study. Furthermore, a collective case study, multi-site case study and multiple case studies seem to be closely related. Third, the exploratory case study design. This design is used to explore the assessment of an intervention that has unclear or multiple outcomes (Baxter & Jack 2008:548). Fourth, the descriptive case study design is employed when the researcher wishes to define a phenomenon or activities within the real-life context (Macmillan & Schumacher 2010:344). In my study I chose the descriptive case study design because the intention was to interpret and describe the practices and experiences of participants in the selected schools. The study was not meant to provide interventions or explore some existing solutions, but to engage in reflections with the participants in order to identify possible solutions.

#### **4.4 RESEARCH APPROACH**

There are at least three research approaches, namely the qualitative approach, quantitative approach, and mixed-method approach. The qualitative approach relies on textual data and, sometimes, image data (Creswell 2014:561). The quantitative approach puts more emphasis on numbers and figures when collecting and analysing data. The mixed-method approach emerged from paradigm wars between qualitative and quantitative research methods, and it is a combination of the two approaches (Terrell 2012:255). A case study is commonly used in qualitative research to collect qualitative data.

This study followed a qualitative research approach. Creswell (2014:562) defines a qualitative approach as a way of investigating and analysing the significance given to social or human issues by individuals or groups. Relativists typically use a qualitative approach for a complex, in-depth explanation of the phenomenon (Macmillan & Schumacher 2010:6). In qualitative research, meanings are usually determined “through and in” cultures and examine the participants’ experiences (Strauss & Corbin 2008:12). Strauss and Corbin (2008:12) argue that the qualitative approach is dynamic and involved as opposed to the inflexible quantitative approach. According to Tillery,

Varias, Meyers and Collis (2010:88), qualitative studies are guided by participants' views, and their views are the driving force of data analysis. Tillery et al. (2010:88) argue that participants' views are analysed against empirical and theoretical literature, which is also significant components of any qualitative study. According to Harris et al. (2009:82), qualitative research is concerned with the participants' "insight, their meanings and also the language they use together with symbols". Qualitative research is perceived as labour-intensive based on the gathering of information and observation of the phenomenon (Harris et al. 2009:82). Babbie (2009:544) states that the qualitative approach provides participants an opportunity to share their perceptions of a phenomenon. Furthermore, this approach is recommended by researchers in studying people's behaviour and attaching meanings to that behaviour (Babbie 2009:544). I regarded the qualitative research approach as the most relevant for my study because it would allow me face-to-face engagement with the participants in their contexts. This way, I could also draw and interpret their practices and interactions with the environment in relation to the research topic.

## **4.5 SAMPLING**

Macmillan and Schumacher (2010:325) define 'sampling' in a qualitative approach as the selection of participants with meaningful information to ensure an in-depth study. They maintain that inquirers for qualitative approaches regard sampling as "dynamic, ad hoc" and phasic as opposed to static, and samples are generally small (Macmillan & Schumacher 2010:328). This characteristic is unlike that of a quantitative approach where samples are usually large to accommodate statistical analyses (Borrego, Douglas & Amelik 2009:57). This study followed a combination of convenience and purposive sampling strategies, as explained below.

### **4.5.1 Convenience sampling**

Creswell et al. (2016:206) define 'convenience sampling' as the type of sampling commonly used in a qualitative approach based on the researcher's convenience. Furthermore, Acharya. Prakash, Saxena and Nigam (2013:332) explain that convenience sampling is known as haphazard sampling or accidental sampling; it is a non-probability sampling method wherein participants are selected based on

accessibility, geographical proximity and availability or willingness to participate (Etikan, Musa & Alkasium 2016:2). In this study, convenience sampling was used to select the sites of the study. I conveniently selected three schools: two secondary schools and one primary school from Dzindi Circuit in Vhembe District, Limpopo. All three schools were conveniently selected because, apart from being information rich in terms of food waste, they were close to my workplace. Therefore, no travelling costs were incurred during the collection of data.

#### **4.5.2 Purposive sampling**

According to Patton (1990:169), purposive sampling is a type of sampling wherein the researcher chooses participants who have substantial information or knowledge about the research topic. Similarly, Macmillan and Schumacher (2010:138) also explain purposeful sampling as a method of selecting participants with certain characteristics. In this study, I purposefully selected the food coordinator of the NSNP in each of the three sampled schools. I also selected one food handler per school; the food handler is responsible for taking out the food to be prepared for learners. Two learners from the Representative Council for Learners (RCL), who form part of the NSNP, were purposively selected from each school. These selected learners monitored the food before the break and were deemed to be information rich. Moreover, two educators from the selected schools were chosen; these educators assist in the NSNP, and two were SGB members. In total, 18 participants were involved in this study.

#### **4.6 DATA COLLECTION**

As indicated by Strydom and King (2009:419), different data collection methods can be used in qualitative research. Among these methods are interviews, observations and document analyses, community forums, nominal groups, workshops, focus groups, storytelling and drama. In this study, data were collected through two methods: interviews and observations. Lodico, Spaulding and Voegtie (2010:121) define 'interviews' as a conversation between a group of people that have information about the research topic. Stuckey (2013:58) states that there are three types of interviews, namely (a) structured interviews – this type of interview is controlled by an interviewer. DiCicco-Bloom and Crabtree (2006:314) claim that structured interviews are

favourable for quantitative data; (b) semi-structured interviews – this is the type of interview where questions are outlined by the researcher but the interview is not restricted to particular responses; and (c) unstructured interviews – this type of interview is based on the ethnographic tradition of anthropology and the interviewer (DiCicco-Bloom & Crabtree 2006:315) and the interviewees are more conversational than structured. This study used semi-structured interviews. These interviews were audio-recorded, with the consent of the participants. The participants were interviewed individually and each of them was asked to suggest the most suitable time for the interview.

The second data collection method was observations. Observation comprises four types namely, (a) observer as a participant, where the researcher participates in the proceedings related to the research, such as in participatory action research, and (b) complete observer: the researcher observes without taking part in the activities (Creswell 2008:180 see also Lodico et al. 2010:117). According to Dargie (1998:10), observation is defined as an advanced qualitative research method, and it is a rich source of data collection. In this study, I was a complete observer, meaning that I was observing without taking part. I observed how learners in each of the three sampled schools disposed of the leftover food and what happened with the food later.

#### **4.7 DATA ANALYSIS**

According to Macmillan and Schumacher (2014:395), qualitative data analysis is defined as an inductive procedure of sorting out data. Furthermore, in qualitative research, there is a lot of data to be summarised, analysed and interpreted. Data should be organised by separating it into fewer units to give the researcher confidence in the research.

Data were analysed by using thematic analysis. Thematic analysis is considered as the identification of and search for “common threads across interviews or set of interviews” (Vaismoradi, Turunen & Bondas 2013:400). Data analysis was preceded by transcribing the audio-recorded interviews and field notes gathered during interviews. These transcriptions and field notes were coded and organised into

categories and themes, as stated by Vaismoradi et al. (2013:400). Braun and Clarke (2012:57) state that thematic analysis permits the researcher to see and understand shared meanings and experiences.

According to Braun and Clarke (2006:77), Ando, Cousins and Young (2014:4), there are six steps to follow in thematically analysing qualitative data. First is familiarising yourself with your data. This step requires the researcher to be effectively engaged in the data by transcribing, reading and re-reading the transcripts and listening to the audio-recorded interviews. The participants' ideas should be noted. Moreover, this step provides the foundation for the subsequent analysis. Next, generate initial codes. This step deals with the identification of codes. Identified codes become more numerous and specific than themes, and they indicate the context of conservation. Third, search for themes; this is the beginning of the interpretive analysis of collected data. Relevant data are combined and split according to themes and the researcher should indicate the relationship between codes, sub-themes and themes. Reviewing the themes follows, when the researcher separates, combines, refines and disposes of initial themes. This review is done over two stages, which the researcher checks with the coded extract (stage 1) and the overall data set (stage 2). Fifth, defining and naming themes; this step involves refining and defining the themes. As a researcher, I provided theme names and clear definitions that captured the principle of each theme concisely and accurately. Lastly, producing a report; the researcher writes a report by using a detailed and compelling extract that relates to the themes and research questions.

## **4.8 TRUSTWORTHINESS IN THE STUDY**

This section discusses the four aspects of trustworthiness in qualitative research, namely credibility, transferability, dependability and confirmability.

### **4.8.1 Credibility**

According to Trochim and Donnelly (2006), trustworthiness means determining if the findings of the study are credible from the viewpoint of the participants. Loh (2013:1), Guba and Lincoln (1985) propose different procedures to ensure credibility, including long-term involvement of researchers in the field, persistent field observation,

triangulation of sources, methods and investigators, peer debriefing, negative case review, data archiving, study group participant checking and peer inspection. To address prolonged engagement, it took me six weeks to collect data from all selected schools. I observed how learners were behaving during break times, and spent two weeks in each school during lunch breaks.

#### **4.8.2 Transferability**

According to Shenton (2004:69), transferability is the point to which the outcomes of the research can be exchanged or transferred to other contexts. Transferability is concerned with the extent to which the findings of one study can be applied to other situations (Merriam 2014). It pertains to whether the findings of the study might be exchanged for another context while still preserving its intended meaning. This is achieved through a “thick description” of the original context of the study to make informed decisions (Houghton, et al. 2013:12). It is the researcher’s responsibility to elaborate on the description of the study (Guba & Lincoln 1985). Moreover, readers can transfer the findings to their specific contexts. Transferability is achieved when the researcher employs raw data, direct quotations and excerpts from field notes to illustrate how themes develop from these notes (Houghton et al. 2013:13).

To ensure transferability in this study, a detailed description of the data collection methods was presented. Also, the sampling strategies and methods were detailed to clarify that the findings are not intended to be generalised. During the interviews, each participant was recorded, so whatever answers they gave could be transferred from verbal to written words. A detailed explanation of food waste recycling in Dzindi schools was thus presented. This presentation should give educators more information on how to start recycling in their schools and make an informed decision on ways to manage or reduce food waste within the school environment.

#### **4.8.3 Dependability**

According to Merriam (2009:220), dependability “refers to the extent to which research findings can be replicated and consistent”. Furthermore, Houghton et al. (2013:13) describe ‘dependability’ as the degree of stability of data; dependability focuses on how reliable the research is. To ensure the dependability of this study, I reported all the

processes in detail, including the research design, research approach, sampling, data collection and data analysis. Furthermore, I ensured dependability by recording and transcribing data into words after conducting interviews. Then, the verbatim responses were provided as much as possible in the report of findings.

#### **4.8.4 Confirmability**

Shenton (2004:72) defines 'confirmability' as the degree to which findings could be confirmed and collaborated by others. Confirmability is closely related to dependability and therefore refers to the neutrality and accuracy of data (Houghton et al. 2013:13). Lincoln and Guba (1985) describe 'confirmability' as the objectivity of the study. Miyata and Kai (2009:67) relate confirmability to situations when qualitative researchers are, on occasion, required to maintain cordial, direct, emotional involvement with the participants. To ensure confirmability, I ensured that the results of the study were entirely based on the raw information that was collected, and nothing else (Miyata & Kai 2009:67). Confirmability is achieved when participants check and affirm that recorded transcripts are a true reflection of their interviews. To ensure confirmability, the findings of this study were based on the responses from the participants, and none of my motivations was evident. I also provided details on every step of the data analysis that took place.

In the following section, the ethical aspects that required consideration while conducting the research are discussed.

### **4.9 ETHICAL CONSIDERATIONS**

Macmillan and Schumacher (2010:15) maintain that since educational research focuses mainly on people, researchers are responsible for protecting participants. The researcher is regarded as credible when he/she adheres to research ethics (Macmillan & Schumacher 2010:338). According to Terre Blanche, Durheim and Painter (2006), the primary purpose of research ethics is to protect the welfare of research participants.

Thus, to ensure adherence to research ethics, I applied for ethical clearance from Unisa. Additionally, permission to conduct the study was requested from the District Senior Manager (DSM), the circuit manager, and principals of the selected schools. I also fully disclosed the purpose of the research to the DSM, circuit manager, principals, SGB, educators, food handlers and learners. Participants were allowed to ask questions for further clarity (Macmillan & Schumacher 2010:339).

To ensure that the research was conducted ethically, signed consent forms were obtained from the participants prior to the interviews, and I assured the participants of their confidentiality and anonymity. Their names would and are not mentioned at any stage of the study. To further protect their identities, the names of the schools are not mentioned but pseudonyms and codes were provided (see Table 4.1). I also assured the participants that the information they gave me would be used only for the purpose of this study and that it would not be shared with anyone without their consent. The participants' right to privacy and fair treatment was emphasised by having an open discussion with participants. Participants were informed of their right to withdraw from participating in the study at any stage.

**Table 4.1: Table of participants**

<b>Participant</b>	<b>Participant category</b>	<b>School</b>
Dinga	Learner	C
Orange	Learner	C
Beef	Coordinator	C
Sugar	SGB member	C
Bele	Food handlers	C
Leaves	Educator	C
Nyala	Learner	B
Cabbage	Learner	B
Haya	Coordinator	B
Salt	Food handlers	B
Plum	SGB member	B
Litchis	SGB/Educator	B
Chawe	Learner	A

<b>Participant</b>	<b>Participant category</b>	<b>School</b>
Piesang	Learner	A
Bee	Coordinator	A
Nuts	Educator	A
Plant	Educator	A
Maty	SGB/ Educator	A

#### **4.10 THE LIMITATIONS OF THE STUDY**

The purpose of the study was to develop recommendations towards a sustainable means of managing food waste as a form of EE in the participating schools. Therefore, the limitations of this study included limited availability of resources and time; otherwise, the research would have been conducted in more schools within the Vhembe district, Limpopo. Only a few schools were selected because they were conveniently located. Secondly, the study could have developed more knowledge if it included an investigation of teachers' integration of sustainable school food waste management into their EE lessons. This aspect can be taken as a topic for further studies in school food waste management in order to promote reflections and improve EE practices for teachers and raise more awareness for learners. Thirdly, even more valuable data could be obtained from conducting classroom observations for the same reason – to see how teachers and learners interact regarding the topic of sustainable food waste in the schools.

#### **4.11 DELIMITATION OF THE STUDY**

The focus of this study was to understand the factors that could enable and constrain the sustainable management of food waste as a form of EE in schools. The study was confined to selected members of the chosen schools, which were the educators, NSNP coordinators, food handlers, learners and the SGB in each of the selected schools.

#### **4.12 CONCLUSION**

This chapter started by discussing the research methodology and all related aspects. These included the research paradigm – constructivism – and the research design that was employed in this study. After the research design, the research approach of this study, which was qualitative, was also discussed. Furthermore, the sampling methods that were used in this study were also elaborated on in this chapter. Thereafter, the data collection methods were presented, together with all the necessary steps that were taken in analysing the data. Finally, the issues of trustworthiness, together with ethical considerations, were outlined in this chapter. The next chapter presents the findings from the investigation.

## CHAPTER 5: RESEARCH FINDINGS

### 5.1 INTRODUCTION

The study aimed to examine how food waste can be managed in the selected schools in Vhembe district, Limpopo, as a way of educating learners about sustainable development through EE. The previous chapter presented the research methodology, indicating the research paradigm, research design, research approach, sampling and data collection methods. It was indicated that the study was conducted within an interpretivist paradigm, following a case study design and the qualitative approach. As presented in Chapter 1, the provision of food to support learners from challenged backgrounds created the problem of food waste in selected schools. Schools get polluted, and individuals sometimes become ill with pollution-related diseases. Thus, the main research question of the study was: *How can food waste be sustainably managed as a form of environmental education in selected schools in Vhembe district, Limpopo?*

The sub-questions were:

- (a) What factors can enable the sustainable management of food waste as a form of environmental education in schools?
- (b) What factors can constrain the sustainable management of food waste as a form of environmental education in schools?
- (c) How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools?
- (d) How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?

From each of the sub-questions presented above, themes were developed and, in this section, I present the findings according to these sub-questions and themes. To present these findings, the participants and schools were given pseudonyms, as indicated in Table 5.1.

## **5.2 FACTORS THAT ENABLE THE SUSTAINABLE MANAGEMENT OF FOOD WASTE AS A FORM OF ENVIRONMENTAL EDUCATION**

From my observation, I found that there was no structured strategy for sustainable food waste management in the participating schools. Thus, sustainable food waste management in these schools was not necessarily part of the EE agenda. I therefore looked at the factors that could enable this practice. I found that two of the schools, B and C, had vegetable gardens. School B was an agricultural school; not only did it have a vegetable garden, but it also had sheds for poultry in the schoolyard. There was also a board stating “Agriculture in Action” at that school, which showed that agricultural activities were performed. School C also had a vegetable garden, but it was not necessarily an agricultural school. My view, therefore, was that the existence of these vegetable gardens could be regarded as a possible enabling factor for the optimum EE towards the sustainable management of food waste. Thus, in pursuit of drawing the participants’ attention to the topic of food waste management in the schools, I asked them if there were any possibilities for this practice in their schools.

All the participants, not only those in schools B and C, were asked about the possibilities for, or the factors that could enable, the management of food waste in the schools. The analysis of data provided three themes under the question related to factors that could enable food waste recycling in the participating schools. These included recycling food waste for agricultural activities, reusing the food waste by engaging the community, and reducing food waste as a cost consideration.

I also observed that waste bins were available in two of the three selected schools, but learners were not disposing of leftovers in the bins due to a lack of guidance from their educators. To me, this suggested that there was not adequate EE in this regard. The engagement of other stakeholders was also lacking; in one of the selected schools, there were no waste bins available. Furthermore, I found that there is no support from stakeholders, such as educators, DBE, DEA, SGB and also learners. My interpretation of this situation was that the schools were missing out on the possible multidisciplinary EE which could be enriched in these schools.

There was no supervision from the educators and SGB members during break time,

and learners were disposing of leftovers everywhere. From the DBE, schools were supposed to have enough waste bins to dispose of leftovers. The DEA should have issued schools with EE pamphlets for learners to learn more about recycling and taking care of the environment. From my observation, I found it assisted when the school could engage all stakeholders within the school to deliberate on ways to handle food waste, rather than disposing of it everywhere.

### **5.2.1 Recycling food waste for agricultural activities**

The findings suggest that recycling is regarded as one possible way of managing food waste in participating schools. This strategy, as far as the participants were concerned, would be possible if the schools used the food waste resourcefully for agricultural purposes. For example, Learner Orange (school C), commented that:

*There is a high possibility for the recycling of food waste in our school. We can reuse food waste as a form of organic fertilizer for our vegetable garden that is located on the school premises.*

Food handler Sugar, from school C, responded by saying:

*There is a high possibility for recycling to occur in this school because during the week, we generate food waste from butternut seeds and skin, cabbage and carrots have recycling potential.*

Therefore, the response from learner Orange (school C) shows that the school can make manure or organic fertilisers through composting; for instance, the schools can make compost from fruit and vegetable peelings. The Agricultural Science educators could form part of the programme as they have more knowledge on how to make compost.

This suggests that the participant used the concepts 'recycling' and 'reusing' interchangeably. What was important, however, was that the participant identified a possible waste management strategy within the school. Even though school C was not an agricultural school, the school had a vegetable garden wherein food waste and

unusable food waste could be recycled to form organic fertilisers, and therefore be reused to enrich the school garden.

Similarly, the NSNP coordinator, Haya, who was one of the educators in school B, commented,

*There is a high chance that food waste is recycled because the school is an agricultural school. It needs organic manure.*

This response confirmed that school B was an agricultural school. The NSNP coordinator identified a high possibility that the unusable food waste could be recycled to make manure for the school. The school could thus stop buying fertilisers and gain other advantages by using a healthier form of fertiliser, namely “organic manure”.

Educator Litchis, from school B, also stated:

*The possibility is to take care of food waste by making compost. We can take the food waste and bury it for a while and allow it to decompose and later extract it for use again in the future. After all, we are an agricultural school.*

This response is similar to that of the coordinator. Both these participants, therefore, thought of the usefulness of food waste fertilising the gardens, rather than using other means to do so. It was also interesting to observe that even learners could relate the problem to their agricultural subject content. For example, learner Dinga (school C) said that:

*Schools can do vermicomposting, whereby we put food waste in the bin and then add worms so that they can digest the waste into manure. The manure can be used in the school garden. This will also help the school not to spend much buying fertilizers.*

One of the educators indicated that if the school could start vermicomposting and use bins to dispose of food waste, the school would benefit. For example, educator Nuts

(school A) said that:

*School can disposed food in bins and then add worm to decompose the food waste into fertilizers that can be used the school.*

These statements reflect that the educator and learner were both able to think about a solution to the problem in the school, but what they were suggesting was not being implemented in the school. The findings from educator Nuts show that food waste can be stored in bins to make manure that will later be used in the school. This response was similar to the response of participant Dinga, in the sense that they all maintained bins are essential in schools.

Therefore, teachers, coordinators and students regarded the existence of agricultural activities in the schools as an enabling factor for the management of food waste. However, I also found that the participants realised the possibility of reusing their school's food waste. The following sections present these findings.

## **5.2.2 Reusing food waste through engaging the community**

Food waste in schools can be reused in different ways in the communities where schools are located. The schools where this study was conducted were in rural areas and experienced poverty. Therefore, it was determined that food waste could be used in two ways in the communities: by the pig farmers, and the children from low- income families.

### **5.2.1.1 Reuse by local pig farmers**

Although the schools were not recycling their food waste, I found that food waste was being reused. Educator Nuts (school A) said:

*The food handlers together with the coordinator give food waste to the community to feed the pigs. They also dispose leftovers to dump sites if not*

*collected.*

Two issues could be drawn from this response. First, the school and local farmers identified the usefulness of food waste as pig feed. Second, the uncollected food by the pig farmers was disposed of in dumpsites. In other words, the school did not have a recycling plan but only a reusing plan. This response could be related to the fact that school A does not have a vegetable garden; thus, only the community members could benefit from the discarded food. The participants were therefore primarily referring to reusing rather than possible recycling, as was the case in the other schools.

Of a similar view, learner Dinga (school C) stated:

*There is a greater possibility for my school to recycle food waste. The school can communicate with local farmers and divert wastes to feed animals.*

This response suggests that the learner regarded giving food to the farmers as a recycling strategy. Nevertheless, this learner identified the usefulness of the food waste for the surrounding rural community. Instead of discarding of the food waste on the ground, the school could be a resource to local farmers by providing food for their animals.

#### **5.2.1.2 Reuse by disadvantaged learners**

The findings indicate that it was necessary to differentiate between food leftovers and food waste. In this case, the food leftovers were those items of food which were edible but had remained unused during the day. While food waste (the inedible food) was given to the pig farmers or disposed of in dumpsites, the food leftovers were given to learners to eat at home after school because some of these learners were from disadvantaged families. The school gave these learners from disadvantaged families this food so they would not have to go to sleep with an empty stomach. Giving this food to the learners to eat at home was a form of reusing food that would otherwise be thrown away.

Coordinator Bee, from school A, also commented,

*We then identify disadvantaged children, like orphans, and distribute it evenly to them so that they eat at home. Some children are very thin and orphaned and lack any sort of guardianship at home.*

It was also noted that the way in which this food was distributed did not embarrass the disadvantaged learners. In this way, learners informally learned about human dignity and social respect, which could be regarded as a social dimension of EE. Bee continued to say,

*If the food is leftover and still raw, disadvantaged children are privately called to come and collect this food to help them at home.*

In addition, there was a method of controlling or managing the distribution of these food leftovers. Food handler, Bele, from school C, explained,

*The leftover foods are given to the learners and the cooks are not allowed to take them home. This means that disadvantaged children that have nothing to get by are always willing and appreciative to take them. No matter what, cooks are not permitted to take any of the food home because learners are considered the only recipients. We also ensure that the food is distributed to young children first.*

As stated, food handlers were thus not allowed to take leftovers home, unless the coordinator gave them permission to do so. However, uncooked food waste was given to learners from disadvantaged families. For example, food handler Sugar (school C) responded:

*When we first started the job, we were strictly instructed to throw away all the leftover food and not take it home, but as time progressed they realized that it wasn't ethical to throw away food that was wanted and needed by other people. We were later allowed to take it home with special permission whilst the uncooked leftovers were given to disadvantaged children. The throwing away of the leftovers wasn't right because some of the cooks were also very poor and*

*was emotionally hard to do.*

The findings similarly reflect that food handlers were not allowed to take food waste home. The coordinator instructed the food handlers to take food waste home only when it was not good to dispose of the food in waste bins, and when the food handlers were from disadvantaged families themselves.

Moreover, according to participant Sugar, learners were given the same amount of food (60g). Food handler Bele (school A) maintained that there was no food waste in school, only the vegetable peels that are thrown in the waste bins. Furthermore, SGB member Plum (school C) indicated that leftovers were given to the cooks to feed their families.

Learner Cabbage seemed dissatisfied with the way in which school B was handling this form of food waste. The learner commented:

*The majority of leftover food produced at the school is thrown away whilst very little of it is given to learners.*

Based on this view, this school needed to revise its strategy of dealing with food waste; either by decreasing the portions given to the learners or following the strategy of giving the leftovers to the local farmers. This may be seen as an indication that some learners were dependent on this food, to some extent.

### **5.2.2 Reducing food waste for cost consideration**

Participants indicated that equal amounts of food being prepared and served result in schools not having leftovers since the correct measurement is used. For example, food handler Bele, from school A, responded:

*A specific scale is used to measure the quantity of food so that an accurate measure of food is produced. For that reason, rarely produce any leftover foods.*

Furthermore, SGB member Maty (school A) responded by saying that:

*Usually, we don't have any leftovers because we use a specific measurement but if we find ourselves having any leftovers, the children are given the food during the second break.*

According to SGB member Plum (school C):

*Normally there are no leftovers in this school. Learners eat and finish all the food. I always see the learners eating all the food given to them. The remaining such as peels and all the inedible leftovers are taken to the trash bin where is collected by someone who is rearing pigs.*

Furthermore, educator/SGB member Litchis (school B) explained:

*In this school, the learners eat all the food. We do not have any leftovers because learners eat and take more food. If there is still some food remaining the learners can take the food home with containers. We measure the food according to the number of learners.*

These findings suggest that food waste management in these schools is a possible strategy for EE to promote sustainable development, since recycling, reducing and reusing food waste and leftovers saves the environment from pollution and degradation. Some participants, however, mentioned EE directly, as indicated below.

### **5.2.3 Environmental education through food waste management**

While some participants were speaking about recycling, reusing and reducing food waste, Litchis (school B) presented a different but related view. This educator seemed to think in terms of what the curriculum says about food waste in schools, in addition to similar views being shared by other participants regarding composting. Litchis said:

*There should be an introduction of a program that will help to transform, recycle, or re-use these leftovers into compost.*

This was another way in which participants were using the concepts 'food waste' and 'leftovers' interchangeably. In this case, the suggestion was that there should be a programme to teach learners about leftovers that were unusable (food waste), as usable food was given to disadvantaged learners.

Coordinator Beef, from school C, agreed with educator Litchis and also emphasised the possibility of involving learners in a recycling strategy. Beef suggested:

*Children must be instructed to collect all the leftovers after eating and the school must provide a trash bin where all this waste can be collected and be recycled.*

Therefore, the response shows that the school can recycle the leftovers by starting a recycling programme to help the school make organic fertilisers through composting. As an agricultural school, the school can benefit from food waste. The possibilities for recycling are there, if only educators would instruct learners to dispose of leftovers in bins provided for recycling.

In addition, the findings suggest that recycling could be implemented in the schools, even if just for the sake of educating learners that food waste is recyclable into compost. For example, coordinator Haya, from school, B stated:

*Composts should be created for learners to see its usefulness, and they should also be encouraged and educated more on the importance of composts. More material for a collection of food waste should be provided to the school.*

This comment suggests that if schools could manage their food waste through recycling, learners would learn to do the same. This could also be considered education on sustainable development because learners might continue doing the same outside school, considering that these children were from rural areas. However, some responses showed that, sometimes, people in the schools act in ways that might promote irresponsibility among the learners. For example, educator Litchis, from school B, who was also a member of the SGB, commented,

*Learners' leftovers are disposed everywhere. The food handlers will come and pick up the leftovers and place them in the bins.*

A similar comment was made by learner Orange, from school C,

*The fact that the food waste is disposed in many different areas around the school makes it difficult to deal with. Some of the learners after getting their meal, they go to the playground and eat there and they will leave everything behind. It will be difficult for the food handlers to go and pick food waste.*

These comments suggest that instead of making learners pick up their own refuse, other people, such as the food handlers, do it for them. This situation does not seem to educate learners for the environment. However, the school was managing food waste by putting the leftovers in waste bins.

#### **5.2.4 Cost consideration**

The consideration of the costs related to agricultural practices in schools was found to be an enabling factor for the management of food waste through recycling. The participants indicated that, to minimise their spending on fertilisers or manure, schools could recycle their food waste to produce manure (compost). Learner Nyala, from school B, said:

*The manure [compost from food waste] can be used in the school garden. This will help the school not to spend much buying fertilizers.*

Also, educator Leaves (school C) commented:

*This [composting] is a very cheap and effective way of getting manure or organic fertilizers.*

These comments reflect that the school could save money by recycling food waste, since they would no longer need to buy fertilisers. In this way, food waste management

would not only save the biophysical environment but also contribute to the economic dimension of the environment.

The above discussions suggest that there are various factors that could enable the appropriate management of food waste, both for the environment and the education of learners in the participating schools. However, the study also found several factors that could constrain the management of food waste, and these are discussed next.

### **5.3 FACTORS THAT CONSTRAIN THE SUSTAINABLE MANAGEMENT OF FOOD WASTE AS A FORM OF ENVIRONMENTAL EDUCATION IN SCHOOLS**

This section addresses the question, what factors constrain the sustainable management of food waste as a form of EE in schools? Three themes emerged from the analysis. These included a dependence on external support, inadequate education and information, as well as stakeholder and funding barriers.

#### **5.3.1 Lack of external support**

The study found that some schools' reliance on the provision of support and resources from people and bodies outside the schools blur the possibilities for the adequate management of food waste in the schools. For example, learner Cabbage (school B) stated:

*Lack of motivation from the DBE is the only problem that makes us suffer as a school and also lack of knowledge for recycling.*

This statement suggests that if the school could be motivated by the DBE, as an external department that regulates the schools, then the school could probably recycle its food waste. The participant suggested that the DBE could also provide knowledge on recycling. This response reflects that even though this learner attends an agricultural school, the participant thought of an external source of support rather than the possibilities within the school. The similar focus on external support was identified from learner Nyala's response, also from school B, who said:

*In my school, there are no recycling bins. If we can have bins we can dispose of the leftovers.*

Although this participant did not mention the external provision of recycling bins, the implication of their non-existence is that the school is waiting on an external provider. As such, the lack of bins makes it difficult to take care of the environment through recycling. It was also interesting that these comments mentioned recycling only, and no other food waste management strategies.

### **5.3.2 Inadequate education and information**

Lack of education and limited information on food waste management were constraints found in this study. The participants indicated that a lack of information or education leads to difficulties in controlling food waste. For example, learner Chawe, from school A, stated:

*The fact that we learners and educators are uninformed and uneducated on the necessity of recycling food waste will make it difficult to get the support of both learners and staff members.*

The response shows that learners and educators should be educated about recycling; it will be easier for them to recycle leftovers once they have acquired such informed. It was also apparent that the issue of food waste management could more easily be addressed if it was integrated into the school curriculum. This idea was mentioned by a coordinator, Haya (school B):

*The current school curriculum does not provide for learners to engage in matters of practical work. It is more theoretical than practical.*

Practical work, in this case, would be to engage in one or more of the food waste management strategies mentioned above. This also suggests that the school was dependent on curriculum designers and could not be proactive in this case.

Some participants seemed to have no information at all about food waste management. Even when given an example of recycling, food handler Salt (school B) responded by saying:

*I know nothing about recycling food as I have never heard anyone talking about recycling food or seen someone doing such recycling.*

Similarly, food handler Bele (school A) mentioned:

*I have never heard anything about recycling. It is for the first time I hear about recycling.*

Food handler Sugar, from school C, gave a wider response to say, *“I do not know of any mechanism that can be used to manage food waste.”* These responses indicate that not everyone in the school community was informed enough to be able to participate in the different forms of managing food waste.

### **5.3.3 Inadequate stakeholder participation**

Non-involvement of stakeholders and lack of funds in the schools was found to be another constraint to food waste management. Some participants noted a lack of support from parents who were not willing to allow their children to be involved in the practices pertaining to food waste management. As such, the school management was unable to involve learners in such practices. Haya (school B) argued,

*The other barrier is the school leadership and parents that will not easily agree on the involvement of learners on participating on school activities such as picking food waste in the school premises.*

Two aspects could be drawn from this comment. First, the parents did not regard it as education for the environment to make learners clean up the food waste mess, regardless of the waste being caused by them. Second, the school could not act against the parents' principles and educate the children accordingly.

### 5.3.4 Inadequate funding

While it is known that affluent schools employ cleaners to keep the grounds clean, some schools could not afford this service. Leaves, from school C, explained:

*Our school still has no funds available and there is lack of support from stakeholders This makes it difficult to get rubbish bins. Lack of rubbish bin and non-involving relevant stakeholders such as SGB members, educators and support staff in schools is a problem.*

The participant identified that although there are unresolved issues, such as funds, other matters that need to be addressed include engaging parents, educators, learners, and other stakeholders within the school. Therefore, the management of food waste requires collaboration between all stakeholders, and it requires funds.

The findings suggest that the schools may either consider financially planning for the sustainable management of food waste, or make use of naturally available resources. Participants from school B mentioned that the school should draw up a budget that will assist them in buying recycling bins. Salt (school B) argued,

*The school may draw up a budget to be able to purchase recycling bins that are bright and colourful to excite and encourage learners.*

This comment suggests that the school could resort to learners' emotions to ensure sustainable food waste management through recycling. However, Maty, from school B, suggested;

*All we need to do is dig a big hole that will strictly be used for this waste so that we are actively recycling food waste to organic fertilizer.*

Thus, unlike the suggestion of having colourful refuse bins, Maty's suggestion was for the use of rubbish dumps, which cost nothing.

Assuming that I could find schools with food waste management strategies, the next

question that I took to the field was how those strategies could be sustained. In the next section, I present the findings from those schools that had such strategies, and what participants thought could be done for the strategies to be developed.

## **5.4 SUSTAINING THE RECYCLING OF FOOD WASTE IN THE SCHOOLS**

Recycling emerged as one of the strategies through which food waste could be managed in the schools. This section addresses the way such recycling, as an enabling factor for sustainable food waste management, can be sustained. Three themes emerged from the findings, namely, providing resources for recycling, educating about food waste management, and planning and improvising.

### **5.4.1 Providing resources for recycling**

The findings suggest that if the required resources are provided, schools might consistently be able to manage their food waste, primarily through recycling. For example, coordinator Bee (school A) commented,

*The school should make sure that there are enough recycling bins in schools, proper training is needed in schools.*

### **5.4.2 Educating about food waste management**

Suggestions were that learners should be trained, particularly on how to recycle food waste. Leaves, from school C, said:

*Learners should be trained on how to recycle and the importance of recycling.*

Other participants also provided additional details on what can be done to ensure the sustainable management of food waste. Leaves, for example, also mentioned the following as some factors that can sustain food waste recycling in schools:

*Placing recycling bins in front of the classes will be the best option, giving learners more information about environmental education, pasting posters of*

*environmental education and recycling on the notice board and Starting the environmental awareness will be of greater importance.*

This comment highlighted a number of possible ways of ensuring the sustainable management of food waste. This view also highlights the visibility of waste bins, along with the provision of information to learners through posters, education and environmental awareness programmes in the school. This view was corroborated by Orange (school C), who commented that there was a limited number of waste bins around the school premises, and there were no EE posters that encouraged the stakeholders within the school to take part in environmental awareness.

Furthermore, learner Piesang, from school A, noted:

*The DBE can provide the school with more information about recycling. School can be assisted by also getting a poster for recycling and environmental information. Schools should engage all stakeholders to facilitate the program. The stakeholders in schools are SGB, SMT, educators, RCL, food handlers.*

The participants indicated that the DBE should provide schools with information related to food waste recycling. They also suggested that schools put up posters for EE and encourage the involvement of educators, SGB members, SMT and RCL.

According to educator Plant (school A), factors that can promote the management of food waste in schools include posters on recycling, environmental information, and finances. Furthermore, learners should be engaged in an environmental awareness programme.

Educator Nuts (school A) responded to the question by saying that:

*Composts should be created for learners to see how serious it is, and they should also be encouraged and educated more on the importance of these composts and more material for a collection of food waste should be provided to the school.*

The responses from coordinator Beef (school C) and educator Nuts (school A), show that learners throw leftovers everywhere because there is no designated place for them to dispose of such waste. However, educators should show learners or choose an area where learners can dispose of leftovers, and teach them to separate food leftovers from other waste.

Having identified the possible enabling factors, the constraining factors and the possible means of sustaining the enabling factors, the next question I was interested in was how the constraints could be addressed. The discussion on this question follows.

## **5.5 ADDRESSING THE CONSTRAINING FACTORS TO FACILITATE THE MANAGEMENT OF FOOD WASTE AS A FORM OF ENVIRONMENTAL EDUCATION IN SCHOOLS**

The participants were asked what kind of support the school needed to manage food waste, and three themes emerged. These were multisectoral collaboration, the provision of resources, and teachers as resources.

### **5.5.1 Multisectoral collaboration**

The findings suggested that working hand-in-hand with other departments, such as the Education Department, DEA, and the local municipality, could assist schools in improving their knowledge and understanding of food waste management and caring for the environment. Mainly, the participants made reference to recycling on this topic and less to the other food waste management strategies. For example, Plant (school A) said that:

*The school can communicate with the district office (Education department) to assist them with recycling bins. They can also communicate with the office of environmental Affairs to assist them with the ideas on how to start recycling in schools. They can also engage the local municipalities to assist them to impart knowledge through awareness. Educators and other stakeholders involved should also form part of facilitating recycling.*

This shows that if the schools are provided with bins, the intervention of the DBE and training, it could assist the school in maintaining the environment. Beef, from school B, also commented,

*Currently, the school should collaborate with the Department of Environmental Affairs, local municipalities, all stakeholders within the school and the Department of Agriculture.*

Furthermore, educator Nuts (school A) mentioned the following as the kind of support the school needs to recycle food waste:

*The school has never attempted to recycle the food waste; however, given the necessary training support for the learners and the relevant teachers, the school may be able to transform the food waste into useful commodities.*

### **5.5.2 Provision of resources**

To address the research question, participants were asked what kind of support the school needed to manage the food waste. The participants indicated that they needed support from the school itself, in terms of being given a designated area where they can dispose of food leftovers. They also mentioned being provided with adequate resources to be used for composting, like purchasing recycling bins. For example, coordinator Beef (school C) responded by saying:

*The school could show its support by giving us a special dumping area that only contains food waste so that it doesn't have to mix with items like tin and paper.*

According to coordinator Haya (school B), factors that can enable the recycling of food waste in schools include the following:

*If the school can be provided with recycling bins it will be easy. Educators should be trained on how to recycle. The department of education must implement EE in school.*

These findings were supported by learner Chawe, and educator Piesang, who maintained the importance of recycling and digging a composting hole.

### **5.5.3 Educator as resource**

One of the identified constraining factors to food waste management, as discussed in Section 5.3.2, was inadequate education and knowledge about the practice. When asked how such a constraint could be addressed, some participants identified teachers as a resource that could be useful in that regard. Their views included,

*There are Agricultural Sciences teachers who probably have more knowledge concerning the compost-making process. (Piesang, a learner from school A)*

*Educators, especially the agricultural science teachers, should undergo training for taking care of the environment including composting. (Beef, coordinator from school C)*

Both these responses identify the most viable and sustainable means of managing food waste; making it the teachers' responsibility. In this way, the practice could also address the concern raised earlier that food waste management should be part of schools' curriculum.

## **5.6 CONCLUDING REMARKS**

In this chapter, the data collected through semi-structured interviews with participants were presented. It started with a brief description of the three selected schools in Vhembe district, Limpopo, that were visited. Various themes emerged from the data, which were developed by focusing on food waste management. The discussion continued to present the participants' opinions on how food waste could be managed. In the next chapter, a discussion of the findings, conclusion, and recommendations is presented.

## CHAPTER 6: DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

### 6.1 INTRODUCTION

This study illustrated a practical example of O'Donoghue's (1993) model of the environment (presented in Chapter 3). Food waste in the participating schools was a multidimensional problem that had implications for the biophysical, the social and the political dimensions. In this chapter, I discuss the findings that were presented in Chapter 5, in order to draw conclusions and make recommendations. This chapter thus begins with a summary of the findings. The next section discusses these findings against the literature that was reviewed in Chapters 2 and 3. Thereafter, I draw conclusions from the discussion, followed by the recommendations.

### 6.2 SUMMARY FINDINGS

The main research question of this study was *How can food waste be sustainably managed as a form of environmental education in selected schools in Vhembe district, Limpopo?*

The sub-questions were:

- (a) What factors enable the sustainable management of food waste as a form of environmental education in schools?
- (b) What factors constrain the sustainable management of food waste as a form of environmental education in schools?
- (c) How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools?
- (d) How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?

Table 6.1 reflects a summary of findings from these questions; a comprehensive discussion follows in Section 6.3.

**Table 6.1: A summary of findings**

Research Questions	Themes
<p>1. What factors enable the sustainable management of food waste as a form of environmental education in schools?</p>	<p>Recycling food waste for agricultural activities</p> <p>Reusing food waste through engaging the community (Reusing by local pig farmers and disadvantaged learners)</p> <p>Reducing food waste for cost consideration</p> <p>EE through food waste management</p> <p>Cost consideration</p>
<p>2. What factors constrain the sustainable management of food waste as a form of environmental education in schools?</p>	<p>Dependency on the external provision of resources</p> <p>Inadequate education and information</p> <p>Stakeholder and funding barriers</p>
<p>3. How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools?</p>	<p>Providing resources for recycling</p> <p>Educating about food waste management Planning and improvising</p>
<p>4. How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?</p>	<p>Multisectoral collaboration Provision of resources</p> <p>Educators as a resource</p>

To examine the research questions, this study was framed through the Value-Belief-Norm theory (see Chapter 3).

### **6.2.1 What factors enable the sustainable management of food waste as a form of environmental education in schools?**

Some schools had vegetable gardens. The study found that the existence of these gardens could facilitate the management of food waste through composting. This practice would not only nurture the biophysical environment in the school but also be educational to learners; especially in the agricultural school. Secondly, the study found that the community around the other schools contributed in the management of food waste by using it for animal feed. The three Rs of environmental management came out practically in the study as the food waste was, and could be, recycled, reused and reduced. Food leftovers were reused by supporting learners from disadvantaged families, and unconsumable food waste was given to pig farmers. Food waste could also be reduced by giving learners smaller portions of food so that they would not have leftovers. Most importantly, for the sake of this study, some participants suggested the possibilities for EE through recycling projects in the schools. However, these were not implemented, partly because of the constraints summarised below.

### **6.2.2 What factors constrain the sustainable management of food waste as a form of environmental education in schools?**

The key finding of this question was that the schools were dependent on external support and could not identify naturally occurring possibilities for food waste management in their surroundings. They attributed the problem to the lack of support and motivation from the DBE. There was also a demonstration of a political divide, in the sense that, unlike schools in some urban areas, these rural schools were not supported by the municipality in terms of waste removal. Therefore, schools needed funding to purchase recycling bins and educate their learners about the possible effects of food waste. The lack of bins led to learners disposing of leftovers everywhere. The lack of education and limited information about food waste management is thus a contributing factor to food waste in schools.

### **6.2.3 How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools?**

It was determined that the provision of recycling bins in schools could assist learners not to dispose of food waste everywhere. Learners and other school stakeholders should have information about food waste management. Furthermore, some of the participants suggested that schools should allocate budgets to buy the required resources for the schools to be used for recycling; such resources include things like recycling bins and bio-digesters. Hence, some participants suggested that schools should start recycling programmes, wherein different strategies will be used, including composting, vermicomposting and bio-digesting.

### **6.2.4 How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?**

The findings suggested a need for schools to collaborate with other sectors, such as the DEA, local municipality, and the department of agriculture; through multisector collaboration, schools will get more information. Findings suggested the DBE, DEA, and local municipality should assist schools with resources to provide learners with information, and they should also start creating environmental awareness. Participants suggested that Agricultural Science teachers, who likely have more knowledge concerning the compost-making process, should be engaged in taking care of the environment. Agricultural science educators should also assist learners by giving them more information that concern composting and vermicomposting.

## **6.3 DISCUSSION OF FINDINGS**

This section discusses the findings from this study against the literature that was reviewed.

### **6.3.1 Economic factors of managing food waste**

Although food waste in schools is not as voluminous as in other organisations, it still has aesthetic and health implications and therefore needs to be managed. Among the ways of managing food waste is the consideration of school finances and actions that can augment or protect these finances. This finding is not unique to the context where this study was conducted, but similar suggestions were made in the reviewed literature as well. For example, in Chapter 2 (Section 2.8), Gustavsson et al. (2011:1) were quoted as arguing that the reduction and proper management of food waste have several benefits, including saving economic resources and contributing to food security. This study confirmed this argument because, as discussed in Chapter 5, participants realised the possible benefits of composting in terms of saving the schools from buying manure for their gardens.

In addition, Papargyropoulou et al. (2014:106) were cited in Chapter 2 (Section 2.5) as pointing to the food hierarchy, which includes, among others, the conversion of food waste into humus. This act is an indirectly economical way of managing food waste because the schools could produce more vegetables from the fertilised soil and sell these to the community. Although none of the participating schools was doing this, it was determined that the schools could also sell their food waste to pig farmers to generate some income.

Secondly, food waste in schools can be managed by contributing to food security. Some learners are from disadvantaged communities and, therefore, as found in this study, schools might reduce their poverty-related problems by contributing the food that would be discarded to these learners. This act would help families struggling for food, and the learners would also be able to eat at home. Thus, the way food waste was being managed and/or could be managed in the schools, could be regarded as a response to Newsome and Van Eeden's (2017) comment about the shameful nature of high statistical figures of food waste when "1 in 8 people are lacking access to sufficient food". Even composting, which was highly suggested in this study as a way to manage food waste, can indirectly contribute to addressing food security. In Chapter 2 (Section 2.8) it was indicated that The South African Department of Environmental Affairs (2013) encourages composting as a way of diverting organic and garden waste

from landfills in order to produce products that can be helpful or beneficial to communities. In this study, it was found to be one of the primary ways in which food waste can be managed.

Furthermore, to reduce costs, the literature in Chapter 2 stated that schools should start recycling programmes as a way of managing their food waste (Moczygemba 2001:3). Similarly, this study's findings suggest that schools can take up composting or vermicomposting to save money on manure or fertilisers needed for their school gardens (See Chapter 2, Section 2.8.2.2).

Therefore, this study found that food waste can be recycled through composting in schools. Although this finding did not match any of the literature about food waste in schools, it still confirmed that composting is one of the recycling strategies for food waste. This was suggested in Chapter 2 (Section 2.8.2) (Hertwich & Peters 2009:43). Hence, according to the Environmental Protection Agency (2015), composting is endorsed as a waste management solution to reduce GHG emissions by diverting organic materials from landfills. The findings indicated that the participants knew that the school could benefit from this practice, especially those schools with vegetable gardens.

### **6.3.2 Educational factors for managing food waste**

In Chapter 2 (Section 2.4), the DEA (2011) was cited as emphasising several waste management strategies, including avoidance and reduction; reusing; recycle; as well as treatment and disposal. While these measures are significant for managing food waste, in this study, it also transpired that educating the school communities can contribute to food waste management in schools. Particularly in an agricultural school, teachers can play a key role in integrating EE in their lessons and use food waste as a resource for instilling necessary values that are possibly sustainable. This situation corroborates what literature reflected in Chapter 3 (Section 3.1), where the FAO (2018) proposed a focus on learners in terms of education about food waste. This, according to the FAO, can create a culture of sustainable food management.

### **6.3.3 The social factors of saving food waste**

To manage food waste, schools can take advantage of the social context in which they are located. For example, the context where this study was located allowed some of the schools to manage their food waste by donating it to the local food farmers because these schools were in rural settings. Similarly, in Chapter 2 (Section 2.4), literature indicated that food waste could be donated to pig farmers to reuse as feed for their pigs, and also be converted into useful forms of manure or fertilisers for agricultural activities (Papargyropoulou et al. 2014; Erickson et al. 2016; Swanepoel et al. 2011). The same was suggested by participants in this study. Therefore, it can be said that when schools are located in rural communities, food waste can be managed by collaborating with farmers.

Secondly, donating food leftovers (cooked and uncooked) to disadvantaged children not only contributes towards a reduction in food insecurity, as stated in Section 6.3.2 above, but is also a social way of managing food waste. This was a unique finding; none of the consulted literature reported anything similar. It suggests that the context in which this study was conducted may be unique in terms of the socio-economic conditions and food waste management in this regard.

#### **6.3.3.1 Collaborative efforts for managing food waste**

It is difficult for rural schools to manage food waste by themselves, especially if they are dependent on external resources. The best way of managing this challenge, as found in this study, is to have a collaborative relationship with other stakeholders. Schools may collaborate with parents, municipalities, and communities; when this collaboration is absent, schools struggle to manage their food waste. For example, in this study, it became clear that schools need collaboration with the DBE who should provide waste bins; the municipality who should collect the waste; parents who should not restrain schools from teaching environmental responsibility through learners cleaning up after themselves; and the local farmers who should collect waste for their animals. However, some of these possible collaborators may not participate, and that becomes a problem for food waste management. For example, this study found that the DBE was not supplying schools with the required resources, and the

municipality was not collecting their waste. The situation related to the municipality was consistent with Guerrero, Maas and Hogland's (2013) assertion in Chapter 2 (Section 2.3.5) that politicians do not prioritise solid waste removal.

Moreover, it can be argued that communities, in the form of parents, are crucial in educating their children how to interact with the environment in which they live. In this study, it was determined that parents had a problem with their children cleaning up the waste they throw everywhere; this can be seen as a lack of collaboration that limits EE in this regard. In Chapter 2, literature indicated that multiple behaviours, such as cultural, political, economic, values and attitudes, lead to food waste (Quested et al. 2013). Also, Schneider and Obsterner (2007) were cited in Section 2.3.5 as identifying social norms, social class, attitudes, and cultural upbringing as contributing to food waste. Pokhrel and Viraraghavan (2005), in Section 2.3.1, suggest age and household income as being among the factors that must be taken into consideration when examining behaviours related to food waste. It is for this reason that collaboration from different stakeholders may assist schools in managing their food waste.

Schools could also work, in collaboration or individually, towards food waste management. This can be done through school policies and regulations. In this study, none of the participants mentioned the existence of a policy or regulation against food waste in the schools. Yet, the literature suggests that regulations can assist in managing food waste (Halloran et al. 2014:297).

Findings revealed there was a lack of support from the DBE; the DBE was turning a blind eye to the school environment. The DBE was also not providing bins to schools, which led to learners disposing of food waste everywhere. Apart from the lack of waste bins, findings revealed a lack of waste control rules. The unavailability of bins and lack of motivation from the DBE led to the poor management of food waste in schools. This is supported by literature in Chapter 2 (Section 2.3), where it was discussed that meso-level causes of food waste include a lack of equipment, coordination and communication, and infrastructure. The causes of food waste at the macro-level are malfunction food systems, lack of policy, and lack of the adoption of good practices (HLPE 2014).

The findings revealed that there was a lack of commitment from the stakeholders. SGB

members were not committed to the programme, and this led to challenges in support of recycling. Moreover, there was a lack of education among the stakeholders; some of the participants did not even know what recycling is. This was also mentioned in Chapter 2 (Section 2.8). The findings also indicated that there were no funds available to assist the schools in starting recycling programmes.

It was interesting to see the VBN theory in practice in this study. Although the study was not conducted to test this theory, the findings suggested a number of values, beliefs and norms as contributing to the research problem. First, the farmers contributed in curbing food waste in the schools by taking it for their farms. They were not doing this with the interest of the schools at heart, but they were valuing their own farms. Another clear example of this theory is the norm of the parents who were reluctant to allow their children to clean the school yards even though they were a big part of polluting the yards. Their beliefs, it seemed, was that their children were not the schools, but the schools should find ways of cleaning up.

#### **6.4 RECOMMENDATIONS**

In this section, I present recommendations for the management of food waste in schools, as addressed in the last two questions of this study. These questions were, respectively: *How can the enabling factors be maintained to ensure the sustainable management of food waste as a form of environmental education in the schools? How can the constraining factors be addressed to facilitate the management of food waste as a form of environmental education in the schools?*

Regarding the sustainability of the possible enabling factors, three recommendations are drawn from the findings. First, food waste can sustainably be managed in schools if resources are provided for recycling. This recommendation, as made by participants in this study, corresponds with the literature in Chapter 2 where it was indicated that, at Seneca Falls Middle School Campus, educators and learners built composting bins to dispose of food waste (Schwarz & Bonhatal 2017:10). Furthermore, the school established a team to assist in the management of food waste. In Californian schools, learners were expected to use the classroom recycling bins to separate food, cans, plastic and glass. The CIWMB (2002:5) state that educators and learners should be

engaged in the education component of food waste management, and they should be trained. The literature in Chapter 2 further emphasised that schools should start recycling programmes and educate learners on how to reduce food waste (Moczygamba 2001:3).

Second, it was disheartening to realise that EE about sustainable food waste management was not part of the core activities even in the agricultural schools in the research sites. As indicated in the discussion of findings above, education should be provided on the sustainable management of food waste in the schools. This education can be presented through curriculum integration, posters on food waste management and/or making waste bin visible and accessible.

Third, schools should prioritise financial planning related to the sustainable management of food waste, or they can make use of naturally available resources. In other words, support from the DBE or other stakeholders should be offered in addition to what the schools are already doing. As suggested in this study's context, schools can also draw a budget which will allow them to buy waste bins to dispose of food waste. The schools can also improvise by digging a hole where they can dispose of food waste for composting.

With regard to addressing the constraining factors towards the management of food waste in the schools, three recommendations are made. First, schools should collaborate with other stakeholders to manage food waste through EE. These stakeholders include the DBE, DEA and the local municipality. This suggests that schools can take advantage of businesses in their municipal areas to seek collaboration towards food waste management. This collaboration can be (as a second recommendation) in the provision of resources to schools. The DBE could provide resources that will indirectly be used for the teaching and learning of EE.

The third recommendation for addressing constraints related to food waste management is that teachers should be resourceful. As suggested in this study's findings, teachers can make the topic of food waste management part of the schools' curricula. This can be done by giving practical examples when teaching certain topics, especially in the agricultural school. Findings suggested that learning about, in, and for

the environment encourages learners and youth to be active in schools for the benefit of the environment and decision-making processes. Findings also revealed that if the DBE could timeously invite environmental officers to visit schools, this will be of great importance to the school. Data further determined that if the municipality engages with schools by collecting waste, it will also prevent the schools becoming landfills and disease-ridden.

The study suggested that to address the issue of recycling, the DBE should provide recycling bins for learners to dispose of their leftovers. The bins should be placed in front of classes and sport-grounds. Bins should be placed around sport-grounds because learners eat food everywhere; they move around the school premises and leave food waste on the ground. Findings suggested that EE should be part of the curriculum to teach learners about the environment and environmental projects. Teachers should thus have knowledge of EE and impart that knowledge to their learners.

In addition, it is recommended that while food waste can be managed through reuse by the local farmers, the schools can also keep some for composting purposes. As one of the schools is an agricultural school, educators and learners should start a recycling programme to benefit the school and transform, recycle, or reuse food waste and turn it into compost. Learners are controllable in school, as such, they can be trained on how to handle food waste through interaction with the teachers and other school community members.

The DBE should train the NSNP coordinators, food handlers and SGB members because a lack of knowledge leads to food waste. The DBE should engage other stakeholders, such as the DEA, Department of Agriculture and the local municipality, to impart knowledge to all stakeholders. The DEA can contribute by providing posters and start awareness campaigns to teach learners how to recycle and take care of their surroundings.

The school curriculum should include practical aspects that are compulsory, rather than theoretical knowledge only, about addressing any form of pollution. In particular, learners should be able to learn practically about recycling, composting and

vermicomposting, and the sustainable management of food waste.

## **6.5 CLOSING COMMENTS**

The purpose of the study was to explore sustainable means of managing food waste emanating from school environments. The study was guided by the following question: how can food waste be managed as a form of EE in selected schools in Vhembe district, Limpopo? This topic shows that this phenomenon is neglected in the field of EE. It was interesting to find such significant information on this topic, which would not have become known without research of this nature. For example, this study brought to light that in order to reduce the cost of buying fertilisers, schools should start composting and recycling programmes as a way of managing their food waste, and schools may collaborate with parents, municipalities, and communities to reduce food waste. Findings also revealed that there was a lack of education among the stakeholders; some of the participants did not even know what recycling is. Food waste management in schools is not only necessary for aesthetics but also to educate learners, teachers and the community about the interrelatedness on the biophysical, the social, and the political dimensions of the environment.

## REFERENCES

- Acharya, A.S., Prakash, A., Saxena, P. & Nigam, A. (2013). Sampling: why and how of it? *Indian Journal of Medical Specialities*, 4(2):330-333
- Ando, H., Cousins, R.S. & Young, C. (2014). Achieving saturation in thematic analysis: development and refinement of a code book. *Comprehensive Psychology*, 3:4
- Ardhna, K. (2019). Out of propotion? The role of leftovers in eating related affect and behaviour. *Journal of Experimental Social Psychology*, 81:15-26
- Babbie, E. (2009). *The practical of social Research* (12<sup>th</sup> Ed). C.A. Wardsworth
- Bada, S.O. & Olusegum, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *IOSR journal of research in education*, 5(6):66-70
- Bagherzaden, M., Inamura, M. & Jeong, H. (2014). Food waste along the food chain, Agriculture and Fisheries Papers, 71, OECD Publishing, <http://dx.doi.org/10.1787/5jxrcmf>.
- Banks C.J., Salter, A.M., Heaven, S. & Riley, K. (2012). Energetic and environmental benefits of co-digestion of food waste and cattle slurry: a preliminary assessment. *Resources, conservation and Recycling* 56(2011):71-79. [doi.org/10.1016/j.resconrec.2011.09.006](http://doi.org/10.1016/j.resconrec.2011.09.006)
- Barr, S.K. (2011). *Green schools that teach: identifying attributes of whole school sustainability*. Unpublished Master's Thesis. Colorado State University.
- Baskarada, S. (2014). Qualitative case study guidelines. *The Qualitative report*, 19(40):1-18.
- Baxter, P. & Jack, S. (2008). Qualitative case study Methodology: Study Design and

Implementation for novice Researchers. *The Qualitative Report*, 13(4):544-559.

Bhattacharjee, J. (2015). Constructivist approach to learning- An effective approach of teaching learning. *International Research Journal of Interdisciplinary & Multi-disciplinary Studies*. London

Bilir, A., & Özbaş, S. (2017). Evaluation of values, beliefs and norms of high school students on the conservation of biodiversity. *Journal of Turkish Science Education*, 14(3), 26-39. doi: 10.12973/tused.10203a.

Bjorge, S., Hannah, T., Rekstad, P. & Pauly, T. (2017). *The Behavioral Effects of Learning Outdoors*. Retrieved from Sophia, the St. Catherine University repository website: <https://sophia.stkate.edu/maed/232>

Boeve-de Pauw, J., Gericke, N., Olsson, D. & Berglund, T. (2015). The effectiveness of education for sustainable development. *Sustainability*, 7:15693–15717.

Bolter, J. D. (2016). Posthumanism. In Jensen, K. B. Craig, R. T. Pooley, J. D. & Rothenbuhler E. W. (Eds.), *The international encyclopedia of communication theory and philosophy*. Hoboken, NJ: Wiley. doi:10.1002/9781118766804.wbiect220

Bonnett, M. (1999). Education for Sustainable Development: a coherent philosophy for environmental education? *Cambridge Journal of Education*, 29(3):313-324. DOI:10.1080/0305764990290302

Boonen, R. (2015). How to feed and not to eat our world. [https://lirias2repo.kuleuven.be/bitstream/handle/123456789/507188/RubenBoonn\\_online.pdf;jsession.d=E4E707B353A7A904994700878A54F](https://lirias2repo.kuleuven.be/bitstream/handle/123456789/507188/RubenBoonn_online.pdf;jsession.d=E4E707B353A7A904994700878A54F).

Borrego, M., Douglas, E.P. & Amelik, C.T. (2009). Quantitative, qualitative and mixed methods in engineering education. *Journal of Engineering Education*, 98(1):53.

Bosman, C. (2009). *Environmental management in South Africa: Integrating waste*

management. (2<sup>nd</sup> Ed), Cape Town: Juta.

Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research In Psychology*, 3:77-79.

Braun, V. & Clarke, V. (2012). *APA handbook of research method in psychology: research design*. American Psychology Association. Doi: 10.1037/13620-004.

California Integrated Waste Management Board. (2002). School Recycling: *Increasing Diversion Rates in School and In the Home*. California. Retrieved from: [www.ciwmb.ca.gov/publications/](http://www.ciwmb.ca.gov/publications/). [accessed September 2020].

Canali, M., Amani, P., Aramyan, L., Gheoldus, M., Moates, G., Östergren, K., Silvennoinen, K., Waldron, K., Vittuari, M., 2016. Food waste drivers in Europe, from identification to possible interventions. *Sustainability*, 9(1): 37. <https://doi.org/10.3390/su9010037>.

Carter, R.L. & Simmons, B. (2010). History and philosophy of environmental education. In A.M. Bodzin, B.S. Klein and S. Weaver (Eds.), *The inclusion of environmental education in science teacher education* (pp. 3-16). Springer: New York.

Chan, T.C. (2013). An examination of Green schools practice in Atlanta schools. <https://files.eric.edu.gov//fulltext/ED5435009.pdf>.

Chawla, L., & Cushing, D. (2007). Education for strategic environmental behavior. *Environmental Education Research*, 13: 437-452

Clacherty, A. (1993b). The Environmental Education Policy Initiative: reflections on the process. *Southern African Journal of Environmental Education*, 13:3-6

Cohen, L. & Manion, L. (1994). *Research methods in education*. (4th ed.) London: Routledge

Cohen, L., Manion, L. & Morrison, K. (2011). *Research Methods in Education*. (7<sup>th</sup> ed).

Abingdon: Routledge

Cox, J. & Downing, P. (2008). *Food behaviour consumer research: quantitative phase. Waste & Research Action Programme*. Available online at <http://www.wrap.org.uk/sites/files/wrap/Food%20behaviour%20consumer%20research%20quantitative%20jun%202007.pdf>

Creswell, J.W. (2014). *Research design: qualitative, quantitative and mixed methods approaches*. (4<sup>th</sup> Ed). London: SAGE

Creswell, J.W. (2008). *Educational Research: planning, conducting and evaluating quantitative and qualitative research*. Upper Saddle River: Merrill/Prentice Hall.

Creswell, J.W., Ebersohn, L., Eloff, I., Ferreira, R., Ivankova, N.V., Jansen, J.D., Nieuwenhuis, J., Pieterse, J. & Plano Clark, V.L. (2016). *First step in research*. (2<sup>nd</sup> ed). Pretoria. Van Schaick

Cronje, N., Van der Merwe, I. & Muller, I.M. (2018). Household food waste: a case study in Kimberley, South Africa. ISSN 0378-5254. *Journal of Consumer Science*, (46), 4-9.

CSIR (2004). *Eastern Cape State of Environment Report CSIR division of water, Environment and Forestry Technology*. Durban, South Africa.

Dargie, C. (1998). Observation in political research: *A Qualitative Approach, Politics, Sage Journal*, 18(1):1-10.

Denzin, N.K. & Lincoln, Y.S. (1998). Constructivist, interpretivist approaches to human inquiry. In Denzin, N.K. & Lincoln, Y.S. (Eds), *The landscape of qualitative research: Theories and issues*. Pp. 221-259. Thousand Oaks: Sage.

Denzin, N.K. & Lincoln, Y.S. (2000). *Qualitative Research*. Yogyakarta:

PustakaPelajar.

Department of Education (DoE). 2003. National Curriculum Statement Grades 10–12 (Overview). Pretoria: Government Printer.

Department of Environmental Affairs (2013). Think. Eat. Save: Reduce your food print, South Africa. Available from: <https://www.environment.gov.za/otherdocuments/reports>. [ accessed 21 June 2019]

Department of Environmental Affairs and Tourism (1996c). Towards a new environmental policy for South Africa, Pretoria: Government Printer.

Department of Environmental Affairs. (DEA) (2002). National Management Act. Pretoria

Department of Environmental Affairs. (DEA). (2011). National waste management strategy. Pretoria. [ accessed 21 June 2019]

Derfa (2010). Household food and drink waste linked to food and drink purchase. Department for Environment, food and Rural Affairs. Available: [https://www.gov.uk/government/system/uploads/attachment\\_data/file/137950/defra-stats-foodfarm-food-foodwastepurchases-100727.pdf](https://www.gov.uk/government/system/uploads/attachment_data/file/137950/defra-stats-foodfarm-food-foodwastepurchases-100727.pdf)

Diaz-Ruiz, R., Costa-Font, M. & Gil, J.M. (2015). Moving ahead from food related behaviours: an alternative approach to understand household food waste generation. *Journal of Cleaner Production*, 172:1140-1151

DiCicco-Bloom, B. & Crabtree, B.F. (2006). The qualitative research interview. *Medical Education*, 40(4):314-321

Dlamini, B.R., Rampedi, I.T. & Ifegbsan, A.P. (2017). Community residents opinion and perception on the effectiveness of waste management and recycling potential in the Umkhayakude and Zululand District Municipalities in the Kwazulu-Natal Province of South Africa. [www.mdpi.com/207-1050/9/10/1835/html](http://www.mdpi.com/207-1050/9/10/1835/html)

DoE. (1997a). Curriculum Policy. Pretoria: DoE

DoE. (2002). Revised National Curriculum Statement: Grade R-9 (Schools). Pretoria: DoE.

Du Plessis, A.A. (2009). The “brown” environmental agenda and constitutional duties of local government in South Africa: A conceptual introduction, South Africa. [Dspace.nwc.ac.za/bitstream/handle/10394/16938/2015%2818%295DuplessisAA.pdf](http://Dspace.nwc.ac.za/bitstream/handle/10394/16938/2015%2818%295DuplessisAA.pdf).

Dube, C. (2012). Implementing education for sustainable development: The role of Geography in South African Secondary school. Scholar [sun.ac.za/bitstream/handle/10019/implementing\\_2012.pdf](http://sun.ac.za/bitstream/handle/10019/implementing_2012.pdf).

Environmental Protection Agency (2015). Sustainability. Available from: <https://www.epa.gov/sites/production/files/2015-06>. USA

Eriksson, O., Bisailon, M., Haraldsson, M. & Sundberg, J. (2016). *Enhancement of biogas production from food waste and sewage sludge-Environmental and economic life cycle performance*. Sweden. Elsevier.

Etikan, I., Musa, S.A. & Alkassim, R.S. (2016). Comparison of convenience sampling and purposive. *American Journal of Theoretical and Applied Statistic*, 5(1):1-4. doi:10.11648/jajyas.20160501.11

Evans, D. (2011). “Blaming the consumer once again: the social and material contexts of everyday food waste practices in some English households”. *Critical public health*, 21(4):429-440.

FAO. (2011). *Global food losses and food waste: Extent, causes and prevention*. Food and Agriculture Organisation. Available <http://www.fao.org/docrep/014/mb060e.pdf>

FAO. (2014). Food wastage Footprint: Full-cost Accounting, Final Report. FAO: Rome

FAO. (2018). The state of food security and nutrition in the world 2018: building climate resilience for food security and nutrition, World Health Organization, Food & Agriculture Org

Fien, J. (2000). "Education for the environment: A critique" - an analysis. *Environmental Education Research*, 6(2):179-192

Friedrich, E. & Trios, C. (2013). GHG emission factors developed for the recycling and composting of municipal waste in South African municipalities, *Waste Management*, 33(11)2520-2531, Available: <https://doi.org/10.1016/j.wasman.2013.05.010>

Girrotto, F., Alibardi, L. & Cossu, R. (2015). Food waste generation and industrial uses: A review, department of industrial engineering, Available: <https://dx.doi.org/10.1016/j.wasman.2015.6.088>.

González-Torre, P.L. & Adenso-Díaz, B. (2005). Influence of distance on the motivation and frequency of household recycling. *Waste Management*, 25(1):15-23.

Gough, A. (2013). The Emergence of Environmental Education Research: A 'History' of the Field." In Stevenson, R.B. et al. (Eds). *International Handbook of Research on Environmental Education*, pp. 13–22. New York: Routledge.

Graham, R.E., Jessop, D.C. & Sparks, T. (2014). Identifying motivations and barriers to minimising household food waste. *Resources, Conservation and Recycling*, 84:15-23.

Graham, L. Hochfeld, T. Stuart, L. & Gent, M.V. (2015). Evaluation study of the national school nutrition programme and the tiger brands foundation in school breakfast feeding programme in the Lady Frere and Qumbu district of the Eastern Cape. University of Johannesburg.

Griffin, M., Sobal, J. & Lyson, T.A. (2009). An analysis of a community food waste stream: *Agriculture and human values*, 26:67-81. Available: <http://dx.doi.org/10.1007/s10460-008-9178-1>

Grubb M. (1993). *The Earth Summit Agreements: A Guide and Assessment*. Earthscan: London

Guba, E.G. & Lincoln, N.S. (1994). Competing paradigms in qualitative research. In Denzin, N.K. & Lincoln, Y.S. (eds). *Handbook of qualitative research* 105-117. London: Sage

Guba, E.G. & Lincoln, Y.S. (1985). *Naturalistic Inquiry*. Beverly Hills. Sage.

Guerrero, L.A., Maas, G. & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, 33:220-232. <http://dx.doi.org/10.1016/j.wasman.2012.09.008>

Gunders, D. (2012). Wasted: How America is losing up to 40 percent of its food from farm to fork to land fill Author. Natural resources defence council

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R. & Meybeck, A. (2011). *Global Food Losses and Food Waste*. Rome: Food and Agriculture Organization of the United Nations. Available at: [http://www.fao.org/fileadmin/user\\_upload/ags/publications/GFL\\_web.pdf](http://www.fao.org/fileadmin/user_upload/ags/publications/GFL_web.pdf)

Håkansson, M., Kronlid, D.O.O. & Ostman, L. (2017). Searching for political dimension in education for sustainable development: socially critical, social learning and radical democratic approaches. *Environmental Research*, 25(1):6- 32

Haraway, D. (1991). *Simians, cyborgs, and women*. New York: Routledge.

Halloran, A., Clement, J., Kornum, N., Bucatariu, C. & Magid, J. (2014). Addressing food waste reduction in Denmark. *Food Policy*, 49: 294–301

Harris, J.E., Gleason, P.M., Sheean, P.M., Boushey, C., Beto, J.A. & Brummer, B. (2009). An introduction to qualitative research for food and nutrition professionals. *Journal of the American Dietician Association*, 109(1):80-90

Hatch, J.A. (2002). *Doing qualitative research in Education setting*. New York: Sunny press

Heale, R. & A. Twycross, A. (2018). What is a case study? *Evidence-Based Nursing*, 21:7-8. Available at: <http://dx.doi.org/10.1136/eb-2017-102845>.

Herodin, B. & Zuhlsdorff, P. (2014) *Environmental path to sustainable development*. Belgium: Pro Europe

Hertwich, E. & Peters, G. (2009) Carbon footprint of nations: A global trace-linked analysis. *Environmental Science Technology*, 43(16)6414-6420

HLPE (2014). Food losses and waste in the context of sustainable food system. A report by the High Level Panel of experts on Food Security and Nutritional of the committee on world food security, [www.fao.org/cfs/cfs-hlpe](http://www.fao.org/cfs/cfs-hlpe), Rome

Hoffmann, T. & Siege, H. (2018). *What is Education for Sustainable Development (ESD)?* Retrieved from [http://esd-expert.net/files/ESD-Expert/pdf/Was\\_wir\\_tun/Lehr-%20und%20Lernmaterialien/What\\_is\\_Education\\_for\\_Sustainable\\_Development.pdf](http://esd-expert.net/files/ESD-Expert/pdf/Was_wir_tun/Lehr-%20und%20Lernmaterialien/What_is_Education_for_Sustainable_Development.pdf)

Hopkins, C. & Mckeown, R. (2002). Education for sustainable development: an international perspective, education and sustainable: responding to global challenges. *Education and Sustainability*, 1(2):13-24

Houghton, C., Casey, D., Shaw, D. & Murphy, K. (2013). Rigour in qualitative case study research. *Nurse Researcher*, 20(4):12-17

Ibtissem, M.H. (2010). Application of value beliefs norms theory to the energy conservation behaviour. *Journal of Sustainable Development*, 3 (2): 129–139

Imbert, E. (2017). Food waste valorisation options: opportunities from the bio economy.

Open Agriculture. De Gruyter Open

Irwin, P. (1990). The concepts of environmental education and the development of Environmental education in South Africa. *Southern African Journal of Environmental Education*, 11:1-7

Irwin, P. (1992). *Environmental education in Bophuthatswana with particular reference to pre-service primary teacher education*. PhD Thesis. Pretoria: Unisa.

Irwin, P. & Lotz- Sistika, H. (2005). History of environmental education. In Loubser, C.P.(ed), *Environmental education: some South African perspectives*. Pretoria: Van Schaik Publishers.

Ishangulyev, R., Kim, S. & Lee, S.H. (2019). Understanding Food Loss and Waste: Why Are We Losing and Wasting Food? *Foods*, 8(297):1-23

James, J.K. & Williams, T. (2017). School-based experiential outdoor education. *Journal of Experiential Education*, 40(1):58-71

James, L. (2016). Facilitating lasting changes at an elementary schools. *International Electronic Journal of Elementary Education*, 8(3):443-454

Jickling B. & Spork, H. (1998). Education for the environment: A critique. *Environmental Education Research*, 4(3):309–327

Kanyimba, A.T. (2009). The incorporation of the environmental education for sustainability in the Namibian Colleges of Education, Pretoria, University of South Africa

Kawai, K. & Tasaki, T. (2014). *Definitions of municipal solid waste and waste generations revisited*, National Institute for Environmental Studies, Japan

Khan, S. (2014). Towards sustainability: managing integrated issues of the brown and

the green agenda in water governance and hazard mitigation. *Policy Brief*, 12:1-9

Kimaryo, L.A. (2011). *Integrating Environmental education in primary school education in Tanzania. Teachers' perceptions and teaching practices*. Pargas: Abo akademi University press

Kivunja, C. & Kuyin, A.B. (2017). Understanding and applying Research paradigm in Educational context. *International journal of higher education*, 6(5)

Kopochinski, L. (2012b). Colorado school achieves top LEED honor, school construction. *News*, 15(4):14-16

Krauss, S.E. (2005). Research paradigms and meaning makings: A primer. *The Qualitative Report*, 10(4):758-770.

Kwatubana, S., & Makhalemele, T. (2015). Parental involvement in the process of implementation of the National School Nutrition Programme in Public Schools. *International Journal of Educational Sciences*, 9(3), 315-323.

Langsford, C. (2012). Enough on our plate? The National School Nutrition Programme in two Schools in Katshehong, South Africa. Master's dissertation. Johannesburg: University of the Witwatersrand.

LaRue, C. (1995). Reduce Reuse Recycle: An ESL textbook/workbook [In four volumes]: <http://www.seek.state.mn.us>

Le Grange, L. (2002). Towards a "language of probability" for environmental education in South Africa. *South African Journal of Education*, 22(2):83-87

Le Grange, L. (2017). *Environmental education after sustainability*. In B. Jickling and S. Sterling (eds.). *Post-sustainability: Remaking education for the Future*, 6-10 New York: Palgrave MacMillan

Lin, C.Z.K., Pfaltzgratt, L.A., Davila, L.H., Mubofu, E.B., Abderrahim, S., Clark, J.H.,

Koutinas, A.A., Kopsahelis, N., Stamatelatou, K., Dickson, F., Thankappan, S., Mohamed, Z., Brocklesby, R. & Luque, R. (2013). Food as a valuable resource for the production of chemicals, materials and fuels. Current situation and global perspective". *Energy & Environmental Sciences*, 6. Hong Kong: RCS publisher

Lleo, T., Albcete, E., Barrena, R., Font, X., Artola, A. & Sanchez, A. (2013). Home and vermicomposting as sustainable options for bio waste. *Journal of Cleaner Production*, 47:70-74. Doi:10.1016/j.jclepro.2012.08.011

Lodico, M.G., Spaulding, D.T. & Voegtle, K.H. (2010). *Methods in educational research: From theory to practice* (Vol. 28). San Francisco: John Wiley & Sons.

Loh, J. (2013). Inquiry into issues of trustworthiness and quality in narrative studies: A perspective. *The Qualitative Report*, 18(33): 1-15

Loubser, C.P., De Beer, J.J.J., Dreyer, J.M., Hattingh, J.P., Irwin, P.R., Le Grange, L.L.L., Le Roux, C.S., Sisitka, H.L. & Schulze, S. (2014). *Environmental Education: some South African perspectives* (2<sup>nd</sup> Ed). Pretoria. Van Schaik

Loubser, C.P. (1992). Environmental education: A field of study to be taught as subject during teacher training. *Educare*, 21(1&2):90-96

Loubser, C.P. (2012). Biodiversity in South Africa: The role of environmental education. In proceedings of the conference on The Best of Both Worlds: Effective Environmental Education. 8-10 November 2010. Kuching, Sarawak

Loubser, C.P., De Beer, J.J.J., Dreyer, J.M., Hattingh, J.P., Irwin, P.R., Le Grange, L.L.L., Le Roux, C.S., Lotz-Sisitka, H. & Schulze, S. (2005). *Environmental education and education for sustainability, some South African perspectives*. (1<sup>st</sup> Ed). Pretoria. Van Schaik Publishers

Lyndhurst, B. (2007). Briefing Paper Banbury: WRAP. Available from <http://www.wrap.org.uk/content>

MacDonald, D. (ed) (2002). *Environmental justice in South Africa*. Cape Town: UCT Press

Macmillan, J. & Schumacher, S. (2014). *Research in Education: Evidence based inquiry*. (7<sup>th</sup> Ed). England. Pearson Ltd

Macmillan, J.H. & Schumacher, S. (2010). *Research in Education: Evidence Based Inquiry*. New Jersey: Pearson Education Inc.

Makana municipality. (2005). Local Environment Action Plan (online). Available from: <http://www.ru.ac.za/media/Rhodesuniversity/content/documents/environment/kypercent20issuepercent20prelimpercent20audit.pdf>

Malinska, K., Golanska, M., Caceres, R., Rorat, A., Weisser, P. & Slezak, E. (2017). Biochar amendment for integrating composting and vermicomposting of sewage sludge - the effect of biochar on the activity of *eisenial fetida* and obtained vermicompost. *Bioresourtechno* 225:20614. <https://doi.org/10.1016/j.biortech.2016.11.049>

Mallison, L.J., Russel, J.M. & Barker, M.E. (2016). Attitude and behaviour towards convenience food and food waste in the United Kingdom. *Appetite*, 103:17-38. doi:10.1016/j.appet.2016.03.017

Marais, M.L., Smit, Y., Koen, N. & Lotze, E. (2019). Are attitudes and practices of food service managers, catering personel and students contributing to excessive food wastage at Stellenbosch University. *South African Journal of clinical nutrition*, 30(3):60-67. <https://doi.org/10.1080/16070658.2017.1267348>

Mathenjwa, J.S. (2014). *The implementation of environmental education in the Ubombo circuit schools*. Unpublished M.Ed. thesis. University of Zululand

Mauthner, N. S. (2019). Toward a posthumanist ethics of qualitative research in a Big

Data era. *American Behavioral Scientist*, 63(6), 669–630.  
doi:10.1177/0002764218792701

Mavrakis, V. (2014). *The generative mechanisms of food waste in South Australian household setting*. PHD thesis: Flinders University, faculty of health sciences, Department of Public Health, Australia.

McKeown, R. Hopkins, C. (2007). Moving beyond the EE and ESD disciplinary debate in formal education. *Journal of Education for Sustainable Development*, 1(1):17–26.

Mellville, H.R. (2007). *Enabling environmental education in an environmental education centre: A narrative account of opportunities and constraints*. Master's Thesis. University of Stellenbosch, Cape Town

Menzel, S. & Bögeholz, S. (2010). Values, beliefs and norms that foster Chilean and German pupils' commitment to protect biodiversity. *International Journal of Environmental & Science Education*, 5 (1): 31–49

Merriam, S.B. (2009). *Qualitative research: A guide to design and implementation. Revised and expanded from qualitative research and case study application in education*. San Francisco: John Wiley & Son

Merriam, S.B. (2014). *Qualitative research: A guide to design and implementation*. London: John Willey and Son

Merriam, S.B. (1998). *The qualitative research and case study application in education*. San Francisco, CA: Jossey-Bass

Mertens, D.M. (2015). *The research and evaluation in education and psychology; integrating diversity with quantitative, qualitative and mixed method (4<sup>th</sup> Ed)*. London. SAGE

Mills, R. (2012). What it means to go Green: Reduce, Reuse, Repurpose and

Recycling. *Family and Consumer Science/4-H Youth Development, sustainability/Recycle/ 2012-01pr*

Milupi, I., Somers, M.J. & Ferguson, W. (2017). Local Ecological Knowledge and Community based Management of Wildlife Resources: A Study of the Mumbwa and Lupande Game Management Areas of Zambia. *Southern African Journal of Environmental Education*, 33:25-36

Miyata, H. & Kai, I. (2009). Reconsidering evaluation criteria for scientific adequacy in health care research: An integrative framework of qualitative and quantitative criteria. *International Journal of Qualitative Methods*, 8(1):64-75

Moczygemba, S. (2001). *How to design a school recycling program*. New Orleans: Springer

Morgan, E. (2009). Fruit and vegetable consumption and waste in Australia. Victoria, Australia: State Government of Victorian Health Promotion Foundation

Nahman, A., Lange, W., Oelofse, S. & Godfrey, L. (2012). The costs of household food waste in South Africa. *Waste Management*, 32(11):2147-2153

National Waste Management Strategy (2011). South African government. [www. Gov. za // Documents/ Documents/2011 November 10/ national waste management strategy](http://www.gov.za//Documents/Documents/2011%20November%2010/national%20waste%20management%20strategy)

Nazir, J. (2016). Using phenomenology to conduct environmental education research: Experience and issues. *The Journal of Environmental Education*, 47:179-190. doi:10.1080/00958964.2015.1063473

Newsome, T.M. & Van Eeden, L.M. (2017). The effects of food waste on wildlife and humans. *Sustainability*, 9:1269. [https://doi.org/10.3390/ su9071269](https://doi.org/10.3390/su9071269).

Nousheena, A., Zai, S.A., Waseem, M. & Khan, S.A. (2020). Education for sustainable development (ESD): Effects of sustainability education on pre- service teachers'

attitude towards sustainable development (SD). *Journal of Cleaner Production*, 250:119537. <https://doi.org/10.1016/j.jclepro.2019.119537>

O'Donoghue, R. (1993). Clarifying environmental education: A search for a clear action in Southern Africa; *Southern African Journal of Environmental Education*: 13: 28-37.

Oelofse, S., Muswema, A. & Ramukhwatho, F. (2018). Household food waste disposal in South Africa: A case study of Johannesburg and Ekurhuleni. *South African Journal of Science*, 114(5-6):1-6

Oelofse, S.H.H. & Nahman, A. (2013). Estimating the magnitude of food waste generated in South Africa. *Waste Management and Resources*, 31(1)80-86, [sagepub.com/doi/full/10.1177/0734242x12457117](https://sagepub.com/doi/full/10.1177/0734242x12457117)

Offermans, G.A. & Glasbergen P. (2017). Spotlights on certification and farmers' welfare: crossing boundaries in social scientific research. *Development in Practice*, 27(8):1078-1090

Ogola, J.S., Chimuka, L. & Tshivhase, S. (2011). *Management of municipal solid waste: a case study in Limpopo Province, South Africa*. In: Kumar, S.(ed). *Integrated Waste Management (1)*: (Rijeka): In Tech, 91-122

Olesen, V. (2015). Early millennial feminist qualitative research. Challenges and contours. In Denzin, N.K., and Lincoln, Y.S. 2005. *The sage handbook of qualitative research*. Thousand Oaks: SAGE

Oliveira, L.R.G., Santos Filho, D.A., Vasconcelos, K.C., Lucena, T.V., Jucá, J.F.T. & Santos, A.F.M.S (2018). Methanization potential of anaerobic biodigestion of solid food waste. *Revista Brasileira de Engenharia Agrícola e Ambiental*, 22:69- 73

Olsson, D., Gericke, N. & Chang Rundgren, S.N. (2016). The effect of implementation of education for sustainable development in Swedish compulsory schools: assessing pupils' sustainability consciousness. *Environmental Education Research*, 22(2):176-

202. DOI: 10.1080/13504622.2015.1005057

Pagan, T. & Steen, R. (2004). *The worm guide: A vermicomposting guide for teachers*. California environmental protection agency. California Integrated Waste Management Board.

Painter, K., Thondhlana, G., Kua, H.W. (2016). Food waste generation and potential interventions at Rhodes University, South Africa. *Waste Management.*, 56, 491–497.

Papargypolou, E., Lozano, R., Steinberger, K.J., Wright, N. & Ujang, Z.B. (2014) The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of cleaner production*, 76:106-115. Available from: <http://dx.doi.org/10.1016/j.jclepro.2014.04.020>

Parfitt, J., Barthel, M. & McNaughton, S. (2010). Food waste within food supply chain: quantification and potential for change to 2050. *Philosophical transaction royal society B: Biological Science*, 365:3065-3081. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2935112>

Patton, M.Q. (1990). *Qualitative Evaluation and Research Methods*. New Bury Park: SAGE publications

Pearson, D., Minehan, M. & Wakefield-Rann, R. (2013). Food waste in Australian households: why does it occur? *The Australian-Pacific Journal of regional food studies*, 3:118-132.

Pérez, A.V., Gámez, M.R., Briones, V.F.V., Viteri, C.G.V. & Molina, L.A.V. (2018). Sustainable development seen from environmental training in university linkage. *International Journal of Life Sciences*, 2(1):12-20. <https://doi.org/10.29332/ijls.v2n1.75>

Pokhrel, D. & Viraraghavan, T. (2005). *Municipal solid waste management in Nepal: Practices and challenges*: Available online 23 March 2005

Porpino, G., Parente, J. & Wansink, B. (2015). Food waste paradox: antecedents of food disposal in low income household. *Waste Management*, 25:555-562. doi:10.1111/ijcs.12204

Potrac, P., Jones, R. L & Nelson, L. (2014). Interpretivism. In Nelson, L., Groom, R. & Potrac, P. (Eds), *Research methods in sports coaching*, Pp 31-41, London: Routledge

Quested, T. & H. Johnson. (2009). *Household food and drink waste in the UK*. WRAP, Banbury, U.K

Quested, T.E., Marsh, E., Stunel, D. & Parry, D. (2013). Spaghetti soup: the complex world of food waste behaviour. *Resource, Conservation and Recycling*, 79(October):43-51

Ramey, A. (2009). Going green: environmental jobs for scientist and engineers. *Occupational outlook quarterly*. Available : [www.bls.gov.ooh](http://www.bls.gov.ooh), 1-10

Ramukhwatho, F.R., Duplessis, R. & Oelofse, S. (2017). Preliminary drivers associated with household food wastage generated in South Africa. *Applied Environmental Education & communication*, 17(3):254-265. Doi: 10.1080/1533015x,2017.1398690

Ramukhwatho, F.R. (2016). An assessment of the household food waste in a developing country: *A case study of five areas in the City of Tshwane Metropolitan Municipality, Gauteng Province, South Africa*, University of South Africa.

Reilly, R.C. (2013). Found poems, member checking and crises of representation. *The Qualitative Report*, Available: <http://www.nova.edu/ssss/QR/QR18/reilly30.pdf>, 1- 18

Richardson, V. (2003). Constructivist pedagogy. *Teachers college records*, 105(9):1623-1640

Robottom, I.M. (2014). Why not education for the environment? *Australian Journal of Environmental Education*, 30(1):5-8

Rozin, P. (2005). The meaning of food in our lives: Across –cultural perspectives on eating and wellbeing. *Journal of Nutrition Education and Behaviour*, 37(2): S107-S112

Rozin, P. (2014). Psychological basis of food waste behaviour: A paper presented at the last food mile conference. University of Pennsylvania, December 8-9. Philadelphia

Russell, R., Guerry, A.D., Balvanera, P., Gould, R.K., Basurto, X., Chan, K.M.A., Klain, S., Levine, J. & Tam, J. (2013). Humans and nature: how knowing and experiencing nature affect well-being. *Annual Review of Environmental Resources*, 38:473–502. <https://doi.org/10.1146/annurev-environ012312-110838>.

Rutten, M., 2013. What economic theory tells us about the impacts of reducing food losses and/or waste: implications for research, policy and practice. *Agricultural Food Security*, 2: 1–13. <http://dx.doi.org/10.1186/2048-7010-2-13>.

Salomone, R., Saija, G., Mondello, G., Giannetto, A., Fasulo, S. & Savastano, D. (2017). Environmental impact of food waste bioconversion by insects: Application of life cycle assessment to process using *Hermetia illucens*. *Journal of Cleaner Production*, 140:890-905

Schneider, F. & Obersteiner, G. (2007). Food waste in residual waste households-regional and socio economic differences. *Waste management, Elsevier, Viena, Austria*, 27(8)47-57

Schwarz, M. & Bonhatal, J. (2017). School composting-Let's Get Growing: A guide for student leaders and teachers: *Cornell Waste Management Institute*, New York

Scotland, J. (2012). Exploring the philosophical underpinnings of Research: relating ontology and epistemology to the methodology and methods of the scientific, interpretive and critical research paradigm. Qatar University. *Canada Center of Science and Education*

Semerici, C. & Badi, V. (2015). A meta-analysis of constructivist learning approach on learners' academic achievement, retention and attitude. *Journal of Education and Training Studies*, Red Fame Publishing, 3(2):171-176. URL:<http://jets.redfame.com>.

Shan, N.L., Wee, S.T. & Chen, G.K. (2015). Construction contractors' perception on effective 3R implementation for solid waste reduction. *International Journal of Conceptions on Management and Social Sciences* 3(4) 2357-2787

Shenton, A.K. (2004). Strategies for ensuring trustworthiness in qualitative research project: *Education for Information* 22. United Kingdom. IOS Press. 63-72

Sibernagl, P. (2011). What's the composition of your domestic waste stream? Is there value in recycling? In: Macfarlaine, L., Emery, R and Silk, S. *The Waste Revolution Handbook South Africa*, 2:137-141. The guide to sustainable waste management, Cape Town, South Africa: Alive 2 Green

Sims, T. (2012). Green building benefits: school construction. *News*, 15(4):17-20.

Singh, R.P., Singh, P., Araujo, A.S.F., Hakimi-Abraham, M. & Sulaiman, O. (2011). Vermicomposting a sustainable option. *Resource, Conservation and Recycling*, 55(7):719-729. doi:10.1016/j.resource.2011.02.005

Sinha, S., Jangira, N.K. & Das, S. (1985). *Environmental education: module for pre-service training of social science teachers and supervisors for secondary schools*. Paris: UNESCO

Sobal, J. (1999). *Chapter 9: Food system globalization, eating transformations, and nutrition transitions*. In *Food in Global History*. R. Grew, editor. USA, Westview Press  
Spooner, A.M. (2012). *Environmental science for dummies*. Hobekon. New Jersey.

Sreekanth, K.M. & Sahu, D. (2015). Effect of ironoxide nanoparticle in bio digestion of a portable food-waste digester. *Journal of Chemical and Pharmaceutical Research*, 7(9):353-359

Stanton, K. (2015). "The effect of vermicomposting on fruit consumption in the elementary schools lunchroom: A pilot study, Ball State University, Muncie. Cardinal scholar [bsu.edu/bitstream/handle/123456789/199864/stantonk\\_2015-3\\_Body](https://bsu.edu/bitstream/handle/123456789/199864/stantonk_2015-3_Body)

Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A. & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmental concern. *Human Ecology Review*, 6, 81–97

Strasser, S. (1999). *Waste and Want: A Social History of Trash*. Metropolitan Books, New York

Strauss, A. & Corbin, J. (2008). *Basic of qualitative research: Techniques and procedure for developing a grounded theory*. Thousand Oaks, California

Strydom, H.A. & King, N.D. (2009). *Environmental management in South Africa* (2<sup>nd</sup> ed). Cape Town: Juta

Stuckey, H.L. (2013). Three types of interviews: Qualitative research methods in social health. *Journal of Social Health and Diabetes*, 1(2):56-59. <https://doi.org/10.4103/2321-0656.115294>

Swanepoel, S., Knott, G., Nkonki, A., Zondi, L., Ngcwayi, B. & Webster, C. (2011). *Solid waste management, Final Report*, Grahamstown

Tani, S. (2006). Multiple meanings but limited visions: the concepts of the environmental education. In Tani, S. (ed), *Sustainable development through education-proceedings of the international conference on environmental education*. Helsinki, 14 June 2005. *Research report 268*: Department of Applied sciences of education, University of Helsinki, Helsinki

Teng, P.S. & Trethewie, S. (2012). Tackling urban and rural food wastage in southern Asia: Issues and interventions, *Policy Brief*, Singapore.

Terre Blanche, M., Durrheim, K., & Painter, D. (2006). *Research in practice: Applied methods for the social sciences*. Cape Town: UCT Press.

Terrell, S.R. (2012). Mixed methods Research methodology. *The qualitative Report* 17(1):254-280. Available from: <http://www.nova.edu/ssss/QR/OR17-1/terrell.pdf>

Thanh, N.C. & Thanh, T.T.L. (2015). The interconnection between interpretivist paradigm and qualitative methods in education. *American Journal of Educational Science*, 1(2): 24-27

Thyberg, K.L. & Tonjes, D.J. (2016). *Drivers of Food Wastage and their Implications for Sustainable Policy Development*. Technology & Society Faculty Publications. 11. <https://commons.library.stonybrook.edu/techsoc-articles/11>

Tilbury, D. (1995). Environmental education for sustainability: defining the new focus of environmental education in the 1990s. *Environmental Education Research*, 1(2):195-212

Tillery, A.D., Varjas, K., Meyers, J.C. & Collins, A.S. (2010). General education teachers' perception of behaviour management and interventions strategies. *Journal of Positive Behaviour Interventions*, 12(2):86-102.

Tregidga, H. M., & Milne, M. J. (2006). From sustainable management to sustainable development: A longitudinal analysis of a leading New Zealand environmental reporter. *Business Strategy and the Environment*, 15(4), 219–241.

Trochim, W. & Donnelly, J.P. (2006). *Research method knowledge based* (3<sup>rd</sup> Ed). Cengage learning, Atomic Dog

Underwood, H. (2013). Exploring the need for Hands-on, Expert-Taught Environmental Education in Tasmanian formal schools: A survey for greening Australia in Hobart, Tasmania, Independent Study Project collection (ISP), Paper 1748. [digitacollections.sit.edu/cgi/viewcontent.cgi?article=2773 & context=isp-collection](http://digitacollections.sit.edu/cgi/viewcontent.cgi?article=2773&context=isp-collection)

UNESCO, (1978). *Trends in environmental education*, Paris: UNESCO.

Vaismoradi, M., Turunen, H. & Bondas, T. (2013). Content analysis and thematic analysis: Implication for conducting a qualitative descriptive study. *Nursing and Health Sciences*, (15):389-405

Varroto, A. & Spagnolli, A. (2017). Psychological strategies to promote household recycling. A systematic review with meta-analysis of validated field interventions. *Journal of Environmental Psychology*, 51, 168-188

Vidanaarachchi, C.K., Yuen, S.T.S. & Pilapitiya, S. (2006). Municipal solid waste management in the Southern Province of Sri Lanka: Problems, issues and challenges. *Waste Management*, 26:920

Waste and Resources Action Programme (WRAP). (2007). Food Behaviour Consumer. Available from: <http://www.wrap.org.uk/sites/files/wrap/Food%20behaviour%20consumer%20research%20quantitative%20jun%202007.pdf>

WasteMinz. (2014). *National Food Waste Prevention Study*. WasteMinz, Auckland, New Zealand. Available from: <http://www.wasteminz.org.nz/sector-groups/behaviour-change/national-food-waste-prevention-project/>. (Accessed 23 October 2019)

WasteMinz. (2015). *New Zealand Food Waste Audits*. WasteMinz, Auckland, New Zealand. Available from: <http://www.wasteminz.org.nz/sector-groups/behaviour-change/national-food-waste-prevention-project>

Whitley, C.T., Takahashi, B., Zwickle, A., Besley, J.C., Lertpratchya, A.P. (2016). Sustainability behaviors among college students: An application of the VBN theory. *Environmental Education Research*, 24: 245–262

Wichuk, K.M. & McCartney, D. (2007). A review of the effectiveness of current time-

temperature regulations on pathogen inactivation during composting. *Journal for Environmental Engineering Science*, 66:573-586. <https://doi.org/10.1139/507-011>

Wilkie, A.C., Graunuke, R.E. & Cornejo, C. (2015). Food waste auditing in three Florida schools. *Sustainability*, 7:1370-1387, doi:10.3390/su7021370

World Bank (2013). Female headed household (%of households with female head). Demographic and health surveys. The World Bank. Available online at: <http://data.worldbank.org/indicator>

WRAP. (2008). The food we waste: Food waste report v2 online]. Available from: <https://www.nsi.is/ns/upload/files/pdfskrar/matarskyrsla1.pdf> [accessed 15 June 2019]

WRAP. (2009b). *Down the drain: quantification and exploration of food and drink waste disposed of to the sewer by households in the UK*. Banbury, UK. ISBN: 1-84405-431-4.

Yazan, B. (2015). Three approaches to case study methods in Education: Yin, Merriam and Stake. *The qualitative Report*, 20(2):134-152. Retrieved from <https://nsuworks.nova.edu/tqr/vol20/iss2/12>

Yin, R.K. (2002). *Case study research: Design and Methods*. Thousand Oaks: SAGE Publications

Zucconi, F. & Bertodi, M.D. (1987). *Organic waste stabilization throughout composting and its compatibility with agricultural issues*. Retrieved from [agris.fao.org](http://agris.fao.org), 109-137

Zwelibanzi, C.M. (2016). *An investigation into issues and challenges in implementing Environmental Education in special school South Africa*. University of South Africa, Unpublished

## APPENDIX A: ETHICAL CLEARANCE



### UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2019/05/15

Dear Ms Maphaha

**Decision:** Ethics Approval from  
2019/05/15 to 2022/05/15

Ref: **2019/05/15/43081479/08/MC**

Name: Ms MH Maphaha

Student: 43081479

**Researcher(s):** Name: Ms MH Maphaha  
E-mail address: 43081479@mylife.unisa.ac.za  
Telephone: +27 76 022 8093

**Supervisor(s):** Name: Dr N Madikizela-Madiya  
E-mail address: madiyn@unisa.ac.za  
Telephone: +27 12 429 4698

**Title of research:**

**Food waste recycling within the school environment in Vhembe District, Limpopo**

**Qualification:** M. Ed in Science and Technology Education

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2019/05/15 to 2022/05/15.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2019/05/15 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.

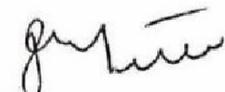
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Preller Street, Muckleneuk Ridge, City of Isthwan  
PO Box 392 UNISA 0003 South Africa  
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150  
www.unisa.ac.za

3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2022/05/17**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

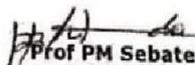
*Note:*

*The reference number **2019/05/15/43081479/08/MC** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,



**Prof AT Motlhabane**  
**CHAIRPERSON: CEDU RERC**  
motlhat@unisa.ac.za



**Prof PM Sebate**  
**ACTING EXECUTIVE DEAN**  
Sebatpm@unisa.ac.za

Approved - decision template – updated 16 Feb 2017

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## APPENDIX B: TURNITIN REPORT

foodwastemanagementforenvironmentaleducationinselected schools within the Vhembe district, Limpopo

## ORIGINALITY REPORT

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30%

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## PRIMARY SOURCES

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Internet Source

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6.7 hdl.handle.net  
Internet Source

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6.8  Submitted to University of South Africa  
Student Paper

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6.9 commons.library.stonybrook.edu  
Internet Source

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6.10 link.springer.com  
Internet Source

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6.11  Submitted to University of KwaZulu-Natal

Student Paper

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6.12 **II** [sustained.org.za](http://sustained.org.za)

Internet Source

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6.13 **EI** [repository.up.ac.za](http://repository.up.ac.za)

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6.14 **II** [www.tandfonline.com](http://www.tandfonline.com)

**II**

