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**2024**

University of the Witwatersrand, Johannesburg

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# Fostering commitment as a tool in environmental education to alleviate littering in rural schools

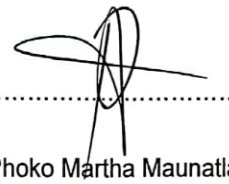
**Phoko Martha Maunatlala**

A dissertation submitted to the Faculty of Humanities, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Education by Research.

Johannesburg,

## Declaration

I, **Phoko Martha Maunatlala**, declare that this dissertation is my own original work except where acknowledged in the text. It is being submitted for the degree of Master of Education in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.



.....

Phoko Martha Maunatlala

Signed on the 27th day of September 2024

## Dedication

I dedicate this dissertation to my family who encouraged me to write and successfully compile it. Moreover, it is through their deepest love, care and support that they showed me that strengthened and compelled me to carry on with the task of writing this study. They are my husband Kgwatle Maunatlala and our children Tshephang, Motlatsi, Matsobane and Lethabo.


## Acknowledgements

Many thanks to my mother, Maselelo Josephine Tau, who devoted herself to prayer whenever I embarked on any level of education. With her blessings, any educational level became easier to achieve.

I am also grateful to my elder sister, Ngwakwana Makhura, who praised me for taking higher education levels, such as a master's degree, which she believes is achieved by few women in South Africa. I am thankful to my younger brother, Mahlodi Tau, for encouraging me to pass and become a role model to the rural girls from Bochum ga Mmalebogo, from which I come. I am also appreciative of my younger sisters, Mosibudi and Nyadi Tau, and my younger brothers, Mosiiwa and Ramosimei Tau, who told me that I would represent the Tau family with my achievement.

I owe a great deal of gratitude to Dr. Paul Goldschagg, who found a sponsor for my research proposal from the outset. I am also thankful to Dr. Thoko Mahlangu for giving me insightful and useful comments and feedback that Dr. Goldschagg provided me.

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**Abbreviations**

| | |
|---|---|
| UN | United Nations |
| UNESCO | United Nations Education for Scientific Cultural Organisation |
| NSNP | National School Nutritional Program |
| GTM | Greater Tzaneen Municipality |
| SASA | South African Schools Act |
| UNEP | United Nations Environmental Program |
| WWF | Worldwide Fund for Nature |
| EE | Environmental Education |
| SDG | Sustainable Development Goals |
| EPWP | Expanded Public Works Program |
| SGB | School Governing Body |
| NGO | Non- Governmental Organisations |
| SUP | Single-Use Plastic |
| ESD | Education for Sustainable Development |

## Glossary

**Anti- littering.** Dhahir (2020) explained anti-littering as an action performed by communities to deviate from the actions of littering.

**Attitude**- is expressed as internal intention inside the individual towards an object that tells origin and preparation of behaviours. In addition, attitude is a complex psychological process composed of emotional, cognitive and behavioural propensity with consistent and persistent traits (Ramdas & Mohamed 2014; Hosseinnezhad 2017; Erhabor & Oviahon, 2018; Liao, 2019).

**Behaviour**- Minton and Khale (2014) termed Behavior (American English) or behaviour (British English) as the range of actions and mannerisms made by individuals, organisms, systems or artificial entities in some environment. They explained further that these systems can include other systems or organisms as well as the inanimate physical environment. Furthermore, it is the computed response of the system or organism to various stimuli or inputs, whether internal or external, conscious or subconscious, covert or overt, and voluntary or involuntary.

**Circular Economy-**. The Ellen MacArthur Foundation (EMF, 2019) defines CE as 'an economic system of closed loops in which raw materials, components and products keep their quality and value for the longest possible and systems are fuelled by the use of renewable energy sources'.

**Commitment**- involves making an individual to oblige or pledge to behavioural acts (Kiesler & Sakumura, 1966). According to these writers, it is our acts that bind us and not our ideas. They claimed that depending on some situations, participants may sometimes feel mostly obliged by their acts they were prompted into execrating. For this reason, they proposed that commitment serves as a bond between people and their actions, and the joint is stronger when an individual performs in a condition that offers freedom of choice than a restricted one. For these authors, when people partake public promise actions, commitment becomes more persuading than using a private where one commits to themselves.

**Educator**- South African Schools Act (1996) stated that an educator means any person, except a person who is assigned to exclusively perform extracurricular duties, who teaches, trains or educates other people or who give professional educational services, including education psychological services and professional therapy at a school.

**Environmental education-** is an elaborated weapon used to cultivate environmental genuine values of students and define the environmental paradigm of the interaction between nature and people and slowly extending the conservation of ecological environment to the changes of political institutions and the entire society (Kim & Song, 2017).

**Knowledge**- Agarwal (2017) said that knowledge is the understanding and awareness of certain aspects of reality, and that there are three conditional requirements of the knowledge approach so that it can be termed as "justified true belief". The first one is justification, as in contrast to believing in something completely as a matter of luck. Secondly, truth, because propositions that are false will not be known, and therefore, he suggested that to count something as knowledge, it must be true. Lastly, belief, because a person cannot know anything that he does not believe in.

**Learner**- the South African Schools Act (1996) suggested that a learner is anyone, including part-time learners receiving education at an independent or public school or learning institution attached to an accredited assessment body.

**Littering-** Ojedokun, Garg and Mashiloane (2015) denote littering as the behaviour in which one improperly or incorrectly disposes of the rubbish.

**Litter-** is defined as any solid waste item misplaced on the ground inappropriately, including trash pieces such as Styrofoam, plastic bottles, candy wrappers, cool drink cans, papers, cigarettes butts, caps and lids, food package and bags (Freije et al., 2019).

**Paris pledge**- is an international agreement adopted by countries to address climate change that requires deeper emissions reduction commitments from all developed and developing countries (United Nations, 2015). The council reflected that countries responsible for 97 percent of global emissions have already pledged their Nationally Determined Contributions (NDCs) for how they will address climate change. These

countries will revisit their current pledges by 2020 and, ideally, strengthen their emissions reduction targets by 2030. According to the council, the agreement contains provisions to hold countries accountable to their commitments and mobilise greater investments to assist developing countries in building low-carbon, climate resilient economies.

**Sustainability** is defined as the capability to remain within the stratospheric ozone. Planetary boundaries of fresh water, biochemical flows and biosphere diversity. Majority of contemporary research has placed focus on understanding the consequences of measures and overshoot of eradications (Bergman et al., 2018).

**Sustainable Development Goals** (SDGs) - are regarded as compilation of 17 intertwined global goals planned to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future" (UN, 2015). These SDGs were launched by the United Nations General Assembly (UN-GA) in 2015 and are intended to be achieved by 2030 (United Nations, 2015). The United Nations stated that SDGs were established in the post-2015 Development Agenda as the future global development framework to replace the Millenniums Development Goals which were faced out in 2015. There are seventeen (17) SDGs, and they are: responsible consumption and production, zero hunger, innovation and infrastructure, no poverty, affordable and clean energy, reduced inequality, decent work and economic growth, good health and well-being, clean water and sanitation, industry, climate action, quality education, life on land, peace, justice and strong institutions, sustainable cities and communities, partnerships for the goals and life below water.

# 1 Chapter 1: Introduction

## 1.1 Introduction

The littering of plastic in rural schools is one of the environmental problems that has been largely overlooked and under-addressed. Even though plastic waste is a significant issue in rural areas, very few attempts have been made to address this issue at a school level. Therefore, this chapter will provide a brief outline of the problems of plastic littering in rural schools, explain its causes and effects, and discuss potential solutions. It will also include a review of existing research on the topic and identify gaps in the existing literature. Finally, the chapter will summarise the objectives of the study and recap how the rest of the study will be structured.

## 1.2 Background

Environmental education involves identifying the current knowledge and practice of learners and how their behaviour contributes to littering. Numerous studies (Nakholi, 2021; Uddin, 2023; Zhang et al., 2024) have noted that learners are not applying what they learn in environmental education, and there are behavioural challenges pertaining to waste disposal in schools, particularly in rural and peri-urban schools.

The impact of littering non-biodegradable plastics has proved to be catastrophic to both terrestrial and marine wildlife if its spread is not curbed. The problem of littering is visible in areas where waste collection is non-existent, such as schools in rural areas. To compound the problem, the rates of plastic recycling in rural areas are extremely low due to the absence of systems that can be used to collect plastics. In most areas, where plastics are not collected, they end up polluting the immediate environment and contaminating river ecosystems, eventually reaching the oceans. To control the littering of plastics in schools and communities, behavioural changes are required, as previous studies across the world (Johannes, Maulana & Herdiansyah., 2021; Kombiok & Jaaga, 2023; Uehara, Asari & Sakurai, 2022) have shown that a variety of behavioural strategies can be used to reduce littering in schools. Learners could play a role in reducing littering in their schools and in the communities at large, which is the focus of this study.

## 1.3 The Research Problem

Research was conducted in two schools with many learners who generate large amounts of non-biodegradable plastics daily. Educators focused more on imparting knowledge about plastic pollution and less on the provision of practical skills on proper waste disposal. This rural school also lacks effective supportive policies to empower educators to encourage learners to dispose of litter properly. The absence of environmental education policy in schools is the biggest challenge. It has shown that educators are ill-equipped with practical skills, strategies, habits and approaches. These tools are needed by educators to help learners to preserve the environment through proper litter management.

## 1.4 The research questions, aims and objectives

This study aims to identify and evaluate approaches and strategies that could lead to better waste management in schools facing plastic littering problems.

### 1.4.1 Research Questions

1. What knowledge and attitudes do learners have towards pro-environmental behaviour?
2. Can commitment encourage pro-environmental behaviour?
3. Does capacitating learners with practical anti-littering skills promote active anti-littering?
4. Can the teachers' level of knowledge and attitude directly influence the knowledge and attitude of school learners?

### 1.4.2 Aim

The dissertation aims to contribute mainly to the preservation of the environment. It also intends to raise awareness about the problems of plastic littering to land and water wildlife. Finally, the study sought to reduce littering in school grounds of a rural environment in Motupa Circuit, Tzaneen, Limpopo Province. This was achieved by using private and public commitment pledges from two groups of learners. This tool served as a means of encouraging them to protect their environment by sorting, reusing, reducing and recycling plastic wastes.

### 1.4.3 Hypothesis

Developing commitment, knowledge, attitudes and practices in pro-environmental behaviour will lead to increased environmental sustainability.

### 1.4.4 Objectives

i. To evaluate the level of knowledge towards environmental problems and concerns among village school learners.
ii. To evaluate the level of knowledge towards environmental problems and concerns among the teachers.
iii. To evaluate the attitude of village school learners and teachers towards proper waste management.
iv. To assess current environmental practices among village school learners.
v. To assess how increased learner knowledge and practical skills can help them to commit to anti-littering.
vi. To evaluate the interaction between teachers' knowledge, attitude and practical skills compared to the learners.

## 1.5 Justification

Littering behaviour is an irresponsible activity (Fenitra et al., 2023) that leads to environmental aggravation globally. One of the best strategies that can be applied to prevent improper waste disposal is the use of policy. Some governments have applied policies strictly as a measure to curb littering behaviour in their countries (Uche, 2023). For example, Rwanda has used strict anti-littering policies and has managed to ban the use, import and sale of plastic, with a jail sentence imposed as punishment for those who are found guilty (Hakuzimana, 2021; Uche, 2023). In South Africa, a policy to ban plastic along with a levy was introduced and implemented for people to reduce plastic consumption (Abiola et al., 2023; South African Government, 2021), yet a single usage of plastic remains high as people and companies do not comply with the policy. Those two law enforcements measures are faced with criticisms (Hanekom, 2020; Muposhi et al., 2022). Hanekom (2020) continued to state that the government is not transparent about the utilisation of large portions of money collected from the plastic shopping bag levy. Therefore, the plastic tax policy is perceived as a ploy used

by the South African government (Hanekom, 2020). Hanekom added that the government might be using the plastic tax money to raise money for other things and not environmental projects. This is because a very little portion of plastic shopping bag tax money is utilised to improve environmental projects. In addition, (Majeed et al., 2022) stated that consumers do not comply with the plastic levy because retail stores are selling reusable shopping bags at a higher price. Poor households might struggle to afford higher prices charged on the reusable shopping bags. For this reason, retailers are also viewed as making profit. The life cycle analysis had proved that many retail stores are not selling eco-friendly products in their stores (Department of Environmental Affairs, 2017). The analysis had proved that retail stores used them as a ploy used to generate profit. In that way, it was impossible to implement the plastic tax policy, and hence single-use plastic continues to be consumed highly in SA. The plastic is used more, and this exacerbates littering.

More single-use plastics are mismanaged in South Africa. The South African government manages the plastic waste by transporting it to the landfill site (Maluleke, 2021). This means that plastic is recycled less in South Africa (Olatayo et al., 2023). The insufficient recycling is due to the variety of plastic products circulating in the market. The other reason is poor waste collection infrastructures in illegal dumps in some provinces. Researchers have noticed that landfill site wastes are posing an environmental challenge in South Africa. When the waste becomes rotten in landfill sites, harmful gases such as methane are emitted into the atmosphere (Manheim et al., 2021). Methane gas traps heat in the atmosphere and rises temperatures. They also showed that heat from the emission of methane gas contributes highly to climate change. Therefore, comprehensive efforts are needed to curb improper disposal of plastic.

This study will contribute to the body of knowledge of environmental education, particularly on how to develop practical habits that will help curb litter. This would also assist in managing waste properly in school environments, thereby using it sustainably.

## 1.6 Layout of the Dissertation

**This section presents the layout of the dissertation.**

**Chapter 1:** This chapter provides a general introduction and motivation of the study. It also poses major questions that the study intends to address.

**Chapter 2**: This chapter provides an overview of the global problem of plastic waste disposal. The main emphasis is on strategies that have been employed across the world to solve the plastic problem. It also brings about background information and review of applicable literature. It also outlines the framework of the study.

**Chapter 3**: This chapter give details on the study methodology and the methods employed to analyse the data.

**Chapter 4**: In this chapter, the problem of waste management in two rural schools in Limpopo Province is investigated. The data are quantified, and responses compared before and after the introduction of the commitment pledges. The chapter also outlines the procedure used by educators to gather, draft and endorse an environmental school policy. The policy was introduced in two schools to enforce reduction, elimination and avoidance of plastic, and to assist learners in signing environmental commitment pledges.

**Chapter 5**: This chapter provides an overall summary of the findings in Chapter 4. It also emphasises the relationship of the key findings to each objective. It provides an assessment of the contributions and the importance of the study to the current knowledge on environmental education and makes recommendations for possible future research.

# 2 Chapter 2: Literature review

## 2.1 Introduction

The chapter introduces plastic as a highly produced and utilised material in the world. It also explains that plastic is a heavily dumped material that causes environmental damage. The chapter explained that the United Nations (UN) stated that the reason for littering is lack of plastic pollution education awareness. The target group that will be educated are identified and the reasons are presented.

The chapter highlights the causes of plastic littering in overpopulated developed and developing countries, including Nigeria. The strategies used by each country to raise plastic pollution awareness to youth and community are shown. The lessons each country has learned about the application of litter policies are discussed. The suggested ways to improve plastic litter management in Nigeria are explained. The lessons that South Africa learned and suggestions for future waste management plans are revealed.

In the chapter, causes of plastic littering in Limpopo Provincial government and policy adopted are elaborated. The causes, measures and failures to reduce plastic in the Greater Tzaneen Local Municipality are clarified. The causes of plastic littering in the villages are discussed. The causes of plastic littering in rural schools are explained. The barriers that hinder educators from implementing environmental education in schools are elaborated. The theoretical framework used to guide the study is explained. Lastly, commitment as an intervention strategy in the study is discussed.

Plastic pollution has become a global, generational, environmental issue, and appears to be worsening annually. Plastic products such as clothing, computers, water pipes, hospital medicine tubes, furniture and kitchen ware intensified dependency on plastic. Although it is a versatile commodity, from its inception to the end of its life, plastic can pose life-threatening consequences to environmental resources and human health (Feng et al., 2023; Gosh et al., 2023). The manufacturing of plastic produces harmful gases and depletes natural resources. Unsustainable disposal after use wreaks havoc to the soil, water, air, plants, people’s health and animals.

The improper disposal of plastic has detrimental effects on the environment, and this affects both developing and developed countries. Raising awareness about unsustainable disposal of plastic in a developing country like South Africa is essential to begin tackling the problem. In this study, which is in South Africa, the targeted location is a school located in a rural area. Mihai et al. (2021) revealed that around the world, rural communities are faced with serious environmental challenges associated with plastic pollution, climate change and loss of biodiversity. Although it is an issue that requires immediate attention, plastic pollution is less studied in rural communities and less focus on this issue (Mihai et al., 2021).

Rural areas are dominated by street vendor businesses and tuckshops selling a variety of goods packed in cheap plastics. These businesses slowly grow the rural economy and lead to people in rural settlements having greater access to cheap plastic packaging materials which compounds littering problems (Mihai et al, 2021; Shaharuddin & Manaf, 2023). To add to the problem, the domestic solutions in rural areas frequently comprise illegal dumping on lands (Du et al., 2021), uncontrolled landfills and wild dumps (Mihai et al., 2021) and open burning practices (Pathak et al, 2023).

The mismanagement of plastic waste in rural areas also contributes to freshwater pollution (Verster & Bouwman, 2020). However, data that covers the problem of plastic pollution on rural lakes and rivers is scarce (Dusaucy et al., 2021). This is because researchers have discovered that enormous amounts of plastic found in rivers and oceans come from developing countries (Meijer et al., 2021). Over 8 million tonnes of plastic were reported entering the ocean each year (Viel et al., 2023; Sharma et al., 2023). The weight of this influx of plastic debris annually entering the ocean is predicted to exceed the weight of fish by 2050 (Paul et al., 2020; Orose et al., 2023).

The perils of plastic waste existing in our seas and oceans are largely because of insufficient provision of education and awareness. Therefore, certain groups of people should be targeted to raise their awareness levels. Various researchers viewed the cultivation of pro-environmental behaviours directed to young individuals in society as crucial (Pearce et al., 2021; Zeiske et al., 2021). Environmental education has been introduced in schools to educate and raise awareness of learners about environmental

protection (Prasetiyo et al., 2020; Verma & Grover, 2021). School subjects that have incorporated environmental protection education include geography (Laaloua, 2023), chemistry (Osunji, 2021), sciences, technology, engineering and mathematics (Matsekoleng et al., 2024; Ratnaningsih et al., 2020). Besides environmental books supplied to rural schools by the government, educators in rural schools require libraries with internet. This will help them to supplement education and enhance awareness of plastic pollution. When libraries are available, educators may have access to media platforms such as magazines, newspapers, internet, TV channels, videos and video games (Fokides & Kefallinou, 2020; Safitri et al., 2021). The government should supply rural schools with computers and internet access for learners to connect to the modern world of information**.**

## 2.2 Production and Usage of Plastic Globally

Globally, plastic production is higher and has reached 400.3 million tonnes in 2022 (Plastics Europe, 2023). According to Plastics Europe, in 2022, the largest producer of plastic was China, which produced 32%. The country that followed was Europe with 28% and North America with 14% respectively. The world ‘s greatest demand for plastic was in packaging, automotive and construction applications (Chen et al., 2021). Amongst the applications, the packaging industry accounted for the greatest market demand in the whole world. The most widely produced and used plastic packaging was polyethylene (PE) (Burelo et al., 2023). Burelo et al. (2023) stated that PE plastic is commonly used in food packaging, PET bottles, shopping plastic bags, to name but few. These types of plastic have a short lifespan and are discarded the same year that they are manufactured (Wamba et al., 2023). People produce and use PE plastics more but reuse and recycle it less (Burelo et al., 2023). This habit of producing, using and recycling PE less poses a challenge to researchers and industries. The biggest challenge is that PE is non- biodegradable. Once used, PE plastics are thrown away inappropriately and the majority are taken to landfill sites. Some PE plastics are carried by wind or land into the seas, rivers and oceans (Burelo et al., 2023). The accumulation of plastic in the water, land and air results in devastating effects on life on earth. Plastics have affected economies of the whole world negatively. Therefore, it is important for the governments, companies, NGOs, educators, communities, including learners to know the effects of plastic pollution. When negative effects are known,

leaders worldwide need to converge and decide on drastic steps to be taken to sustain the environmental resources.

## 2.5 Plastic Problem in the Developed World

The next section discusses various causes of single-use plastic littering in countries with high production and consumption of single-use plastic. The section discusses techniques applied by two developed and two developing countries to mitigate plastic littering. With this discussion, this study sought to investigate how ESD programmes are applied holistically to educate and commit learners and communities to recycle plastic waste. The discussion is also about how the lessons learned from those countries can be applied in South Africa to eliminate plastic debris.

### 2.5.1 United States of America (USA)

U.S Census Bureau project estimated that about 334,233,854 people resided in the USA in 2023 (Moore, 2023). The USA is one of the North American countries with many plastic-producing companies. The plastic-producing companies in the USA produced 18% of the single-use plastic in 2021 (Burelo et al., 2023). The greatest demand for plastic package in the USA was in the food and beverage sector (Heller et al., 2020). In total the sector used over 7.5 billion extruded polystyrene (EPS) packaging items in the USA annually (Gallego-Schmid et al., 2019). Hu et al. (2022) revealed that EPS food packages include plastic cups, straws, Styrofoam packages, shopping bags and water bottles.

The largest consumer of single-use plastic package is fast food outlets such as restaurants. Most of these fast-food outlets used disposable EPS containers to serve their customers (Wagner, 2020). A fast-food outlet is an establishment that serves meals at a lower price point and typically provides fast service, a limited menu and a limited table service (Statista Research Department, 2023). According to Statista, the USA has the most well-established fast-food outlets in the world. Statista also indicated that many popular fast-food restaurants that dominate the global market today originated in the USA.

Lack of alternatives to plastic in the USA was the major cause of littering. Research has shown that the demand for fast food plastic EPS wrappers increased massively in

2020. Sharma et al. (2021) claimed that EPS single-use plastic increased tremendously in 2020 due to the onset of Covid-19 pandemic lockdowns. The lockdown restrictions led USA citizens to look for alternative ways of shopping fast food and other items (Ray et al., 2020). The citizens of USA opted for online shopping platforms to order and purchase their fast food. The fast-food outlets delivered and packaged fast food in single-use EPS plastics (Ray et al., 2020). Dhaka et al. (2022) argued that plastic covers were preferred because they are resistance to heat and cold. The heat resistance characteristic of plastic keeps food warm while the coldness property allows plastic beverages to maintain coldness (Dhaka et al., 2022). For this reason, Wagner (2020) revealed that the food and beverages received in such conditions attracted American citizens to rely more on plastic products. This fast-food store preferred plastic wrappers to prevent the contamination and spread of diseases. The plastics which were used to wrap their food were discarded after usage.

The other organisation that leads to increased single-use plastic was the health sector in 2020. The US Government allowed compulsory usage of SUPs products to prevent the spread of viruses and contamination. The compulsory SUPs included equipment such as gloves, masks, sanitiser bottles, medical dresses and shoes (Silva et al., 2020). Hospitals and clinics use SUPs products. Once used, they are disposed of into dustbins and on the ground.

Attitude and lifestyle of buying fast food instead of cooking led to the rise in plastic littering. Argawal (2022) found that Americans preferred sea food as it protects them from cardio- vascular diseases like stroke and heart attack. Saksena et al. (2018) perceived that people who feed on sea food have a tendency of buying this food instead of cooking it at home. Therefore, the rise in the consumption of sea food from fast food stores increased single-use plastic pollution in the USA (David et al., 2020). According to David et al. (2020), the largest consumption of sea food was found amongst people living in coastal cities, where the travel and tourism industry contributes to pollution of the environment.

Lack of plastic pollution awareness and enough dustbins to tourists left the USA experiencing a high rate of plastic littering. The USA travel and tourism industry is the largest and most competitive industry in terms of attracting international tourists in the

world (Houston, 2024). The popular tourists' destination in the USA are beaches. According to Houston (2024), beaches in the USA attract 3.4 billion tourists annually and contribute large to the USA's economy. When visiting beaches, people carry along fast food covered by plastic packages. When they leave the beaches, some beach visitors do not place their fast-food plastic containers in the dustbin. This plastic debris left on the beaches are carried into the oceans by the winds or rivers (Bolívar-Anillo, 2023). The USA coastal cleanup reported that plastic take away packages was the most commonly items found in the ocean in 2018 (Ocean Conservancy, 2019).

Lack of awareness by learners about the reuse and recycling of plastic increased the littering of plastic. Fast food and beverage packages are consumed and discarded improperly in public schools in the USA. These public schools are also ranked highest amongst institutions that consume and pollute the environment with plastic packaging (National Centre for Education Statistics, 2021). The National Centre for Education Statistics (2021) also reported that 50 million learners attend classes in public schools in the USA. According to Nestor (2021), the huge number of learners in public schools contributed about 14 500 tons of plastic wrapper waste per day.

Lack of political will in the USA was the cause of littering. Plastic production and improper disposal continue to rise because plastic producers did not want to stop the production of single-use products. Plastic producers challenged the regulations of the government in some states to imposed ban of single-use products (SUPs). Maldonado et al. (2020) noted that plastic producers are supported by fourteen states with several legislations that prevent local government from banning SUPs. For this reason, politicians supported the plastic producers (Snyder, 2021) because they rely on their funds to run their political parties. Corkery (2020) reported that politicians who relied on funds from the plastic manufacturers did not accept single-use plastic ban. This increased demands for single-use plastic led to the rise in the improper disposal of plastic in the country.

Plastic pollution in the USA is posing a challenge to the environment. Plastic pollution in water bodies affects the economy, water ecosystem and human health. Pew (2022) found that plastic debris resulted in lower income to the fishing and tourism industries. The National Academies of Science, Engineering and Medicine (NASEM) (2022)

reported that chemicals leaking from plastic impacted the reproductive system of animals. MASEM have also discovered the microplastic beads in the placentas of humans.

The USA government has a way of preventing the adverse impact of plastic pollution in the environment. The study has shown that the USA has a well-maintained waste system (Iverson, 2019) when compared to other countries. When the recycling of plastic is low, the government relies more on information carried by the NGOs. Bennett and Alexandridis (2021) stated that a non-governmental organisation (NGO) called the "Recycling Partnership'' noticed the problem. The NGO found that plastic producers manufactured different types of plastic products. These items were produced fast in a short period of time. Therefore, such regular and rapid changes in plastic products were making it difficult for the recycling facilities to recycle plastic fully (Bennett & Alexandridis, 2021). The rapid changes in the type of plastic products in turn caused confusion amongst the USA people. They ended up not knowing the type of plastic to recycle. Bennett and Alexandridis (2021) stated that recycling education should be provided to increase recycling in the USA and remove confusion between plastic recycling companies and consumers.

EPA is the largest body in the USA responsible for enforcing regulations to strengthen the application of ESD and mitigation of plastic pollution in the USA. Below are measures applied by the USA to reduce plastic production and incorrect disposal of plastic.

#### 2.5.1.1 Break Free from Plastic Pollution Act

The regulation was introduced for the retail stores to encourage the use of eco-friendly products. Snyder (2021) stated that an NGO, 'Break Free from Plastic' proposed a "Break Free from Plastic Act". The act was introduced to minimise plastic littering and promote safe disposal. Snyder reported that the act came up with a plastic levy regulation in retail stores. The collected funds would be used to fund clean-up programmes and to produce reusable bags (Merkley & Lowenthal, 2021). With this regulation, the learners would learn to go shopping with a reusable bag. The funds collected would be used to purchase dustbins in their schools and communities. The plastic levy is also used to fund recycling programmes in the community and schools

(Merkley & Lowenthal, 2021). The law was also established to encourage plastic companies to design and produce sustainable packages. Companies that do not comply with the rule would be held responsible for collecting improperly disposed waste (Snyder, 2021). In that way, plastic would be reduced in the USA.

### 2.3 Effects of Improper Disposal of Plastic on the Environment globally

The following section explains the negative effects of massive consumption, production and inappropriate disposal of plastic on the environment. The sections explain the consequences of improper disposal on the land, water, soil, human health, economy and tourism. It also explains the distress experienced by organisms when plastic is deposited in the water. The section serves to educate learners, educators and the community about the importance of committing to sorting and recycling of plastic.

Research has demonstrated that single-use plastic is found in every region of the world, from the Arctic to the Antarctic. Plastic waste is present in large concentrations in the oceans. It is estimated that over 150 million tonnes are currently circulating in marine waters (Kruse et al., 2023). The presence of plastic in our environment is a major cause of concern for the wellbeing of marine life (Kruse et al., 2023). Population growth and continuous demand of plastic products has led to increased production, consumption and improper disposal of plastic. A study conducted by (Junaid and Gokce, 2024) reflected that the world population is estimated to increase to 9 billion by 2050. Kan et al. (2023) warned that if more people continue with the current pattern of once-off consumption of plastic and production, plastic will reach 86 million metric tonnes by 2050. This will have a devastating consequence on the environment if millions of tonnes are discarded improperly.

Plastic pollution can affect marine life in several ways. Plastic debris can entangle, and choke animals and block their digestive tracts. It can also interfere with their movement and feeding (Tuure et al., 2023). Plastic also acts as a carrier of toxic chemicals, allowing them to enter the food web and accumulate in the tissues of animals. These chemicals can poison the fish, birds and other animals. It can even pass on poison to humans who consume them. In addition to these direct effects, plastic can also have an indirect impact. It can reduce oxygen levels in the water and

block light, affecting the growth and reproduction of plants and animals (Tuure et al., 2023; Vidal et al., 2024).

The detrimental effects of single-use plastic are also experienced by some countries that depend on tourism (Cordova et al., 2021; Mejjad et al., 2023). Plastic pollution can chase away tourists, which negatively affects the economy of the country. Major economic activities along marine shores are responsible for plastic debris that drive away tourists. The beaches of some countries have lost their beauty due to enormous plastic debris covering their surfaces. For example, meditarrenean beach of Morocco and Island of Indonesia were popular with tourists but are no longer preferred tourists' destinations due to plastic pollution (Cordova et al., 2021; Mejjad et al., 2023). The Therefore, the severity of plastic waste has caused these two islands to lose revenue income.

Examples of single-use plastic items that commonly prompt uncleanliness include beverage bottles and food packaging, straws and grocery bags (Kruse et al., 2023). These items are not designed for reuse and are typically discarded in landfills or carried into the rivers and oceans where they can persist for centuries. Rakesh et al. (2021) added that these items can break down into microplastics which eventually become consumed by the marine organisms and cause further environmental damage.

The human health impact of single-use plastic pollution is also of significant concern (Coffin et al., 2021; De-la-Torre, 2020; Rubio et al., 2020). The plastic lying in the marine ecosystem for years can start to shed away toxic chemicals that can accumulate in the body of animals and humans who feed on them, leading to health risks, including cancer, reproductive issues, impaired growth and development (Kruse et al., 2023).

Studies have also shown that single-use plastics give off excessive amounts of greenhouse gases during their manufacturing. The release of greenhouse gases into the atmosphere traps heat. The heat causes temperatures to rise, which contributes to global warming, leading to changes in climate patterns. In addition, the production of single-use plastic items demands large amounts of energy (Kruse et al., 2023,

Marczak, 2022). The energy is derived mostly from fossil fuel, which accelerates the climate change crisis.

The issue of plastic which causes problems with flooding has also been of great concern. When plastic is littered irresponsibly, it can block drains, which results in floods. The floods in cities of India occurring during monsoon seasons are mostly due to plastic litter blocking the drains (Upadhyay & Bajpai, 2023; Yadav et al., 2022).

Incorrect disposal of single-use plastic is an extensive environmental concern. This is due to the negative effects of plastic on species living in water or on land and the life of the people. Current research has revealed that single-use plastic items are generally sources of pollution, while their production and improper wastage influence climate change and the leaking of dangerous chemicals into the ecosystems. The key to reducing plastic pollution and its impact is to educate the community and youth to recycle it.

## 2.4 Education for Sustainability of Plastic

The next section explains that massive production, consumption and disposal of plastic would be solved by education for sustainability. This section explains that ESD was adopted by world leaders in the UN Conference and passed to UNESCO to lead its implementation worldwide. The section revealed that ESD that would be employed by the world governments applies to companies, retailers and NGOs, including learners in schools.

The world is grappling with the pressing issue of high consumption, production of plastic and improper disposal. The younger generation will bear the brunt of its effects in future. A universal deal was the only solution necessary to resolve the plastic waste issue. For this reason, the leaders of the world agreed on education that would sustain the environment. On the 25$^{th}$ to 27$^{th}$ of September 2015, world leaders adopted Agenda 2030 for sustainable development with 17 goals and 169 targets (UNESCO, 2017). Agenda 2030 was signed at the United Nations Conference held in New York. In the Agenda, education was proposed to be a vehicle that would help to achieve 17 goals of sustainable development. According to UNESCO (2017), the

world needed urgent action against challenges of plastic pollution, production and consumption. The duty of implementing and reaching sustainable goals in 2030 was placed in the hands of United Nations Educational Scientific and Cultural Organisation (UNESCO, 2017), which is the United Nations`s specialised agency for education. The Agency was entrusted by the United Nations to lead and coordinate Agenda 2030 Education for sustainability (UNESCO, 2017). The goal that binds UNESCO was goal 4, which “ensure[s] inclusive and equitable quality education and promote[s] lifelong learning opportunities for all.” In response to the commitment made in the conference about education for sustainability, UNESCO dignitaries signed an Incheon declaration. The declaration was a commitment pledge towards the implementation of education for sustainability which is equal and inclusive to everyone. The pledge to implement education for sustainability was signed on the 21st of May 2015 at the World Education Forum held in the Republic of Korea.

The goal that aligned with the call to increase education on sustainable use and reduce the production of plastic was goal 12 of Agenda 2030, which is designed to “ensure sustainable consumption and production patterns.” According to UNESCO, all stakeholders, businesses, institutions, governments, NGOs and civilians are requested to live a sustainable life. UNESCO stated that the first giant step should be taken by governments worldwide. The governments are tasked with ensuring that informal and formal education is transformed to education for sustainability. This is because target 12.8 of goal 12 mandated UNESCO to “ensure that people everywhere have relevant information and awareness for sustainable development and lifestyles in harmony with nature by 2030.” This mandate led UNESCO to inform the governments around the world to take ownership by enforcing policies and regulations that would reduce plastic waste. Their policies and regulations are needed to promote circular economy practices to achieve goal 12 and target 12.8. Promoting the circular economy involves designing eco-friendly packages by companies. UNESCO added that the circular economy transition involves the reuse, reduce and recycle to minimise plastic waste by civilians. In this way, plastic pollution will be reduced and goal 12 will be achieved in any country.

The younger generation are at the top of Agenda 2030. The heads of states also signed for a goal that calls for the youth in schools to act against plastic consumption and production (UNESCO, 2017). The younger generation are topping the agenda

so that they do not bear the brunt of the negative effects of plastic pollution such as climate change, depletion of natural resources and loss of biodiversity. In response to the call, UNESCO suggested the infusion of sustainable development topics in the school curriculum. This is because educators were trusted to provide learners with knowledge, skills, values and attitude to achieve sustainable development lifestyles. Target 4.7 of goal 4 stated that educators should ensure that youth in schools are transformed to use and produce plastic sustainably. The target provided that “by 2030, ensure that all learners acquire knowledge and skill needed to promote sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, appreciation of cultural diversity and culture’s contribution to sustainable development.’’ For this reason, UNESCO (2017) mentioned that ESD is a broad interdisciplinary, transformational and holistic education philosophy meant to cater for pedagogy, learning content and outcomes, and the learning environment. For this reason, educators would not only concentrate on teaching sustainable practices but also on skills to perform practices. Wahyuding and Malik (2019) and Uddin (2024) added that ESD was initiated to enable learners to participate in sustainable practices.

Education for Sustainable Development (ESD) and Environmental Education (EE) are confusing when they are used together. Müller et al. (2021) define Education ESD as an educational programme that empowers learners to think and act for the future. It also enables everyone to understand the effects of their own actions on the world and to make responsible decisions. To clarify ESD and EE, (Uddin, 2023) considered environmental education as education that cultivates learners’ proper environmental value in the interaction between people and nature. Uddin (2023) added that EE would gradually expand conservation of the environment from schools to the communities to change the entire society.

ESD needs collective efforts to deal with the issue of improper disposal of plastic and is regarded as a whole school approach requiring collaboration between learners, educators, NGOs, government and companies (Parry & Metzger, 2023). Parry and Metzger (2023) showed that such partnership is required on an ongoing basis. In this way, ESD would raise awareness and create responsible behaviour in learners. It will also preserve the environment and promote sustainable development in communities (Uddin, 2023).

In conclusion, UNESCO requires NGOs, companies and environmental specialists to initiate community projects and educate people about plastic pollution and its impact. The partnerships would also educate communities to practice separation, reuse and recycle plastic. In schools, education about plastic pollution and its impact would be provided by educators, who are also required to teach learners to sort, reuse and reduce plastic. The partnerships are recommended by NGOs and companies to provide expert knowledge to educators and learners. UNESCO requires the state to formulate policies aimed at monitoring compliance with the production of environmental-friendly packages. The policies are also required to monitor compliance with the reuse, reduction and recycling by the communities and learners in schools.

### 2.5.2 Plastic Problem in Germany

Germany is the most populous country in the European Union states (Lorang et al., 2022). According to Federal Statistical Office (Statistiches Bundesamt, 2023), in 2023 Germany was projected to have 84.5 million people. The number of school children in elementary schools in Germany was roughly 2.9 million (Davies, 2023). Germany is a home to the world ‘s cleanest tap water pumped from the snow melt and clean lakes (Valavanidis, 2020). It is also the largest plastic-producing country in Europe (Chen & Tan, 2021). Lorang et al. (2022) found that European Union states (EU) generated 15.4 million tonnes of plastic package waste. These states had an average of 34.3 kg per capita in 2019. Germany was ranked the highest amongst those European states that produced more plastic waste. The plastic wasted generation rate was about 39 kg per capita in 2019 (Lorang et al., 2022).

Awareness from the media stimulated attitude towards the use of plastic. Research has found that PET bottle was the most consumed plastic package in Germany. This came after a water company advertised hygiene of their water stored in PET bottles. Valavanidis (2020) argued that hygiene advertisement turned Germany residents to prefer water packed in bottles than tap water.

Research found that Germans developed negative perceptions about the smell and taste of tap water. They were perceiving bottled water as healthier and safer to drink

than tap water coming from old pipes (Valavanidis, 2020). The plastic bottle manufacturers fuelled citizens to develop negative attitudes towards tap water. According to Valavanidis (2020), they claimed that the source of their water is natural and exotic mountain springs with superior qualities. In addition, they advertised that spring water contains trace elements like Magnesium, Calcium, Sodium and Potassium. People are not aware that companies used the same tap water to fill their bottles (Valavandis, 2020). Valavandis argued that light odour of chlorine and taste in the tap water is authorised for microbial disinfection. Due to that smell and taste, people in Germany consumed more plastic bottles that pollute the environment.

Lack of plastic pollution education to tourists caused plastic pollution. Tourism was also one of the leading consumers of SUP that causes plastic leaking in the water environments. Lorang et al. (2022) found that German people are wealthy and spend their tourist destination in cruise ship journeys. The Cruise market represents about 41% of the active river cruise in Europe (van Klink, 2022). The passengers of the cruise ship carried food contained in plastic. These passengers dumped their used plastics into the rivers from cruise ships (van Klink (2022). He also found that the disposal of plastic from cruise ships could be compelled by lack of enough dustbins in the ships. Therefore, the cruise industry needs to educate the customers to place their waste into the dustbin.

Littering in German schools has subsided due to partnerships between schools and NGOs. About 23000 learners are served with plant base food during lunch (United Nations, 2019). Two organisations have partnered with schools to serve learners with plant base meal. They are Aktion Pflanzen power (Plant-Powered Pupils) and KEEKS (Climate and Energy Efficient Kitchens in schools). The two projects are run by a partnership between vegan non-profit organisation ProVeg international and IZT (Institute for future studies and Technology Assessment). The organisations educate learners in schools to prepare sustainable food and train chefs to cook sustainable food in the school canteen. The organisations claimed that serving learners with plant base lunch reduces weekly carbon footprint by 1,076, 400 kg. The NGOs further stated that promoting energy efficient behaviours in school canteens and climate inefficient food reduced greenhouse gases by 40 per cent.

Germany is committed to ensure sustainable consumption and production in schools and that the community achieves 2030 Agenda. This is due to regulations employed to reduce plastic littering discussed below:

#### 2.5.2.1 Right2Water Campaign

The German government is supported by initiatives from NGOs for proper consumptions and disposals of SUPs. These NGOs play a role in educating people about the hygiene of tap water and the health impact of plastic. The organisations in Germany (Valavanidis, 2020) raised awareness to communities, educators and learners to change their attitudes towards safe tap municipal water. Valavanidis (2020) highlighted that the European Federation of Public Service Union, NGOs, public water companies and water activists in Europe came up with the “Right2Water” campaign. The main aim of the campaign was to shift civilian focus from bottled water and promote the use of tap drinking water. The campaign also aimed to raise awareness and reduce the consumption of plastic bottle from polluting the environment (Valavanidis, 2020).

#### 2.5.2.2 German Package Ordinance (Extended Producer Responsibility (EPR) and Deposit Refund System

Germany has a functional system that holds companies that produce single-use plastic product to collect them when they are disposed of improperly. The German Package Ordinance came into effect in 1991 as the first EPR policy in the country's legislature. The preliminary EPR scheme forced plastic producers to cleanup SUPs if people litter them on the ground (Cowan, 2020). Cowan added that manufacturers produced eco-friendly packaging because the Ordinance provided them with funds.

With this regulation, Deposit-refund-system company was initiated in 2005 to buy back PET bottles (Žmark & Hartmann, 2017). The company placed machine in retail stores less than 200 $m^2$ around the country to collect PET bottles, including schools. In return, the customers got a 25-cent cash money. The company placed an identification logo to show educators, learners and the community that they are returned for cash money. The system made Germany to recycle 97.2% of the PET bottles and diverted it to a landfill site.

#### 2.5.1.1 Packaging and Packaging Waste Directive 94/62/EC

This is a legislation that introduced plastic package ban. Wurm et al (2020) stated that the European Commission established the Packaging and Packaging Waste Directive 94/62/EC in 1994 to ban single-use plastic packaging. According to Wurm et al. (2020), the ban applied to single-use plastic packaging products found in the sea such as straws, cutleries, cotton buds and fishing gears. These EU regulations were also proposed to encourage the active involvement of industries, companies and consumers (Wurm et al., 2020). With this law, companies that produce plastic were forced to design reusable plastics.

#### 2.5.1.2 Green Dot System

The system was initiated to encourage educators, learners and the community to sort waste at source. The separated waste is collected by PRO at their doorsteps for free to the recycling companies. The civilians are given yellow plastic bags to place their plastic waste. The residents pay fine penalty if they did not sort the waste properly. The manufacturers pay a fee to the PRO for their waste material to be collected at the residential areas, including schools. The fee allows manufacturers to place a green dot label on their products. The PRO only collects the waste materials that have this green dot label when they are collecting waste from the community. This allows the residents to purchase this product because they can be sorted and collected at their doorstep. The method in return reduces littering and encourages recycling. Ramasubramanian et al. (2023) stated that the Green Dot System (DOS) initiative is run by an NGO called Duales System Deutschland (DSD). The DOS is the largest Producer Responsible Organisation (PRO) in Germany comprising 60 DOSs representing over 90% of plastic package producers (Ramasubramanian et al., 2023). The Green Dot system covers and recycles all kinds of packaging, including glass, cardboard, plastic and metal. Through the system, Germany has managed to enhance recycling waste packages.

Ramasubramanian et al. (2023) reported that 94% of all packaging that was placed on the German market in 2019 were collected for recycling, and over 71% of those packaging was recycled. For that reason, Germans are able to reduce littering using circular economy principles.

#### 2.5.1.3 Circular Economy Principles (CE)




Figure 2. 1 Diagram of Waste management structure (Adapted from DEF, 2017)

Circular economy principles help learners, educators and communities to learn about reusing and recycling products to save the environment. Waste management hierarchy is represented in figure 2.2 above. The system allowed them to keep the product for a long period of time and from becoming a waste. Waste management is controlled by a hierarchy of strategies that emphasise different steps of managing solid wastes (Ramasubramanian et al., 2023). Ramasubramanian et al. (2023) stated that communication between manufacturer, consumer and producer is necessary. This is because it reduces the production of plastic wastes and is considered the first step in a hierarchy of strategies to mitigate plastic waste. Reusing products is the next step in a hierarchy (Ramasubramanian et al., 2023) that requires less energy because the single-use plastic would be replaced by reusable items. The crucial hierarchical step is recycling as it deals with solid wastes and their diversion to landfills Ramasubramanian et al. (2023) has indicated that the next step in the hierarchy is recovery, which includes energy recovery, microbial degradation and incineration. In the final step of disposal, materials are discarded without trying to recover energy and is typically achieved through landfilling and incineration. Through the circular economy and principles such as recycling and reusing, Germany succeeded in reducing littering of plastic packages.

#### 2.5.1.4 Lessons Learned in Germany

Germany is using various strategies to curb people from littering fast food and PET plastic improperly. The government introduced a ban on single-use plastic to reduce littering. In that way, people are compelled to use reusable and recyclable products. Partnership between organisations is important in raising awareness about plastic consumption and littering. The collaboration also assists in changing negative attitudes of people. In Germany, various organisations collaborated in one campaign to educate and raise awareness about plastic packages. This was found when people had a positive attitude towards plastic bottle packaging instead of tap water. The campaign educated people about plastic pollution and disposal. The government funded the companies to design sustainable products and reduce plastic bottle packaging. This was achieved by using the EPR scheme, which initiated Deposit Refund Scheme in the whole country, including schools. The scheme reduced littering of PET bottles and encouraged recycling of food waste materials. The PRO in Germany also played a major role in reducing plastic littering. They introduced Green Dot label to the companies for their material waste to be collected and recycled. The Green Dots PRO is playing a crucial role in decreasing the littering of plastic. The system encouraged sorting of plastics and recycling amongst young and olds. The system-imposed penalty to residents when wastes are not separated properly encourages people, including learners to recycle waste. The EPR and Green Dots assisted the people of Germany in maintaining sorting and recycling of plastic wastes for years. Through EPR funding from the government, companies were able to create environmental-friendly products. This assists the country to recycle the products. Although EPR can reduce plastic littering of PET, it needs a lot of money from the government. Therefore, poor countries would fail due to lack of funding companies. The measures applied in Germany increases recycling. Incineration and landfilling are last resorts to reduce waste in Germany. The country has adopted a circular economy where wastes are reduced, reused, recycled and recovered before they reach these landfill facilities. This measure reduces littering and saves environmental resources.

#### 2.5.2.3 Education

By visiting NGOs or using NGOs online platform, educators, learners and communities learn about reduce, reuse and recycle procedures. Keep America Beautiful is a non-profit organisation that specialises in educating and promoting recycling to keep America clean. Bennet and Alexandridis (2021) stated that the organisation runs websites that teach people and plastic recycling companies to improve plastic recycling. The organisation published articles such as “How to Recycle” and the “Recycling Journey” to serve as education tools. The How to Recycle article teaches people about the type of plastic to recycle and the way it can be recycled. The Recycling Journey article teaches people the steps a plastic product undergoes to become a new product. The online education was initiated to help learners to educate their friends and families to recycle plastic and reduce littering.

To reduce plastic pollution in USA schools, Keep America Beautiful in partnership with Keep Huto Beautiful Foundation conducts recycling competitions. The competition called Recycle- Bowl programmes encouraged learners to collect and recycle plastic in schools (Keep Hutto Beautiful, 2023). The competitions allowed the learners to collect and recycle plastic according to grades to reward the most recycling grade. In the communities every year, Keep America Beautiful introduced an initiative called Keep America Beautiful campaign. The campaign was held each year on the 15$^{th}$ of November. The communities on that day clean streets, pick-up waste, plant trees and recycle wastes (Keep America Beautiful, 2023).

#### 2.5.2.4 Ocean Clean Up and Beach Clean Up

In the coastal areas, the government introduced programmes to remove plastic in the oceans to save water plants and animals. The USA has taken an initiative to extract plastic debris to save coastal water bodies. Singh and Devi (2019) reported that between California and Hawaii, the government installed a 20-million-dollar ocean clean-up system. They added that the system is made up of 600-meter-long floater above surface of water with a 3-meter-deep skirt below the water. The floating part aids the system to hang up above the surface of water to collect plastic debris. The skirt part helps to collect and prevent plastics from escaping to another area (Singh & Devi, 2019). They stated further that the system was successful in capturing plastic floating above and below water and is projected to capture 50% of plastic within the

next 5 years. This programme raises awareness to educators to teach learners about plastic pollution and save disposal. The communities would be encouraged to recycle and practice proper waste disposal to save the environment.

Besides the government, the coastal areas have organisations that help people to remove plastic and other waste in their beaches. Ocean Clean Up organisation “Beach Sweeps” was one of the organisations joined by 8000 volunteers to clean beaches in New Jersey in 2022 (Clean Ocean Action, 2023). In that way, beaches were cleaned for local people to gain income through tourism.

#### 2.5.2.5 Engineering Technology

The government supports research programmes initiated in higher education learning institutions. In the USA, scientists collaborated to help to reduce the PET plastic in the environment (Singh & Devi, 2019). Singh and Devi (2019) have revealed that a group of scientists from the United States, the United Kingdom and Brazil collaborated in the USA to use technology to engineer an enzyme called PETase. This enzyme was created to digest Polyethylene Terephthalates (PET) plastic products so that they can be converted into useful products.

#### 2.5.2.6 Circular Economy (CE)

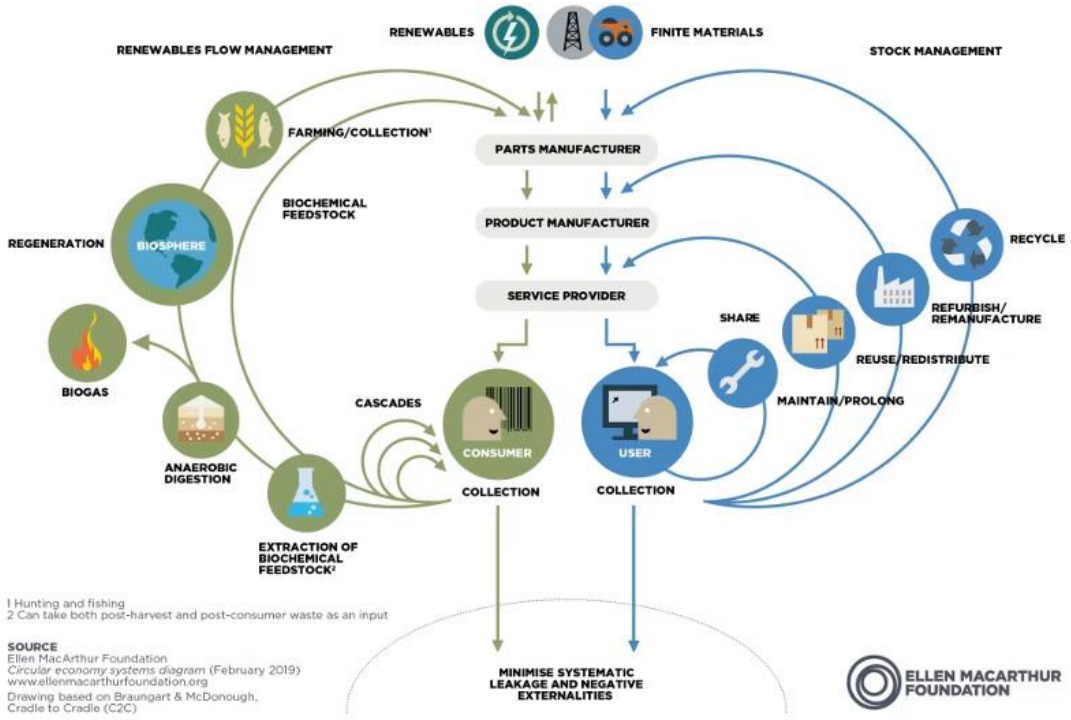



Figure 2. 2 Diagram of circular economy (Ellen MacArthur Foundation, 2022)

The USA has adopted the innovative approach of the circular economy from the non-profit foundation to encourage American citizens to recycle plastic. The model is useful to schools for educators to teach about reusing and recycling plastic products. It would help learners to buy products that are recyclable. The approach helps communities and schools to stop littering plastic and divert it to landfill sites. Ellen MacArthur Foundation describes Circular Economy as a system that is concerned about eradicating waste, allowing the products to circulate and rebuild nature (Ellen MacArthur Foundation, 2022). The Foundation reported that the diagram above is divided into two-sided cycles, the right and the left side cycle. The left cycle is regarded as biological, and the right cycle is a technical cycle side. The biological cycle shows the processes that return nutrients to the soil for the nature to regenerate. The Foundation revealed that the biological cycle has five principles of circular economy. The regeneration is regarded as a principle where farming practices that help the nature to rebuild the soil are employed. With the Farming principle, food that is harvested and consumed is collected and returned to the soil through composting and anaerobic respiration. With composting, the material is broken down in the presence of oxygen. In contrast, anaerobic respiration breaks down material waste in the absence of oxygen. Composting and anaerobic respiration turns material into compost and releases gas such as methane and carbon dioxide. The gases produced can be

used as a source of energy required in the circular economy. In the cascade principle, the food waste is used to make other products such as textile. The extraction of biochemical feedstock principle involves using biorefinery to produce chemical products.

According to Ellen MacArthur Foundation, the technical cycle shows steps of using a product without turning it into a waste. The cycle has five principles of circular economy. The sharing principle indicates that when a product is no longer useful, it can be shared with others. The maintaining principle shows that a product needs to be maintained to prevent it from wearing away. With the reusing principle, the product is reused to protect it from becoming a waste. The explanation of redistribution principle indicates that a product needs to be diverted from intended market to another. In that way, it cannot become a waste but used by another person. The Foundation regarded the refurbish principle as a principle that requires the product to be repaired to return it to good working order. In the remanufacturing principle, the product is re-engineered to a new condition to be reused. The recycling principle refers to the product which is no longer to be turned into a new product that can be used.

#### 2.5.1.6 Lessons learned in the USA

The USA has NGOs that provide waste management education and awareness to learners, educators and the communities who do not know the type of plastic to recycle. The NGO like Keep America Clean provides education on various forms of plastic that are present in the market. In that way, circular economy principles such as reduce, reuse and recycle policy are encouraged in schools and in the communities. The plastic tax or levy in the USA encourages learners to use reusable shopping bags. The educators are encouraged in schools to teach about reusable shopping bags to reduce plastic consumption. The money collected from plastic is used to support their recycling programmes in the community and schools. The USA has realised that littering is high in coastal areas, and modern technology would help in removing most of the plastic deposited into the ocean. For this reason, the USA invested 20 million dollars for five years to remove plastic items using the technological system. The plastic which are extracted from the oceans help learners and educators to raise awareness about plastic pollution. In the coastal areas of the USA, NGOs involve individuals to clean beaches and streets of the country. Lastly, the USA has a group

of research scientists that engineered an enzyme that can digest PET plastic. In that way, PET plastics can be recycled. This study will help science students in schools to follow a career in plastic recycling research.

## 2.6 Plastic Problem in Developing countries

### 2.6.1 Plastic Problem in India

India is also the most populated country in the world with a population estimated at 1.44 billion in 2024 (Worldometer, 2024). Statista reported that plastic consumption in India was 20.9 million tonnes in 2021 (Jagangmohan, 2023). According to Statista, in India, over 200 million learners enrolled in school in 2022 (Rathore, 2022). Statista showed that in terms of per capita plastic consumption and per person, India reached 21 kg. India is also the largest producer of plastic. The food packaging like in developed countries is the most used plastic in India.

The attitude towards traditional food packaging drove the Indian community to utilise more plastic package. The lifestyle changes also contributed to high usage of single-use packaging. According to Kora (2019), Indian people have adopted western cultural food packaging and turned away from their ancient cultural food packaging practices. This transition to western culture has increased plastic pollution in India. Traditionally, Indian people were collecting leaves of plants from the forest to make cups and plates (Kora, 2019). The plates and cups were used to serve food during religious festivals, community feastings and marriage ceremonies. Kora (2019) stated that Indians were using leaves to wrap food when grilling, frying and steam cooking. These long- standing traditions are still practiced in some parts of India (Kora, 2019). The high consumption of plastic showed that the majority are using single-use plastic.

Lack of awareness about the danger of plastic pollution and impact led Indians to produce single-use plastic packaging. Kora (2019) reported that Indians were not using plastic items, rather, they were excavating a talc, soft non-porous rock called Soapstone to make cups, containers, pots and plates. The soapstone items (Kora, 2019) were used to cook gravies, and store and preserve milk curd, buttermilk and rock salt. The soapstone items are still utilised in some parts of India (Kora, 2019). These two traditional packages, the soapstone and leaves need to be promoted in India to reduce plastic pollution.

Urbanisation and wealth led Indians to use large amounts of fast food contained in SUPs materials. Plastic packaging in India is extensively used by people who migrated to urban areas (Das et al., 2020). Wealth changed the standard of living of people in urban areas to afford fishing boats, fishing gears and nets (Das et al., 2020). According to Das et al. (2020), when visiting places such as seas or oceans, Indian people carry with them food and drinks packed in single-use plastic, including water bottles, plastic plates, straws, plastic cups and shampoo (Das et al., 2020). These items are often left lying on the shores and into the water. Therefore, the government needs to impose strict laws and regulation to reduce littering.

Tourism is also a contributing factor of littering in the beaches and rivers of India. Polluted rivers and beaches often chase away the scenic beauty of the beach and river. This in turn drove away tourists and loss of revenue of the country. The Ganges River was once popularly known as the holiest and iconic river in India; but now it is flooded with plastic pollution (Wahyudin & Malik, 2019). The river used to attract religious tourists, but pollution chased them away. Wahyudin and Malik stated that plastic debris poses danger to species of Dolphins that survive in the river. This calls for the Indian government to arrange a clean-up programme to remove plastic debris. The removal of plastic would save lives of Dolphins and attract tourists.

Tourism and fishing are also leading causes of plastic pollution in the ocean. Research has found that plastic products in the Indian Ocean are caused by tourism. Tourists have a habit of dumping plastic products inside and outside of the Indian Ocean (Das et al., 2020). Tourists in fishing boats and ships enjoy their leisure time fishing or diving with plastic gear in the oceans. The fishing tourists use fishing nets to catch and draw fish with large plastic nets into their boats (Das et al., 2020). These activities lead to loss of fishing gears and plastic products into or outside the ocean. A study by Robin et al. (2023) has confirmed that coastal water is filled with plastic items from shipping, fishing and tourism activities. Plastic litter education is needed to tourists to teach them to learn to dump plastic items in dustbins.

Littering in Indian schools is high. This is because learners lack knowledge of segregating waste, and this increases the disposal of plastic waste in schools. A study by Khanam et al. (2019) showed that learners have knowledge of plastic pollution that they received on television. Even though they have high knowledge of plastic pollution,

the main method of disposing plastic were open dump space, burning and throwing into the drains. This implies that schools in India do not practice proper waste disposal methods. Khanam et al. (2019) reported that these methods pose danger to the health of learners. The smoke releases into the atmosphere carry dangerous gases that learners may inhale, leading to respiratory system problems. Therefore, in India, schools contribute to littering of plastic waste. The burning of plastic put learners at risk of respiratory diseases like asthma. The open dump attracts mosquitoes and malaria diseases.

Natural disasters also play a role in sweeping littered plastic into the Indian Ocean. A study by Mugilarasan et al. (2021) has observed that more and more plastic debris are accumulating in the Indian Ocean. Those plastic debris were carried by monsoon floods from inland landfill sites and open dumping into the Indian Ocean (Das et al., 2020). The rivers of India were also affected by monsoon floods. As a result of monsoon floods, rivers of India were ranked the top 20 most plastic polluting rivers in Asia.

Various measures were taken by the Indian government to reduce plastic littering.

#### 2.6.1.1 Clean Up Campaign

The Prime Minister leads by example by participating in clean-up campaigns. This behaviour encouraged educators, learners and the society to volunteer in clean-up campaigns. The Prime Minister of India has used the clean- up campaign to remove plastic in the Ganges River. The campaign was used to raise awareness about the danger of plastic in tourist destination areas. With this campaign, people learned that to attract tourists to the once sacred river, they should dispose of plastic. The Minister invited every member of the society, including learners to the clean-up programme. The Prime Minister, Narendra Modi, initiated the ‘’Beat Plastic Pollution’ campaign and ‘’Plastic Free program’’ during the World Environment Day in 2018 (Wahyudin & Malik, 2019). The two campaigns involved cleaning up the Ganges River, beaches and lakes. In addition, Wahyudin and Malik said that the Minister passed the message to schools across the country to go plastic-free. The Minister also initiated the Good Green Deeds campaign to encourage people to use recyclable cloth bags, paper bags and biodegradable plastics (Robin et al., 2023). Wahyudin and Malik indicated further that the team that cleaned the Ganges River and the participating schools were awarded

certificates, which encouraged them to reuse and recycle plastic to protect natural resources.

#### 2.6.1.2 Radio Program

The Prime Minister also educated civilians about plastic education and recycling and used litter education to increase the knowledge of people about the importance of recycling. The Minister emphasised the cleaning up of heavy polluted areas to protect human health. The NGOs were also encouraged to raise awareness about recycling and reusing the plastic. Robin et al. (2023) stated that the Prime Minister runs a radio programme called ‘’Mann ki Baat’’ to reach a wider audience and educate people about improper disposal and recycle. In the programme, the Prime Minister also expressed appreciation to those who participated in clean- ups of the river voluntarily. The awareness was raised because through a talk show, NGOs started to reuse plastic to make pouches and carpets (Robin et al., 2023).

#### 2.6.1.3GreenWave’s Environmental Solutions

Partnerships in India helped to raise awareness about the danger of using plastics when visiting beaches. They also raised awareness about bringing plastic gears to the divers. The fishing industry employees were also educated about the impact of fishing lines left in the seas and oceans. The NGOs play a vital role in India in raising awareness about plastic pollution and recycling. NGOs in India played an important role in demonstrating the recycling of fishing gear littered in the marine environment. GreenWave’s Environmental Solutions (NGO) collaborated with the World Wildlife Fund to initiate the ‘Ghost Gear Upcycling’ recycling programme in 2021 in India (Robin et al., 2023). Through the project, fishing nets were converted into products such as pouches, doormat, bracelets and pots.

#### 2.6.1.4 DSM Engineering Materials

Companies also take part in raising awareness about marine plastic pollution in India. The company also helped to demonstrate to the learners the recycling of fishing gear where educators and learners learn about the impact of plastic on marine species. The fishing gear education helped to recycle plastic and to protect the water environment. DSM Engineering Material collected ‘ghost fishing nets’ from the sea and recycled them into surfboards (Robin et al., 2023). Robin et al. (2023) have indicated that the

company has already used 6000 tonnes of ‘ghost nets’ and is estimated to process about 2000 tonnes of these nets annually.

#### 2.6.1.5 Trash booms

The government also played a role in raising awareness of plastic consumption and disposal. The learners and educators would learn about the importance of reducing plastic products and recycling. According to Nikiema et al. (2020), a trash boom is a floating layer of logs hinged together with stainless steel connectors. These trash boom techniques are installed in a river to intercept waste from being carried from one area to another (Nikiema et al., 2020). The government of Tamil Nadu in India has taken drastic steps to stop plastic pollution in the Greater Chennai Corporation (Robin et al., 2023). It installed trash booms technology (Robin et al., 2023) in urban rivers such as the Adyar and Cooum. The main purpose of trash booms was to prevent plastic and other garbage from entering the sea. Overall, 23 000 million tonnes of garbage was curbed from reaching the Bay of Bengal from the mentioned rivers (Robin et al., 2023).

#### 2.6.1.6 Lesson Learned from India

The educators, learners and the society are involved in clean-up campaigns during earth day. They were empowered to continue with the clean-up campaigns to rebuild tourists’ destination areas. This would in turn bring back tourists and increase income to the community. The Prime Minister managed to clean the river which was heavily polluted for many years. A mass clean-up campaign was used to involve learners and the community in cleaning up the Ganges River. Earth Day is celebrated by avoiding the use of plastic items to save the environment. A radio programme was utilised to educate people about littering and to encourage them to recycle plastic wastes. Partnerships between NGOs and WWF has also aided in removing fishing equipment such as fish nets to save dying marine species such as dolphins. The species are saved by converting plastic fishing nets into reusable products. India has also developed a technique of trapping and preventing plastic waste from reaching the seas and oceans. The technique helps to clean and sustain species from being entangled or suffocated by swallowing plastic materials. The debris collected help learners to reuse and recycle materials.

## 2.7 Plastic Problem in Nigeria

Nigeria is the most densely populated country in the African continent with an estimated population of 262.2 million in 2023 (Sasu, 2023). The country owns many plastic manufacturing companies. About 3000 companies produce plastic bags (Obioha, 2019) while 1 500 manufacture plastic water sachets (WACA, 2019). This causes plastic production to increase by 10.3% annually and the consumption of plastic to increase by 6.5% yearly (Wirmko et al., 2019). Recycling in Nigeria is less than 12% and over 80% of plastic waste is taken to the landfill site (Ayeleru et al., 2020). The disposable packaging industry is the dominant consumption market of single-use plastic in Nigeria (Onyekachi & Chukwuemeka, 2022). It is the market that causes plastic pollution in Nigeria. Below are factors that cause littering of the single-use plastic in Nigeria.

Industrialisation and urbanisation in Lagos city contributed to the rise in plastic littering. Allen-Taylor (2022) reflected that industrialisation and urbanisation in Lagos city are increasing every day. One of the industries that grew rapidly in Lagos city is plastic sachets packaging (Emeka & Lesley, 2020). The industry attracted more investors in small and large plastic scale businesses (Allen-Taylor, 2022). Emeka and Lesley (2020) posited that plastic sachets are cheap products, and have gained popularity amongst vendors, retail stores and the communities. The popularity of plastic sachets led to their consumption and disposal to rise to 60 million (Emeka & Lesley, 2020). This industry is producing single-use plastics immensely because no law prevents them from producing plastic. The Lagos State Environmental Protection Agency (LASEPA) is responsible for the banning of polyethylene plastic (Aare et al., 2023). However, the Agency is not taking drastic steps to ban plastic production and monitor the compliance. The other law enforcement that does not perform its duty of imposing the regulation of the production of plastic is the Harmful Waste Act.

According to Aare et al. (2023), the Harmful Waste Act issues strict penalty to manufacturers when they do not comply with the production and improper disposal of single-use plastic. The companies continued to produce and improperly dispose of plastic without being given harsh penalties. Nigeria is struggling with mismanagement of plastic waste because they are not holding producers accountable for the collection

and recycling of plastic. Aare et al. (2023) stated that the National Environmental Standards and Regulation Agency (NASERA) has embraced EPR and PRO. These approaches hold companies responsible for buying back recycling and proper disposal of their products. The companies in Nigeria are reluctant to join PRO because the government did not give them clarity about the implementation of EPR. For this reason, Nigeria is faced with more production and improper disposal of single-use plastic. Aare et al. (2023) stated that the government should be blamed for non-compliant of plastic companies. The government failed to allocate funds to the law enforcement agencies to monitor and enforce penalties.

Besides increase in plastic littering by industrialisation, urbanisation also increased plastic littering in Lagos city. The total number of people who migrated to Lagos were estimated to reach 22 million (Dania, 2022). The population generated 870 000 tonnes of plastic waste annually in Lagos. This large number of people consumed more plastic, but they dispose it indiscriminately. People cannot comply with law enforcement when there are no proper waste management facilities. Aare et al. (2023) showed that the Lagos plastic pollution was exacerbated by inadequate waste management infrastructure and public awareness campaigns. There were few private companies that were collecting waste for recycling in the city and failed to reduce plastic waste. For this reason, the city of Lagos became the biggest contributor of plastic waste in Nigeria.

Lack of public awareness alternatives to single-use plastic exacerbated littering in Nigeria. LASEPA, a body responsible for raising awareness, is not functional in Nigeria (Aare et al., 2023). The improper disposal of sachets blocked drains and caused floods. Floods pollute ground water with sewage and people with dirty water. A study by Magaji (2020) found that the residents of Gwagwalada were utilising ground water but unmanaged sewage and floods in Nigeria polluted ground water. For this reason, Magaji (2020) claimed that the residents of Gwagwalada switched to plastic sachets and bottled water. People in Nigeria use plastic sachets water because the government fails to provide them with safe drinking water (Allen- Taylor, 2022).

Lack of political will by the government to ban plastic elevated plastic littering in Nigeria (Anabaraonye et al., 2023). This is coupled with the inadequate supply of dustbins, which causes accumulation of plastic waste in Nigeria. The plastic containers used in

Nigeria are banned in other countries. Okolo et al. (2022) found that Nigerian households used plastic packaging more on special occasions to pack their food. The plastic packages include Styrofoam packs and spoons, cups, sachet water and bottled water, as well as bottled beverage drinks with straws (Okolo et al., 2022). These products are often dumped carelessly on the grounds. People who visit beaches, waterfall, and parks also use and dump plastic products carelessly without thinking about the danger they pose to the species. Nigerians used plastic packaging to eat and drink, and they drop them anywhere because there is no regulation (Okolo et al., 2022). Plastics are dumped because there are no adequate waste collection facilities like dustbins.

Lack of waste management strategies in schools causes littering of plastic in schools. A study by Onuorah et al. (2023) showed that the commonly found plastic waste in Anambra state schools were water sachets and sanitary pads. Another study by Hamafyelto and Abdullahi (2019) showed that 5000 plastic bottles of juice and sachets are used by learners every day in Maiduguri state schools. Onuorah et al. (2023) have also found that the open burning of plastic waste is a common method used by most schools to reduce the accumulation of plastic waste. The learners do not separate waste and recycle plastic waste in schools (Onuorah et al., 2023).

Nigerian communities lack awareness about recycling and reusing of plastic. These people also lack awareness about the impact of burning plastic. It is common in many large cities and rural areas to burn plastic to cook meal (Donuma et al., 2024). In large cities like Lagos and Maiduguri, wastes are incinerated in landfill sites. This results in inhalation smoke that causes poor vision, itching eyes and difficulty in breathing. The waste in landfill sites is breeding homes for mosquitoes, flies and rodents. The prevalent diseases in these areas are Malaria and typhoid fever.

Nigerians use and litter plastic because they lack awareness of proper waste disposal. The effect of plastic is that they cause floods in Nigeria. Dumbili and Henderson (2020) found that plastic pollution in Nigeria blocks water pipes during the rainy season and causes floods. This flood results in death of people, destruction of properties and displacement of people from their homes.

Single-use plastic waste is a problem in Nigeria. Below are measures applied by Nigeria to eliminate plastic debris and to sustain the environmental resources.

### 2.7.1 Education

Schools have partnered with NGOs to raise awareness about plastic pollution and to encourage people to recycle plastic. Learners are encouraged to volunteer in ocean clean-ups with NGOs. In this way, the awareness of plastic pollution would increase, and they would continue to recycle it. Nigeria has a project known as Citizen Observation of Local Litter in Coastal ECosysTems (COLLECT), which collaborated with Observation of the Global Ocean (POGO). POGO is regarded as a deep-rooted network of oceanographic research institutions that combine to advance and form global ocean observations through outreach, capacity development and innovations (Miloslavich et al., 2019, POGO, 2021). According to Catarino et al. (2023), the COLLECT project trained learners aged 15 -18 to use quantitative assessment to sample and analyse small and large plastics in beach sediments. The COLLECT project (2021-2022) gathered data on plastic litter in seven coastal countries: Malaysia (Asia), Cape Verde, Côte d'Ivoire, Ghana, Morocco, Nigeria and Benin. The data collected from these was useful in raising awareness about plastic consumption and the safe disposal of plastic.

### 2.7.2 Land filling

The common method of disposing plastic waste in Nigeria is landfilling, which should be the last method that the country should implement to deal with waste. Landfill sites have limited space to store more waste, and Nigeria does not have a space to construct another landfill site (Hikmath & Arachchige, 2020). Landfilling has been criticised for contributing to climate change, and soil and water pollution. Manheim et al. (2021) stated that decomposition of plastic waste leaches chemicals into the ground and pollutes groundwater. Besides leaching chemicals, in the landfill sites, plastic and other waste decompose and release methane. Methane is a greenhouse gas that traps heat and increases temperatures of the earth and contributes to global warming and climate change (Manheim et al., 2021). Taking plastic to the landfill site poses a serious problem. Marczak (2022) stated that more energy, crude oil and coal are exploited by manufacturers when they produce products. In that way, landfill sites also contribute to the depletion of natural resources (Manheim et al., 2021). Landfill sites are breeding home for mosquitoes, which causes malaria in Nigeria. Therefore, the accumulation of waste in landfill sites shows that the government does not support law

enforcement agencies with money to impose sanction and ban of plastic production. There are few recycling companies in Nigeria because only 20% of plastic is recycled, and 80% is carried to landfill sites (Ayeleru et al., 2020). For this reason, learners and educators need to be educated about the recycling and segregation of waste. This would divert plastic waste to reach landfill sites. The government should collaborate with NGO to provide awareness of the proper disposal of plastic. The government needs to fund law enforcement agencies to impose sanctions about the production of single-use plastics.

### 2.7.3 Incineration

The most preferred method of reducing plastic waste in Nigeria is burning wastes openly in the environment (Okolo et al., 2022). The fumes of plastic release heavy metals and harmful chemicals into the atmosphere. Kora (2019) asserted that plastic releases toxic carbon substances like dioxins and furans. In large cities like Lagos, incineration resulted in smoke and horrible odours that cause air pollution (Donuma et al., 2024), and caused diseases like asthma, poor vision and running nose. Therefore, the government should consider searching for funds to pay law enforcement agencies to monitor and impose ban on single-use plastic. The partnership with NGOs can assist with raising awareness about proper waste disposal and recycling in communities and schools. Incineration causes respiratory and eye problems.

### 2.7.4 Extended Producer Responsibility

Through their National Environmental Standards and Regulations Enforcement Agency (NESREA), the Nigerian Federal Ministry of Environment adopted the Expanded Producer Responsibility Policy in 2014 (Alan-Taylor, 2022). The Agency provided policy requirements for manufacturers to develop plans to design, recover and recycle plastic waste. NESREA is also responsible for setting up the guidelines of EPR in Nigeria and required producers to finance and manage plastic collection and recycling (Allen-Taylor, 2022). However, Nigerian states have never incorporated the policy for EPR in their waste management (Allen- Taylor, 2022). According to Allen-Taylor (2022), the legislation was hampered by the growing number of unregulated types of plastic bottles and sachets. The PRO, Food and Beverage Recycling Alliance and NGOs responded by partnering and appointing small-scale companies to collect and recycle plastic on their behalf (Allen-Taylor, 2022). Smaller companies such as

Recycling Point and We-cycler collected plastic products and sold them to large companies for recycling (Allen-Taylor, 2022). The companies used happy points for the customer to redeem them as rewards in retail stores. Despite these efforts by small companies, Allen-Taylor (2022) stated that plastic pollution in Lagos was uncontrollable due to a lack of plastic regulations.

In response to plastic littering, Allem-Taylor stated that Lagos State Environmental Protection Agency and Lagos Waste Management Authority introduced a smart recycling initiative on a software Application. The technology was used by small and big companies to inform the people about collection and recycling days of plastic and other wastes. Households in Lagos were able to setup date and time for the collection of recyclables by companies. However, Allen-Taylor stated that the government should raise awareness and educate people about plastic. Educators in Nigeria are helped by small companies to recycle waste. Therefore, there is a need for the government to clarify to plastic-producing companies the implementation of EPR. In that way, more plastic would be reduced by big companies.

### 2.7.5 Lesson Learned in Nigeria

The law agency in India is struggling with funds and equipment to impose plastic ban in India. The government is lagging in gathering plastic-producing companies and clarifying the implementation of ERP. Municipalities are not collecting waste in some parts of the country due to lack of funds to improve infrastructure. The country has no adequate dustbins and recycling facilities. The uncollected waste drives people to burn waste openly. The government needs to partner with companies and stakeholders and start a recycling programme. In this way, plastic littering would be reduced. The country relies on small scale companies to implement EPR to collect plastic waste in large cities. The initiative is failing to downscale plastic littering due lack of plastic regulation to plastic producers, who are producing more and more SUPs because there is no regulation of plastic in Nigeria (Allen-Taylor, 2022). The country should look for more investors to fund companies for eco-friendly products to be produced (Allen-Taylor, 2022). According to Allen-Taylort, investors are investing more in SUPs despite their negative impacts on the environment. The insufficient provision of clean and safe water also increased the consumption of sachets and bottled water. For Nigeria to

eliminate plastic bottles and sachets, they need to find a way of providing clean water to the people. The NGO is trying to increase knowledge of recycling to learners by partnering with schools. In that way, NGO helps to raise awareness about the proper disposal of plastic. The NGO inspired learners to collect data on plastic debris in the ocean by participating in litter pick-up. In that way, the NGO increased the awareness of learners so that they could teach others at home about the impact of plastic on marine organisms.

Shah and Sattler (2020) suggested a couple of improvements that Nigeria could follow to increase the effectiveness of waste collection to prevent open burning. They stated that the main areas for improvement in Nigeria include:

1. Formulation of public awareness campaigns to motivate communities to participate in waste separation and to practice proper waste disposal methods such as throwing waste in bins instead of open burning.

2. Collection of waste on a daily basis instead of alternating days.

3. Coordination between the timing of waste generation and collection be improved.

4. Vehicles used for waste collection be mechanised.

5. Increased access to waste collection vehicles.

6. More regular services by sweepers.

## 2.8 The Plastic Problem in South Africa

South Africa (SA) is also a densely populated country. Stats SA estimated that the population of South Africa grew to 62 million in 2022 (Stats SA, 2023). South Africa has many companies that manufacture single-use plastic while some are imported from other countries (Naidu, 2022). The Worldwide Fund reported that roughly 2.5 million tonnes of plastic is produced annually in SA (Mokale, 2024). Naidu (2022) found that the packaging industry is the main market of single-use plastic in SA, and accounts for 40% of the local market. The construction followed with 13%, agriculture 9%, automotive and transport application with 7%. The International Union for Conservation of Nature (IUCN) of South Africa Reports reported that the production of plastic in SA is equivalent to 41 Kg per capita per year (Naidu, 2022). This amount has exceeded the global average of 29 Kg per capita. IUCN indicated that out of 70%

plastic waste produced, only 14% is recycle in SA. Over 40% is disposed of in landfill sites and 11% in illegal dump sites. Therefore, the study intends to find the causes of littering in SA.

Urbanisation and industrialisation in major cities of the country influences littering. Migrants from neighbouring countries such as Lesotho, Swaziland, Zimbabwe, Botswana, Mozambique and Namibia and local people increased the population growth urban areas. This led Plastic South Africa (2022) to report that South Africa is experiencing the highest urbanisation rate in the world. Population growth and the standard of living in many cities of SA increased littering. The South African State of Waste Report (2018) revealed that people living in most urban areas of SA are wealthy. Wealthy urban dwellers utilise large amounts of single-use plastic than people in the rural areas (South African State of Waste Report, 2018). World Wildlife Fund (WWF) South Africa (2018) has found that plastics are preferred and used in building materials, medical devices and electronic applications. In addition, plastic is utilised in the production of synthetic clothing and materials such as polyester, nylon and fleece. WWF SA (2018) proposed that people need to stop purchasing single-use plastic items such as shopping bags, plastic cutlery, take away food containers and plastic bottles. Rather, people should buy items using reusable grocery bags, bottles and cutlery because most single-use plastic items cannot be recycled (WWF SA, 2018). WWF SA indicated further that single-use plastic is prone to littering and easily blown by wind to the ocean and on the environment.

Street vending business in major cities influenced littering in SA. Besides bringing wealth to the people, urbanisation and migration brought unemployment. The scarcity of employment in major cities of SA prompted Stats SA (2023) to pronounce that SA is experiencing a high unemployment rate in the world. According to Arias (2019), within large cities of SA, unemployed migrants and local people opted for street vending business. Street vending is defined as a mobile, space bound, urban form of business practice (Adama, 2020). This business is popular in streets as an indispensable source of income for the unemployed migrants and local people (Adama, 2020). In addition, Adama posited that the street vending business in South Africa contributes to about 7% of Gross Domestic Product of urban areas annually.

The street vending business uses more plastic packaging. Over 70% of street vendors sell food with free single-use plastic. Kalitanyi (2021) argued that street vendors sell food in single-use plastic because they are not aware of the plastic regulation. The plastic ban initiative is only practiced by large retail stores (Kalitanyi, 2021). The street vendors are often blamed for the plastic littering and dirty streets (Gamieldien & Van Niekerk, 2017). They operate in overcrowded busy streets and sidewalks. The municipality can be blamed too for providing fewer dustbins and not collecting waste. Chokoe and Meso (2017) added that the informal sector business such as street vending is unregulated. Lack of dustbins and regulation encourages street vendors to sell goods using free and cheap single-use plastic that causes littering.

Urbanisation also led to the eruption of slums and squatter camps, which in turn increased littering. Bikis and Pandey (2023) indicated that some unemployed migrants who struggle to afford housing often resort to erecting slums and squatter camps. Their residential areas are mostly inaccessible for plastic waste to be collected by municipalities. Informal settlements have narrow roads for municipal garbage trucks to pass and collect wastes (Verster & Bouwman, 2020). Uncollected wastes and lack of waste collection facilities compel residents to dump plastics along the streets and bushes (Verster & Bouwman, 2020). Verster and Bouwman (2020) revealed that in SA, domestic waste accounts for 440 000 tonnes of unmanaged plastic waste that contaminate the environment. Plastic SA (2018) noticed the gap between waste collection in suburbs and informal settlements. The gap leads to plastic littering in informal settlements of SA. More plastic waste is collected in affluent urban settlements than in informal settlements (Plastic SA, 2018). Improving waste management infrastructure, building roads and intense plastic awareness campaigns in informal settlements could reduce plastic littering.

The travel and tourism industry in SA is the largest market that expands the economy of the country and increases littering. Most people travel day and night within the country from one province to another. The Domestic Tourism Survey conducted a survey on the total number of trips taken during the day and night in 2022 (Stats SA, 2022). The Survey found that 16.0-million-day trips and 10.9-million-night trips were taken during a 12-month period in 2022. The survey revealed that the reason for travelling includes leisure in beaches, nature reserves and shopping. In terms of provincial trips, the Domestic Tourism Survey found that Gauteng dominated day visits

by 20.3%, Western Cape by 16.1% and Limpopo by 14.3% in 2022. The overnight trips in 2022 were dominated by the Western Cape with 15.1%, Limpopo with 14.9% and KwaZulu- Natal with 14.7% 9 (Stats SA, 2022). The tourists of this industry consumed large amounts of single-use plastic and dumped them inappropriately. This was confirmed by World Wildlife Fund South Africa (2022), who noted that beaches in SA are filled with polystyrene plastic materials. The common plastic items were shopping bags, ear buds, sweet wrappers, bottles and lids, sucker sticks and cups. For this reason, Verster and Bouwman (2020) reported that SA coastal areas contributes 15 000 to 40 000 tonnes of plastic waste into the ocean annually. Sustainable education is in coastal areas, and parks of SA can reduce plastic littering. In that way, species that thrive in water can be protected.

South African public schools are overpopulated because education from pre-schools to universities is free. According to Stats SA (2023), in 2022, South Africa had 13.4 million students, with 12.7 million in public schools and 735 085 in independent schools (Cowling, 2024). Stats SA has also found that the number of schools in South Africa accounted for 24 900 in 2022 (Stats SA, 2023). Overcrowding and school vending business increased littering in many public schools. Most public schools across South African schools have allowed unemployed people to sell fast food and snacks to learners. Almost all fast food and beverages are sold wrapped in plastic bags, Styrofoam containers and plastic bottles. The Department of Education introduced the National School Nutrition Program (NSNP) in 2004. The programme serves public schools because parents cannot afford healthy and nutritious food. The programme caters for both primary and secondary schools across the nine provinces of SA (Labour Research Service, 2022). The labour research service regarded NSNP as a feeding scheme that supplies hot nutritious food every day to 9 million learners whose families cannot afford nutritious. The research service has elaborated further that the food is delivered to schools by suppliers contracted to the Department of Education. The food supplied to schools are covered in plastics and include rice, samp, sugar, salt, milk cartoons and vegetables. Therefore, education for sustainability needs to be introduced in schools to reduce plastic consumption and littering.

The Department of Environmental Affairs in SA deals with environmental protection in SA. The Department came up with measures to minimise littering and encourage

recycling to protect the environment. The regulation applied to the companies, community, educators and learners. They are discussed below:

### 2.8.1 The South African Constitution

The South African Constitution is a large body that pushed the government and the Department of Forestry, Fisheries and the Environment to formulate plastic pollution regulations and policies. The Constitution mandated the Department of Forestry, Fisheries and the Environment and the government to keep the environment clean. It views a clean environment as a basic human right that should not be violated. It proved that: 'Everyone has the right to an environment that is not harmful to their health or wellbeing and to have environment protected for the benefit of present and future generation through reasonable legislative and other measures''-

(i) prevent pollution and ecological degradation

(ii) promote conservation, and

(iii) secure sustainable ecological development and use of natural resources while promoting justifiable economic and social development.

### 2.8.2 Environmental Education in SA Schools

Learners in some South African schools are prone to littering plastic. The Department of Education ensured that learners are sensitised about conserving natural resources by reducing plastic littering. The Department responded to calls for introducing sustainable education by infusing environmental education in the schools' curriculum. It the introduced Curriculum Assessment Policy Statement (CAPS) in 2011 in schools (Department of Education, 2011). The Policy statement advocates that environmental education be integrated in all subjects and grades. The government through the South African Schools Act (SASA) no.84 of 1996 provides schools with funds to support environmental education programmes (SASA, 1996). The South African Schools Act No.84 of 1996 mandated the school governing body in public schools to adopt a code of conduct for learners, which allows the school to impose regulations related to discipline, which includes regulation that does not allow learners to engage in littering. NGOs such as WESSA introduced an international programme called Eco-school

programme in 2003 in all the provinces of South Africa (WESSA, 2018). The programme raises awareness and helps learners to take part in school and community recycling. The PRO (PETCO) has partnered with Pick `n Pay school club to educate learners and educators about the importance of recycling plastic (PETCO, 2024). Educators and learners are supplied with CAPS workbooks and posters containing recycling and sustainability topics. In this way, SA is ensuring that learners live a sustainable lifestyle and commit to environmental protection.

### 2.8.3 Waste Hierarchy

The South Africa government responded to the global concern for reducing plastic littering by adopting a waste management strategy. The Department of Forestry, Fisheries and the Environment adopted a world class waste management strategy to minimise the production, consumption and disposal of plastic (Department of Forestry, Fisheries and the Environment (DFF), 2024). The DFFE was influenced by the Constitution of South Africa to introduce the strategy. The constitution mandated the government and the Department of Environmental Affairs to ensure a safe and healthy environment for the citizens. In recognition of this obligation of the Constitution, the Department of Environmental Affairs promulgated the Waste Act. The Environmental Management: Waste Act of 59 of 2008 and National Waste Management Strategy in 2010 were initiated to deal with waste management. To live in an environment that is safe and healthy from improper disposal of plastic, the government had to implement strategies. The strategies include the reduction of waste production, waste disposal and a plan for zero waste. The Department of Environmental Affairs responded by initiating a Working on Waste programme under the auspices of the Expanded Public Works Program. The working on waste is regarded as a proactive preventive measure that identifies poor waste service that may lead to littering. In that way, working on waste ensured the implementation of sustainable waste management that leads to the achievement of ecological and social sustainability. The government was pressurised to take immediate actions to achieve the three mentioned strategies. The Department of Environmental Affairs' Waste Act introduced the best internationally practiced Waste hierarchy (Figure 2.6.4) to manage waste. The strategies help the community, educators and learners to sort waste at source, recycle it and prevent it from becoming a waste. This strategy led to the circular economy of plastic products.




Figure: National Waste management Strategy (DFF, 2024)

### 2.8.4Extended Producer Responsibility (EPR)

Plastic is recycled less in SA because the majority is taken to the landfill sites. This habit was noted by South African State of Waste Report (SAoWR, 2018) as they have indicated that plastic is recycled less than metal and glass. Less recycling meant that plastic waste is taken to the landfill or is disposed of improperly into the environment (SAoWR, 2018). In 2020, the Department Environmental Affairs (DEA, 2020) responded by initiating a new National Waste Management Strategy, the Extended Responsibility Producer (ERP). DEA reflected that the strategy would maximise the prevention and regeneration of plastic waste products. The policy was also initiated to deal with volumes of plastic waste like in developed countries. According to DFFE (2020), the strategy is provided under the National Environmental Management: Waste Act 59 of 2008. The EPR regulation was introduced to hold plastic producers accountable for the end- of life of their plastic product. The regulation required plastic-producing companies and Producer Responsibility Organisation (PRO) to register with the department of environmental affairs. Once registered with the DFFE, the companies pay levies which are transferred to the government. The government releases the money to the producer responsibility organisation. The PRO in turn pays the companies to produce recyclable products. In this way, the companies would stick to the production of sustainable products that the community, educators and learners would recycle.

Plastic Engine Technology Corporation (PETCO) is a leading Producer Responsibility Organisation that has been supporting ERP schemes from 2004 to 2022 in SA (PETCO, 2022). As a leading registered Producer Responsibility Organisation (PRO), PETCO regulates EPR schemes for polyethylene terephthalate (PET) packages, liquid board packages and plastic closures and labels. PETCO also finances projects that promote CE such as producers, waste collectors, recyclers and marketable recycled products.

The Department of Forestry, Fisheries and the Environment (DFFE) has established mandatory set targets for the collection and recycling of identified products to PETCO. PETCO stated that 121 369 PET bottles and jars were placed on the market along with their closures and labels in 2022. The PRO stated that they reached over 99% of collection and recycling of volume Identified Products placed in the market. DFFE also mandated PETCO to include waste pickers in the informal settlement. About 800 waste pickers were registered, and this increased recycling in SA. To ensure that recycling is done in SA, DFFE has also informed PETCO to report recycling progress annually.

In case of disasters, PRO and NGOs removed waste in flood-stricken areas. Even though learners do not practice proper disposal in schools, they volunteer to remove plastic debris in oceans and rivers. In April 2022, the province of KwaZulu-Natal was struck by floods that lasted for two days. The harbours, Umgeni River, and the South Coast of Durban were left drowning in plastic wastes. Plastic manufacturers and other companies converged to remove the waste from the ocean in Kwazulu-Natal. Plastic SA partnered with other organisations and organised a buy- back of plastic swept into the ocean. Fish line bins and litter booms were installed in Durban harbours, Umgeni River and Durban South Coast beach to catch plastic. According to Dyer Island Conservation Trust (2023), a fishing line bin is a PVC pipe receptacle erected in beaches or oceans about 6cm high to act as a repository for fishing lines. Through the project, educators, learners and the community learned about proper plastic consumption.

Regarding litter boom, Mani et al. (2021) stated that installing litter booms is challenging because it needs people with knowledge and skill. This prompted Mani et al. (2021) to report that NGO, Durban Green Corridors failed to collect plastic waste in

Umgeni River due to inefficiencies related to design, placement and implementation of litter booms. According to Helinski et al. (2021), litter booms are not effective when used alone; they need to be coupled with clean-up boats.

The SA Plastic Pact is a combination of organisations launched in 2020 and is supported by the Ellen MacArthur Foundation and by WRAP (SA Plastic Pact Annual Report, 2022). The report stated that due to mandatory EPR introduced in 2022 by DFFE, the SA Plastic Pact has set four target steps to achieve collecting and recycling rates in 2025.

#### 2.8.4.1 In the first step target: Eliminate problematic

In target 1, 12 problematic plastic products were identified and phased out at the end of 2021. They include plastic straws, stirrers and stickers. The lollipop sticks and cotton earbuds have changed to paper stems. In 2022, 0.5 million items of single-use plastic picnic plates and cutlery, PVC rigid packaging, and 3.2 million PET/PVC shrinks sleeves on PET bottles were removed.

#### 2.8.4.2 In target 2: Reusable, Recyclable Plastic (100%)

In target 2, Unilever Sunlight collaborated with Sonke in 2023. They designed a refill station machine as well as FMCG to test sunlight liquid in three Spar stores for 3 months. The customers were given a bottle free to refill the sunlight dishwashing liquid at a discount. The reuse was reported to be high as the customers returned for more refill and therefore plastic packaging was recycled 100% in 2023. If customers continue with this attitude, plastic packaging would be recycled by 2025.

#### 2.8.4.3 In target 3: Plastic Recycled by 2025 (70%)

Overall, 35.4% of plastic packaging, which was placed on the market, was recycled. An input recycling rate of 70% needs to be attained based on the figures reported above. To increase recycling, the informal sector needs to be integrated in a recycling value chain. The waste pickers play a key role in recovering plastic from mixed sources in landfill sites.

Education and awareness have been identified as target 3 for plastic packaging to be recycled. The aim was to teach learners about the importance of recycling plastic

packaging items to prevent them from going to landfill site. In this way, 70% of plastic will be recycled by 2025.

#### 2.8.4.4 In target 4: Recycled Plastic (30%)

The tonnages of locally purchased recycled polymers have been increased by converters. Currently, many retail stores have shown progress in recycling plastic packaging. For instance, there was an increase in the tonnages of recycled content in Clicks primary packaging by 4% in 2021. Many personal cares in Clicks products such as Payless, My Earth and Revive ranges are using recycled PET or recycled HDPE bottles. In 2021, Clicks sold over half a million units of products packaged in rPET or rHDPE. By 2025, 30% of plastic packaging would be recycled.

### 2.8.5The Good Green Deeds Campaign

In response to the South African constitution 108 of 1996`s call for a clean environment in SA from waste such as plastic, the Department of Environmental Affairs (DEA) introduced the Good Green Deeds Campaign on 8 March 2019 (DEA, 2020). The campaign is led by the Department of Environmental Affairs (2020), and its main purpose is to change attitudes and behaviour of people towards littering. The campaign was introduced in 2019 by President Cyril Ramaphosa. The President also led the campaign and joined volunteers by picking plastics on the streets, water bodies and illegal dumping stations. He was accompanied by a mascot of the national Good Green Deeds Programme called Billy Bin. The masot's mission was to educate and raise awareness about the negative effects of littering and illegal dumping. The mascot exhibition showcased items such as plastic that they need to recycle. During the Good Green Campaign, Plastic SA (2022) partnered with Government, Producer Responsibility Organisations, Community Based Organisations and other Non-Governmental Organisations through the project clean-up and recycling. During the 2021-2022 clean-up, the Minister of Environmental Affairs, Mrs Babara Creecy participated alongside 120 000 people who were sponsored with 500 000 plastic bags to clean the beaches, roads and rivers (Plastic SA, 2022). On average, 2500 tonnes of waste were collected but only 2,3% was recycled and the rest was taken to the landfill sites.

### 2.8.6 Landfill sites

In SA, most of the plastic waste is collected from the streets, residents and business places to landfill sites. Maluleke (2021) indicated that landfilling is the most common method of plastic waste disposal in SA. In total, SA has 781 licenced landfill site facilities (State of Waste Report, 2018). According to Mazhandu et al. (2021), the prevalence of landfilling in SA is due to perceptions that it is the best waste management method. The other reason for the abundance of landfilling is lack of alternative ways to dispose of waste (Mazhandu et al., 2021). The landfill often lacks formal compliance practices (Rodseth et al., 2020) and causes unregulated management practices. Rodseth et al. (2020) has found that common unregulated practices include outside formal waste dumps, illegal dumping and uncontrolled burning. Although waste pickers trespass into the landfill sites, they play an important role in recycling materials in landfill sites. Waste pickers collect recyclables such as plastics and take them to buy-back centres to get paid to earn a living (Madzhandu et al., 2021). With their role in recycling, over 80 to 90% of plastic packaging is recovered by waste pickers in the landfill sites (APWC, SA, 2020). According to the SA Plastic Pact Annual Report (2022), there are 60 000 to 90 000 waste pickers removing larger portion of recyclable plastics in the landfills of SA.

### 2.8.7 Plastic bag regulation

To encourage learners, community and educators to use eco-friendly products, the Department of Environmental Affairs introduced plastic bag regulation in May 2003 to eradicate the production of single-use plastics (Mazhandu et al., 2020). The plastic bag ban was motivated by the need to conserve petroleum reserves, aesthetic value of oceans, minimise pollution and to prevent the leaching of poisonous chemicals into the water bodies (Madzandu et al., 2020). The only permissible bags would be those with a minimum thickness of 30 µm, which ensures that the plastic thickness meets the standard of being recycled. Mazhandu et al. (2020) reported that the plastic ban was combined with a plastic levy of 3 cents (R0.03) in 2004, and in 2017 and 2020, the levy increased to 6 cents (R0.06) and 25 cents, respectively. However, the plastic bag levy policy has not met expectations of cutting down plastic bag consumption in SA (DEA, 2017). If plastic can be very expensive, this would encourage the use of reusable shopping bags.

### 2.8.9 Lesson learned by SA

South African President Cyril Ramaphosa like the Indian Prime Minister initiated and led a clean-up campaign. The president participated in Good Green Deeds Campaign to raise awareness about keeping the environment clean. As a role model of the country, participating in picking up waste encouraged volunteers to follow. Educators, learners and the community volunteered to clean polluted areas such as streets, bushes and water bodies. During the campaign, people are educated about plastic pollution and recycling. The suggestion to the government is that invitations need to be sent to the rural areas for municipalities to engage citizens in cleaning their polluted areas.

Education for sustainability has been introduced in schools. This has encouraged NGOs to support learners with sustainability skills. NGOs in the USA collaborate with schools to educate learners and educators about recycling procedures. In South Africa, NGOs have collaborated with schools to educate learners and educators about recycling plastic, and posters to show procedures of recycling. Most NGOs are operating in urban areas than rural areas. This creates a gap in environmental awareness to learners who live in rural areas. To reduce the gap, schools in rural areas need to collaborate with local government municipality and an NGO to provide learners in rural areas with recycling skills.

SA established the EPR strategy, a strategy that was successfully applied in Germany. There are recyclable bottles in many retail stores with cash back in SA. EPR schemes in South Africa appeared more effective than plastic bag levies. People are now aware of returning plastic items for cash but fail to buy reusable bags because they are expensive. However, the study highlighted that the differences could also be attributed to the fact that unlike PET, other plastic bags are not easily recyclable (SA Pact Annual Report, 2022). The SA Pact Annual Report indicated that such plastic products have lower recycling value.

Deposit return scheme (DRS) programmes discourage unsustainable consumption patterns and promote recycling. The study has highlighted that DRS are in large metropolitan cities (SA Pact Annual Reports, 2020). Therefore, the government should spend more money for PETCO to establish buy-back centres for plastic packages in rural areas where people are unemployed and could earn a living by recycling.

SA has also allowed informal waste pickers to join PROs officially to recycle plastic. The inclusion and registration of waste pickers in large projects of PETCO means that plastic dumped in landfill sites would be collected and recycled.

### 2.8.10 SA's future plastic management Plans

Madzhandu et al. (2020) argued that SA needs to tackle plastic waste using the suggested three plans below to achieve zero plastic waste by 2030.

#### 2.8.10.1 Immediate 2021 Plan

1. All plastic products should have a recycling code;
2. Invest in research work involving alternatives;
3. Audit all plastic products to assess if they meet quality requirement and are correctly numbered;
4. All importers of plastic products and small-scale plastic manufactures should be registered;
5. Enforcement of regulations to deter perpetrators, e.g, supply of sub- standard plastic bags and illegal dumping;
6. Registration of all informal waste plastic pickers and their induction into the formal sector through the formation of cooperatives;
7. Roll mandatory waste separation where waste collection services are available;
8. All innovators should be supported to expand their work and create employment; and
9. Train the public on the importance of waste separation at source audit importance.

#### 2.8.10.2 Year 2022 Plan

1. Extend EPR scheme to all plastic products;
2. Ban non-recyclable plastics or find alternative sustainable treatment methods apart from landfilling;
3. Find alternative ways to increase the recycling rate of PVC or replace it with alternative materials;

4. Have dedicated collection points for small plastic items, e.g, sweets wrappers and bread tags;

5. Increase waste collection service to 80% and use transfer station where roads are inaccessible such as rural areas and informal settlements; and

6. Implement Pay- AS-You throw scheme all households with waste collection.

#### 2.8.10.3 Zero Waste plan

If all the above-mentioned actions are implemented successfully, SA would achieve zero waste to landfill sites by 2030. There are fewer reasons that may lead to unsuccessful zero waste to landfill sites. They include lack of enough funds from the government to finance companies to produce reusable items. If the regulation of the plastic levy does not include street vending businesses, they will continue selling goods with free plastic. The SA government must ensure that buy-back centres are readily available across the country, including rural areas. Sufficient funds are needed for schools, NGOs, companies and municipalities to educate people about plastic in schools and communities.

### 2.9 Plastic Problem in Limpopo Province

Limpopo Province is a densely populated province in South Africa. The population residing in Limpopo in 2022 were 6.5 million (Stats SA, 2023). Limpopo has six district municipalities. Migration in these municipalities is high due to neighbouring states. Limpopo is bordered in the west by Botswana, north by Zimbabwe and east by Mozambique. These borders offer easy access to people into Limpopo Province. According to Stats SA (2023) census data of 2022, about 1.66 million migrants are living in Limpopo. Besides the large number of migrants in Limpopo, the number of households in the six district municipalities is high. Stats SA reported that the number of households in six district municipalities in Limpopo were 1.8 million in 2022. Most people in this province are employed in manufacturing, mining and agriculture. Findings by Stats SA (2023) showed that manufacturing production and sales in Limpopo was equivalent to 63.5% in 2022. In the GDP of Limpopo, mining contributes 29.4%, manufacturing 2% and agriculture 2.5% (Stats SA, 2023).

Migration and unemployment into the province increase littering. The unemployed local people and migrants who cannot afford proper housing live in inaccessible informal settlements. Due to littering in inaccessible places, many municipalities in Limpopo provided rural areas and informal residents with a large communal skip (Sekgobela & Semenya, 2023). Sekgobela and Semenya elaborated that citizens who live in towns and townships are provided with refuse plastic bags. They are also charged waste collection service fees by municipalities. The wastes in these areas are collected regularly. Sekgobela and Semenya (2023) indicated that rural and informal settlements are provided with free waste collection service. Their large skips are not collected regularly. The uncollected wastes lead to illegal dumping, burying and open fire burning (Sekgobela & Semenya, 2023). Therefore, the municipality needs to educate people in rural and informal settlements about plastic pollution and its impact on the environment. The municipality also needs to collect waste in these areas regularly.

Travel and tourism are high in Limpopo and leads to more production and rise in the littering of single-use plastic. The most common reason citizens of Limpopo embarked on trips is religion. Religious tourism is the biggest market that increases plastic pollution in the province. Different religious groups hold religious prayers during the weekends. The number of people gathering in a religious event are roughly 150- 500. The plastic items used during the events are water bottles, Styrofoam trays and containers, plastic cups, spoons and plates. When the event is over, the plastic items are left on the streets, and some are collected and placed in a shallow hole for burning. The largest religious gathering that comprises millions church members is a visit to Moria by Zion Christian church members. The events take place in Easter and September months. The gathering is attended by local and international members from neighbouring countries, such as Botswana, Namibia, Zimbabwe and Namibia. The event attracts small and informal businesses. Products such as fruits and vegetables are sold in small and big plastic bags to the passengers and motorists. These people leave these items on the streets for EPWP cleaners to pick and take them to the landfill site. An adequate number of dustbins need to be provided to the small business for people to dumb waste.

Changes in lifestyle and negative attitudes towards traditional food and packaging leads to the consumption of plastic and littering. Traditionally, Limpopo citizens were

using packaging made of wood and clay. A study by Masekoameng and Molotja (2019) found that traditionally, people of Limpopo prepare mabele soft porridge as breakfast. Additionally, mopani worms, locusts, ants, mabele porridge, goat meat and others were served during lunch and super. The traditional food was kept in a reusable clay or wooden container when people were shopping or travelling to work in towns (Masekoameng & Molotja, 2019). Masekoameng and Molotja (2019) have found that some young generation resents this traditional food and their packages. The resentment has driven young generation to consume western food prepared in the streets of Limpopo Province (Masekoameng & Molotja, 2019). Education about proper consumption and disposal is needed to deal with plastic littering.

Street vending businesses increase littering in Limpopo. Kalitany (2021) reported that many street vendors sell food and goods in various plastic packaging that meets the expectations of customers. The cheap western foods sold includes coffee or tea in single-use cups, cookies and fruits in small plastic bags, lunch in Styrofoam packs, water and soft drinks in plastic bottles (Kalitanyi, 2021). This street vending business is often found in overcrowded streets of shopping malls, taxi ranks, suburbs, townships and village settlements of Limpopo Province (Schenk et al., 2023). More dustbins should be placed in overcrowded streets to reduce plastic littering.

The local government has inadequate bins to support street businesses. The businesses are not monitored to find if they use reusable product to reduce plastic littering. Kalitanyi (2021) added that selling products in busy streets make it difficult to maintain plastic waste management. The vendors are trying to clean their surroundings, but they do not have enough dustbins to cater for the disposal of multiple pedestrians (Kalitanyi, 2021). The responsibility of municipal government is to clean the streets and to provide receptacles to the people to prevent street accumulation (Greater Tzaneen Municipality, 2022). Kalitanyi (2021) emphasised that educating the street vendors to use reusable items can also reduce littering of plastic packages. This is because Kalitanyi (2021) has noticed that street vendors lack knowledge of using environmental-friendly products because majority use SUP products.

Schools also contribute to the littering of plastic material in Limpopo. The schools in Limpopo Province are densely populated and this increases littering. Stats SA reported that in 2022, there were 1.8 million learners in Limpopo Province. About

920 000 boys and 878 000 girls were studying in Limpopo schools. The report from Stats SA showed that the number of schools in Limpopo were 3847 in 2022 (Stats SA, 2023). The schools have vendors on the grounds selling fast foods in plastic. The waste is collected by municipalities to landfill sites. When the municipality trucks fail to collect waste, the plastic is littered and placed in overflowing dustbins. The waste attracts wild species because schools in Limpopo are surrounded by bushes. The wild species that are attracted to plastic with food residues may pose danger to learners and educators. Species like squirrels, birds, scorpions, rats, bees, flies, wasps, ants and snakes are often killed in schools. Some schools are invaded by rats which tear up textbooks, leading to shortage of books. The bottle is breeding grounds for mosquitoes, which cause malaria. And mosquitoes transfer malaria to learners. The uncollected wastes are burned in open fire. Education about plastic pollution and its adverse effects reduces littering.

Limpopo Province is mandated by the Department of Environmental Affairs to ensure the implementation of measures to prevent plastic pollution. The Department of Public Works in Limpopo reacted by issuing regulations to the municipalities. The municipalities use the regulations to resolve plastic pollution in the communities.

### 2.9.1 Measures Used by Limpopo Province to Reduce littering

Limpopo Department of Public Works, Roads and Infrastructure responded to the call by the Constitutional Law and National Waste Management Act. The Constitution needs people to live in a healthy environment. The National Waste Management Act wants the implementation of reduce, reuse and recycle to be practised for Constitutional rights to be achieved. Limpopo Department of Public Works responded to the call by the Constitution by allocating funds to district municipalities, which in turn transfer funds to local municipalities, which use these funds to roll out a programme called Expanded Public Works Program (EPWP). EPWP is a nationwide government programme implemented in all spheres of the government and state-owned enterprises to create jobs and skills to the unemployed people of SA. Through its channel funds are available for EPWP programmes in each municipality to clean streets, illegal dumps and bushes, and to collect the waste to respective landfill sites.

## 2.10 Plastic Problems in Greater Tzaneen Municipality towns

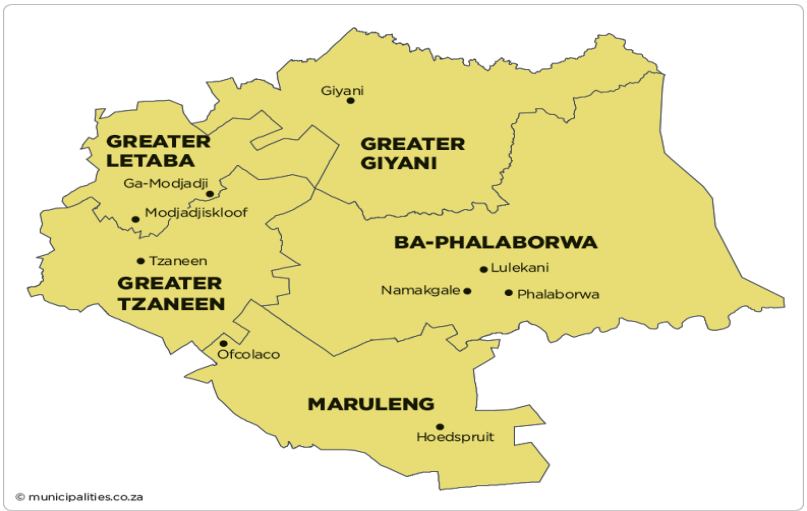



Figure 2. 3 Mopani District Map with the Greater Tzaneen Municipality

The Greater Tzaneen Local Municipality (GTM) is located 150 km on the East side of Polokwane City, Mopani District, Limpopo Province (Greater Tzaneen Municipality (GTM, 2022). The municipality occupies about 2 897 km$^2$ of the land size. Out of five municipalities of Mopani District, the Greater Tzaneen was the most populous with 478 254 people in 2022 (Stats SA, 2023). Stats SA also revealed that GTM was leading in the province with 124 420 learners attending school in 2022. Stats SA also indicated that the number of town households in 2022 was 100 495, rural 4 823 and informal dwellings 1 267. Roughly 80% of the household's income level is less than R38 400.00 annually (GTM, 2022). On average, many people earn R3 200.00 per month and most are employed in farms. The GTM households are dominated by 53% females. The municipality has a higher rate of unemployment amongst the youth population who reside in the villages (GTM, 2022). Mamabolo (2019) stated that the District Municipality has a greater advantage of Eco-tourism due to its closer proximity to Kruger National Park.

Besides Eco-tourism, Bunce (2020) argued that a large part of economic growth in GTM is played by agriculture. Due to high production of quality subtropical fruits, Tzaneen was nicknamed the 'tropical paradise' of Limpopo Province (Bunce, 2020). Bunce (2020) indicated that annually, the region produces around 223 000 tons of nuts and subtropical fruits. Some fruits such as avocadoes, mangoes and guavas are processed into achar and juices, which are sold in different plastic packages to

hawkers, supermarkets and other provinces (Tshitave, 2022). The achar, juices and fruits provided job opportunities for young men and women to establish informal businesses (Bunce, 2020). Bunce (2020) has noticed that restricted places such as pavements and streets of Tzaneen towns possess “no hawking signs”. The lack of these signs has led to street vending businesses on the streets and pavements seen selling goods in various plastic materials (Bunce, 2020). This in turn leads to the littering of plastic when there are fewer dustbins in such streets.

### 2.10.1 Strategies to Minimise Plastic Pollution in the Greater Tzaneen Municipality

The municipality of Tzaneen fulfilled the call for a healthy environment and the practice of reduce, reuse and recycle by implementing service delivery. The municipality responded by funding the EPWP project to collect waste from towns, townships and villages to the landfill sites (GTM, 2022). In towns and townships, the residents pay municipality collection fees. Once a week, residents in towns and townships place their dustbins on the streets on a scheduled date to be collected to the landfill site. In the villages, the municipality has erected drop-off centres and placed large communal bins. The waste collection is delivered free of charge in the villages as mandated by the government. The EPWP programme has hired youth to pick up waste in streets and illegal dumps of the villages. The youth take the waste to the drop-off centre and recycle them before they are taken to the landfill sites. The waste is collected by municipal trucks to the landfill site in Tzaneen town. The EPWP was also tasked to conduct plastic pollution awareness door- to- door to the villagers. The main aim was to educate people to practice reduce, reuse and recycle. The municipalities placed the drop-off centres close to primary and secondary schools for the EPWP programme and schools to partner in educating learners and educators. In this way, the municipality ensured that learners acquired knowledge and skills for sustainable consumption and production procedures.

## 2.11 Plastic Problems in Rural Areas of Greater Tzaneen Municipality

There are 125 villages in the Greater Tzaneen Municipality where 80% of people live (GTM, 2022). Agriculture and tourism are the major contributors of economic growth in the villages. The two economic impetuses have increased littering in the villages. Economic growth in agriculture was influenced by the “Rain Queen Modjadji”, who was

providing rainfall to the crops of the villagers. Closest to the Rain Queen dwellings grew the primitive plant species of Cycad (GTM, 2022). The government protected and preserved this ancient species of Cycad in Modjadji Nature Reserve. The Reserve brought tourism to the villages and the explosion of street vending businesses. The villagers can produce mangoes, bananas, avocadoes and nuts and sell them to tourists and amongst themselves. The green mangoes are also sold to factories that cut them into smaller pieces to make foodstuff called “Achar”. In the factories, smaller pieces of green mangoes, spices and cooking oil are combined to make achar. The villagers are also capable of producing achar and sell it to street vendors, local markets and schools. The villagers were using steel cups to sell and buy achar. Since plastic was produced, the foodstuff is now sold packed in a variety of plastic containers. The high consumption of plastic in the villages increases littering; so, education about plastic pollution is needed.

Attitudes towards traditional containers and standard of living increased littering in the villages. The villagers were using pots made from clay, baskets made from dried grass and containers made from dried round vegetable to sell and buy crops. Masekoameng and Molotja (2019) stated that traditional containers made of clay were used to store and cook food. In addition, wooden dishes, cups and plates were also used to wash hands, serve food and drinking liquids, but people have turned to plastic bowls, plates and cups (Kandoli, 2022). Amboro et al. (2022) also found that people in the villages have switched from these traditional cutleries used for storing, cooling, cooking food and drinks to plastic packaging products. The villagers changed to plastic because traditional containers had more disadvantageous characteristics than plastics. Amboro and Purwasito (2022) claim that clay items are no longer preferred because they are heavy, fragile and break more easily than plastic. Kandoli found that wooden cutting boards harbour harmful bacteria because they are hard to clean (Sekoai et al., 2020). Plastic cutlery is used intensely because cutlery designers believe that the material property of plastic cutlery retains the taste of the food, and wood mixes itself with food (Carvalho & Spence, 2021). Raising awareness about the plastic material would reduce plastic consumption and littering.

Poverty alleviation schemes in the villages increase littering. These schemes are an informal group saving formulated by women in the villages. They are well known as Accumulating Savings and Credit Association or Rotating Savings and Credit

Associations (Lukwa et al., 2022). Lukwa et al. stated that this informal saving group is common in low- and middle-income countries worldwide and has been given names. This savings in Nigeria is called Isusu, Kuries in India and Tandas in Mexico. In South Africa, this informal savings is commonly called 'Stokvel' (Lukwa et al., 2022). The initiative helps women in the villages to conduct functions such a wedding celebrations, funerals and birthday celebrations. In stokvels, women gather in a group of 20- 30 members and contribute R150 each in case of a death, birthday and wedding of a family member.

The Stokvels are collective contributions done to garner discounts in major wholesalers and retail stores (Lukwa et al., 2022). Lukwa et al. (2022) stated that about 30% of these Stokvels are described as grocery stokvels. The group decided that a person receives grocery that includes 10 Kg rice, Mayonnaise, 10 litre cooking oil, braai packs, 6 pack of 2 litres cool drink, 5 litre Juice, Styrofoam containers, water bottles and plastic cups. This grocery is covered by single-use plastics and is used during the celebration. In many villages around Tzaneen, the plastic wrapper of this grocery is burned after the celebrations to reduce waste. The municipality needs to educate the communities about plastic pollution and its impact on the environment. Education for sustainability would ensure sustainable consumption and production of plastic and the protection of the environment.

### 2.11.1 Strategies to Prevent Littering in Rural Areas by Tzaneen Municipality

The villagers have drop-off-centres close to schools where they dump waste (GTM, 2022). The residents dumped waste into the large skip bins without separating them. The EPWP workers sort waste and the waste truck transport it to landfill sites. This waste management strategy is rendered once a week by EPWP in the villages (GTM, 2022). GTM has revealed that due to lack of funds, the EPWP is unable to render the service fully in surrounding villages. The uncollected waste in large skips forces the communities to dump it in illegal dumps. Some villagers bury and burn waste in their own households (Rodseth et al., 2020).

Studies have shown that the backlog of uncollected waste in the villages is common in Limpopo municipalities. Sekgobela and Semenya (2023) found that Polokwane local municipality is providing irregular waste collection to GaMothapa village, and villagers reduce it through open burning. Another study by Baloyi and Matloga (2024) have

found that Collins Chabane Municipality has waste collection backlog in Vuwani village, and villagers had protested for poor service delivery. Findings from Selomo (2022) found that Polokwane Municipality does not provide waste collection to Matobole village, and villagers resorted to burning wastes.

The open dumping sites along the roads in the villages poses problems to domestic livestock such as goats, sheep and dogs (Nxumalo et al., 2020). Although the littering of plastic is high in rural areas, there has been more recycling noticed by older people in the villages (Nxumalo et al., 2020). A study done Nxumalo et al. (2020) in rural areas of Eswatini has shown that plastic containers are reused to store tea bags, sugar, salt and spices. More funds are needed to service vehicles that transport wastes and conduct plastic litter education in rural areas.

### 2.12 Plastic Problem in Rural Schools of Greater Tzaneen Municipality

The Greater Tzaneen Municipality has the highest number of learners attending schools. According to Stats SA, schools in Greater Tzaneen are the most overcrowded in the municipality (Stats SA, 2023) and are generating more plastic waste. The NSNP programme, school vendor business and tuckshops close to schools have increased littering. Muller et al. (2023) have discovered that learners are eating less from the National School Nutritional Program (NSNP). The learners claim that some foods are not edible and not enough to satisfy their appetites. Learners who do not like NSNP food seek other options, which eventually result in increased plastic pollution. These learners buy fast foods sold by school vendors and tuckshops during lunch time (Mahopo et al., 2023). The majority of fast-food sold are covered by plastics and are discarded on the grounds or overflowing dustbins. There are fewer people who are hired to pick up waste in schools, and this leads to the accumulation of waste in open spaces. The hired people often dump some waste into large skip bins provided by the municipality. Some wastes are burned in an open fire and the smoke reaches the classrooms.

The large skips close to schools are not collected regularly by Tzaneen municipalities. The waste releases strong odours and flies. The wasted plastic items on the school grounds attract wild animals, birds, chickens, cats, insects and snakes. Species like birds feed on plastic contents by tearing and pecking on the plastic. This poses danger after swallowing plastic. The plastic containers become breeding grounds for

mosquitoes. Rats are tearing off books in libraries, leading to shortage of textbooks. Some species of reptiles like snakes may become extinct as they are constantly killed when encountered on the school ground. In some cases, learners are beaten by wasps on their way to classrooms. Spiders create spider webs on the ceiling of school roofs and reduce the aesthetic value of classrooms. The ceilings of the schools are breeding grounds for bats and are damaging the ceilings and adding more costs to repair.

### 2.12.1 Strategies to Curb Littering in Rural Schools by the Greater Tzaneen Municipality

As compelled by human rights in the Constitution and the National Waste Management Act, the GTM responded by erecting drop-off facilities next to schools. The GTM aimed at partnering the EPWP programme with schools to educate learners about separating waste at source by building 66 drop-off facilities close to schools (GTM, 2022). EPWP was entrusted with raising awareness about plastic pollution and its impact on learners and the community without collaborating with them. The GTM (2022) stated that the EPWP programme is funded to provide waste collection and awareness education to the community. The lack of funds leads to lack of service delivery to the community and schools. The massive littering in schools is an indication that learners are not exposed to education for sustainable development in rural schools. This lack of education on sustainability on both young and old was confirmed by the Department of Environmental Affairs in 2020. In 2020, DEA stated that 60% of schools and municipalities taught learners and the community about waste minimisation (DEA, 2020). Besides the municipality, for sustainability has been introduced to schools for educators to teach education learners sustainable developments. Education for sustainable development was integrated into CAPS subjects like Life Sciences, Agricultural Sciences, Economics, Geography and Life Orientation (Department of Basic Education and training, 2011). This education was trusted by UNESCO to serve as a vehicle globally to educate learners about sustainable development (UNESCO, 2017). UNESCO trusted that if sustainable development is practiced in schools and in the communities by 2030, sustainable consumption and production goal would be reached in every country. This is because learners would be equipped with knowledge and skills to join the community in fighting against plastic pollution.

This study intends to find obstacles that impede educators from raising awareness, and suggested solutions to commit learners to the sorting and recycling of waste in rural schools. In the next section, factors that hinder educators from applying education for sustainability in their teaching in rural schools are discussed.

## 2.13 Barriers Leading to Poor ESD implementation in rural schools

### 2.13.1 Insufficient education

The first step to downscale littering in rural schools was to merge commitments with practical educational activities and awareness. However, there are significant challenges noticed in schools in developing countries. They include insufficient provision of education and awareness about the causes and effects of plastic wastage. Educators in developing countries have poor litter management practices because of narrow litter management knowledge and awareness (Ryan and Deci, 2020; Uddin, 2023). Thus, educators in rural schools provide limited education about the impact of plastic littering in the environment. They fail to conduct outdoor education and awareness activities because they have inadequate knowledge of approaching such activities. In addition, a strong internal motivation that could encourage learners to engage in pro-environmental behaviours is when they have knowledge and awareness of the procedures and importance of recycling (Dalu et al., 2020; Kush et al., 2022).

Moreover, they do not teach learners to dump waste in a proper way. For this reason, learners in rural schools possess little knowledge and awareness about plastic pollution and proper waste disposal. Therefore, insufficient education and awareness of have been widely noticed as barriers to successful solid waste disposal (Uddin, 2023; Yuksel, 2021).

Educators do not teach waste management and engage learners in waste management practices. Studies by (Kasavan et al, 2020; Uddin, 2023) found that when learners are not taught about waste management in schools, they will be less concerned about protecting the environment and littering and will perceive waste as disgusting. Bennett and Alexandridis (2021) reported that educating people, consumers and plastic manufactures about plastic recycling increases recycling. They believe that recycling education is a better way to maximise the recycling of waste. Bennett and Alexandridis argued that recycling methods change over time and understanding how the recycling programme functions is necessary. Recycling

education can cause a change in the behaviour of participants and increase their participation. This was indicated in a study by Yusuf (2022) in which educators were surveyed before and after participating in a recycling awareness programme. After the programme, the educators reported being more aware of purchasing recyclable products and recycle them. These waste management activities are not practiced in their own schools with their learners. The survey reflected that educators were willing to purchase recyclable plastic materials rather than those who did not participate in a programme.

### 2.13.2 Poor waste management

Poor waste management practices have become a worldwide school management challenge in developing countries (Ampofu, 2020). Rural school grounds and classrooms are filled with plastic materials that are not recycled. Cheap plastic bags in different sizes and shapes are excessively found in most remote villages and rural communities (Mihai et al., 2021). For this reason, food that people buy daily from the local market are packed in plastic. Research by (Müller and Süßbauer, 2022; Permana et al., 2022) have opined that people would not avoid plastic consumption because their preferred foodstuff is wrapped in plastic.

Improper disposal of plastic items in open spaces poses danger to local species. Pied crows usually feed on snakes hiding unnoticed in many school yards. The birds have changed their diets and now feed on small plastic bag contents wasted recklessly on the school grounds. The birds peck and tear plastic bags into pieces and swallow them. Research has shown that plastic debris swallowed by birds may suffocate and entangle them and lead to their death (Clark et al., 2023; Schutten et al., 2024). Educating learners about the impact of plastic pollution and awareness about the need for environmental protection promotes the utilisation of eco-friendly products (Pahlevi & Suhartanto, 2020).

To add, most rural schools do not have cafeterias; shades of trees are used during lunch time to sit and eat food. Littering attracts snakes which threaten learners and discourage them from relaxing under the trees. In some cases, other learners skip lunch as they lose their food when they run for safety. This point highlights how pied crows have adversely impacted the lives of the people by changing their diet from feeding on snakes to consuming small plastic bags. Hendrarso (2021) suggested that

the indiscrimination of dumping found accumulating in the schools resulted from poor waste management. Educators need to cultivate the culture amongst learners of reducing, reusing, recycling and disposing of plastic securely in the trash bins.

### 2.13.3 Lack of incentives

Schools could persuade learners through verbal encouragement or incentives to motivate them to recycle and change their behaviour. Recyclable plastic nowadays is valuable and can be utilised to diminish littering in rural schools. Sometimes learners are not aware that some waste that they litter could be recycled. Mir et al. (2021) stated that educators need to teach learners about incentives to recycle recyclable products. This would in turn encourage them to recycle plastic materials made from PET. People use PET in large numbers because they are lighter and tougher than glass. Most learners buy soft drinks made of this material from shops near schools and vendors operating in most rural school yards.

Learners also consume soft drinks packed in cheap plastic sachets from local vendors. The littering of plastic has risen in school because educators do not raise awareness about the importance of recycling PET packages. Teaching learners to recycle PET not only provides incentives but can save natural resources. Study by (Gabisa et al., 2023; Kou, 2019) reflected that recycling PET saves natural resources such as coal, crude oil and energy. In addition, teaching learners about toxic greenhouse gases, for instance, toluene, acetone, trichloroethane released during PET manufacturing (Kou, 2019) is essential to mitigate littering PET containers.

Research has shown that a monetary incentive known as the Deposit- Refund Scheme (DRS) is beneficial in the reduction of PET plastic bottles in schools (Allen- Taylor, 2022; Alpizar et al., 2020). Schools should consider the introduction of DRS to minimise PET littering. Alpizar et al. (2020) regarded DRS as a crucial incentive for litter picking up and recycling. Alpizar et al. (2020) added that as DRS is a monetary incentive that involves the returning of empty PET package, it assists in recycling, reusing and lessening littering.

The DRS has been found to be successful in recovering plastic bottles in many countries. Developing countries that have succeeded in recovering PET bottles are South Africa and Nigeria. Developed countries include Denmark, Norway, Australia,

Sweden, United States and Finland (Roca et al., 2022). Therefore, coupling recycling, reusing and reducing with PET monetary incentive (DRS) in schools could change the littering behaviour of learners. The absence of PET items in retail stores could be due to lack of funds from the government to assist companies in producing PET items. In turn, PROs cannot raise awareness to the public about the availability of Deposit Refund Schemes.

### 2.13.4 Inadequate resources

Learners' negative attitudes towards litter pick-up could be discouraged by the provision of equipment that could be used to hold dirt. Rural schools do not provide educators with equipment and tools to practise litter collection with learners. Mir et al. (2021) suggested that educators should provide gloves, bins, refuse bags and medical emergency kits to learners. This equipment could help to encourage recycling and sorting of waste with ease. Schools are running feeding schemes called the National School Nutritional Programme (NSNP). Most learners do not eat vegetables like butternut claiming they are not edible. Due to insufficient garbage bins in rural schools, learners drop the food on the ground. Some trashes are placed in trash bins that are already full. In some cases, papers from classroom activities, plant leaves and plastic wrappers from shops are dumped in one bin. The separation of waste at source is required to enhance recycling.

Research by Tinuke and Aditola (2020) has shown that majority of developing countries do not practice separation of waste at source, a technique which is highly rated to serve as a conduit for sustainability. Similar findings were revealed by a report from Statistics South Africa (2018), which shows that older people aged 40 and above separate waste more than younger people aged 18-39 years. It is important to bridge the gap between young and old education about waste separation.

Research has revealed that a shortage of facilities and infrastructure exacerbates littering in rural areas (Mir et al., 2021). When a large amount of waste accumulates in one area, schools burn the waste containing plastic. Tzaneen Municipality is criticised for poor service delivery. Therefore, inadequate resources are a major cause of littering in rural schools and an obstacle in the implementation of ESD outdoors. Schools need newspapers, magazines, internet access, and television to provide learners with information to supplement books at schools. The media coverage has

more information needed to change the attitudes of learners about littering. A study conducted in Malaysia by Mahat et al. (2023) among higher education students reported that the Internet is their most preferred choice for finding more information about environmental issues. The authors went on further to suggest that other media forms should be appreciated as they can also be effectively used in disseminating environmental information (Ayanwale et al., 2023). Awareness of plastic litter is hampered by shortage of technological tools such as web sites or computers**.**

### 2.13.5 Lack of time

ESD is a multidimensional and comprehensive field that requires different teaching strategies in overpopulated rural institutions. School Management Teams (SMT) often lack planning to manage curricula in overcrowded schools. A study conducted by (Shin et al; Uddin, 2023) revealed that lack of support, interest and time from the SMTs impedes the successful implementation of ESD in rural schools. Educators are overloaded with multiple subjects, grades and class sizes of up to 80 learners. However, the SMT are unable to write a letter to the Department of Education to supply rural schools with more educators. Oversubscribed subjects in rural schools are Life Sciences, Geography, Agricultural Sciences, Economics and Life Orientation. These are subjects where environmental education such as proper waste management should be stressed in class. The proper waste management such as recycling need to be practised outdoors to change the littering behaviours of rural school learners. The educators in rural schools are faced with challenge of catching up the work when they are absent from school. The SMT does not look for another educator to help learners while the other is off duty. The educators are required to conduct morning study, afternoon study and saturday lessons if they were absent for one or two days as a way of catching up with the lost time. Saturdays are used often in rural schools to catch up with previous lessons, writing activities and revision before the following week topic starts. In this way, educators in rural schools have limited time to prepare a variety of strategies for environmental education lessons to become effective.

The circular economy needs to be ushered in such a way that educators persuade learners to participate in recycling programs. By employing one teaching strategy in environmental education lessons, pro-environmental behaviour is limited. Research (Hamalosmonglu et al., 2020; Sadeghie, et al., 2020) suggested that various teaching

methods such as film watching, photovoice and case studies could help educators to teach the 3Rs approach and reduce littering in rural schools. Photovoice is a visual research methodology that invites participants to use photography to tell stories about their lives, experiences and issues that matter to them (Mooney & Bhui, 2023). For example, a study conducted by Coronado et al. (2020) has proven that after being exposed to teaching tools mentioned above, most science educators in Spain understood the 3Rs approach and began practising them in their schools. This methodology can be utilised to encourage learners to participate in recycling programs provided in rural schools. They are discussed below:

#### 2.9.5.1. Photovoice

Omar (2023) regarded Photovoice as a tool that can be used to probe how learners think about the 3Rs approach to encourage them to participate in a school programme. Coronado et al. (2020) indicated that this method is used in universities and gives an in-depth understanding of learners' perceptions and beliefs about sustainability topics such as recycling (Shaw, 2021). The methodology allows learners to choose an environmental topic and reflects their chosen environmental issue in a photo (Coronado et al.., 2020). It saves public school educators' time to prepare lessons on recycling. This in turn, gives learners time to express their understanding of the effect of littering on the environment and measures needed to deal with littering. By providing learners with a school base project about photovoice, learners will take photos about the effects of littering on their local environment. In that way, learners would develop positive attitude towards recycling and reduce littering in their schools.

#### 2.9.5.2 Video

Environmental education films (E-films) are used to activate learners' interests in learning about 3Rs (Omar, 2023). E-films are used widely to show environmental destruction in an environmental education course (Hamalosmonglu et al., 2020). Research has shown that educators need to introduce videos that display problems that arise when people litter on the environment. Hamalosmonglu et al. (2020) posit such videos are required to stimulated learners to pay attention to the effects of littering on the environment and to take responsibility for managing littering. This method will be useful to educators who struggle to teach overcrowded classrooms since it catches

the attention of learners and help them to understand the topic. SMTs should ask the Department of Education to provide educators with videos about litter management in schools. This will increase knowledge and awareness about recycling and encourage learners to participate in recycling.

### 2.13.6 Lack of educator training in environmental education

Environmental Education (EE) has been infused in all South African schools' subjects. Although EE content is infused in Curriculum and Assessment Policy Statement (CAPS) subjects, the Department of Education did not train educators. The department did not support schools with funds and resources to implement EE efficiently. Studies by (Sikhosana et al., 2020, Uddin, 2023) confirmed that EE is not effectually integrated in teaching and learning procedures. Bopape et al. (2022) highlighted that lack of funding educators' environmental projects is a factor impeding implementation of education for sustainability in schools.

The shortage of trained educators in environmental education is a primary obstacle in the implementation of environmental education policy. Uddin (2023) advised that educators in developing countries have little practical knowledge of plastic litter and understanding of what to teach learners. Most educators currently teaching environmental education subjects have no knowledge of plastic pollution and its impact on the environment. Tertiary institutions where those educators obtained their qualification should be blamed because they never provided educators with practical lessons on proper waste management (Debra et al., 2021).

Debra et al. (2021) also suggested that plastic waste in developing countries schools can be downsized by offering practising skill to educators. Government must focus on supporting educators with workshop on proper waste management skill to minimise littering in schools. According to Uddin (2023) this is line with Agenda 2030's sustainable 17 goals, which stipulates that for developing countries to attain goal 12, educators' lessons should be practically oriented.

Educators need to be trained in topics related to ESD and methodology associated with imparting knowledge, obtaining resources and assessing learners formatively and practically. Thus, educator need training on plastic pollution, its negative effect and disposal to effectively teach learners in schools. Moreover, educators must be trained

to conducts scientific research projects, investigations and experiments in schools. This is because, research need topics like marine littering to be taught in class (Bettencourt et al., 2021). For educators to teach such topics in class, an access laboratory is required. They stated further that they are difficult to teach theoretically because learners need to see microplastic with their own eye (Bettencourt et al., 2021). Additionally, Bakar et al. (2021) emphasise that training teachers is essential, as it allows educators to enhance their teaching approaches and enable learners to develop ESD competencies. Thus, training institutions should teach educators practically how to conduct waste management projects for littering in rural school to reduce.

Trained and qualified educators in ESD would help learners gain the knowledge and skills to achieve Sustainable Development Goal (SDG) 4, Target 7, which aims at eradicating littering (UN, 2021). Bakar et al. (2021) noticed that training of educators on litter education at Kibale National Park, Uganda, produced positive results after three years. It was found that learners being taught by the trained educators had a better comprehension on issues related to litter management. ESD training was supported by Uddin (2023), who stipulated that pedagogical techniques would assist educators to teach learners about environmental issues and plastic waste recycling.

### 2.13.7 Lack of school environmental policy

Litter policies and regulations at schools' level are designed by the school following the procedures of South African Schools ACT (SASA), of 1996. One of the regulations that control littering in schools is litter the code of conduct. In any school in SA, the School Code of Conduct, are formulated in accordance with the South African School Act of 1998, indicated that littering in schools is a misconduct (SASA, 1996). For littering to reduce in schools, mandatory policies must be formulated and introduced in schools. These policies assist educators to implement a ban on plastic littering for learners to comply with the rules of recycling. According to SASA (1996), the Policy should be formulated by electing committee members comprising educators, learner representatives and School Governing Body members. SASA added that every policy formed must be incorporated into the mission and vision of the school.

The purpose of the committee is to enforce the mandatory recycling policy that will promote learners to participate in school recycling program. Mariñas et al. (2022)

stated that regulations such as mandatory recycling are required to make learners to comply with disposal controls. In support of the committee in schools, Mariñas et al. (2022) added that the nomination of a school committee would make litter reduction education to become effective. Educators would teach about the impact of littering and involve learners practically in litter management programmes. Therefore, the explosion of littering in rural schools was due to lack of policy and education about the segregation of waste. For the committee to minimise the production of wastes in schools, the 3Rs principle of circular economy must be introduced (Banchonhattakit et al., 2022). Nguyen (2023) added that the circular economy principles are useful as less waste would be generated and environmental sustainability would be maintained.

Learners in schools litter more recyclable materials such as glass, cans and plastic bottles. Considering the recyclables produced in large amounts, schools could couple the 3Rs approach with incentives to enhance the participation of learners. A study by Kasavan et al. (2020) has indicated that revenue of approximately 0.6, 0.38, and 0.86 dollars per kilogram could be generated when one recycles glass, cans, papers and plastic. Recycling plastic in South Africa needs government to raise awareness about it because people recycle more glass and metals. In this way, plastic waste would be recycled and diverted from landfill sites, and natural resources would be saved for future generations.

### 2.13.8 Collaborations

Tackling the littering behaviour of a learner and cultivating sustainable ones that protect the environment requires an integrated approach in schools. Lee et al. (2022) indicated that when educators address learners about an issue that has devastating effects on the planet like plastic waste, a multidimensional approach is necessary. The approach requires that educators collaborate with parents, scientists, politicians, NGOs, engineers and artists outside school yards. These group of people could bring expert advice on how to recycle waste generated by learners at schools. For example, annually, a partnership between PETCO and Pick n Pay School club visits schools to educate and raise awareness about the detrimental effects of recycling. These visits are not reaching rural schools to add more knowledge about recycling plastics. In 2022, PETCO offered primary schools' posters and workbooks about how to minimise the negative impact on the environment. This collaboration of PETCO with Pick n Pay

school club is highly needed in rural schools for expert advice about reducing, reusing, recycling plastic and preventing it to become waste.

### 2.13.9 Logistic Barriers

According to (Gani et al., 2023) logistic barriers include a lack of teaching aid materials, sufficient funding, science equipment and laboratories, textbooks and access to outdoor learning activities. The presence of these logic barriers leads to the explosion of waste in schools. Schools belonging to Quintile 1 and 3 categories receive funding from the Department of Education called Norms and standards. Quintile 1 and 3 category schools are those schools in which learners do not pay school fees for their education and are funded by the government (SASA, 1998). The Department of Education is responsible for providing school buildings such as libraries, laboratories and classrooms with furniture, computers, exercise books and textbooks. Some schools in the rural areas have libraries with less textbooks that encourage recycling. Books with littering case studies can influence learners to adopt anti-littering behaviours.

In most cases, libraries in rural schools do not have computers and internet access. Learners in these schools do not have access to the internet to search for information about recycling. These teaching aids are expensive but highly effective in promoting recycling behaviours. Bennet and Alexandridis (2021) confirmed that internet access is important because people in the USA were confused about the type of plastic to recycle. The Keep America Beautiful organisation created a website to teach people about plastic recycling. Without computers with internet access, learners in rural areas would lack information about recycling. This is because most parents in rural areas earn less money and cannot afford to buy smartphones and mobile data. Therefore, the Department of Education should consider supplying schools with enough funds to purchase such valuable tools.

Improper disposal in rural schools is influenced by proximity and arrangement of the dustbins. Yang (2020) stated that longer distances and inconvenient locations of a dustbin increases littering as learners are lazy to walk long distances to throw waste. The shape of a dustbin also increases littering. In such cases, Yang advises that a shorter distance with convenient spot where a learner takes few steps increases proper disposal. The shape of a dustbin also increases littering. Gamariello (2024)

found that a special shaped dustbin may confuse a learner carrying a waste belonging to a particular shaped dustbin. If the waste does not fit into the dustbin, it will be thrown on the ground. Gamariello (2024) suggest that schools should use common rounded shape dustbins to encourage proper disposal. Rural schools should raise funds to purchase dustbins to reduce littering.

### 2.13.10 Demographic Factors and linguistic

Demographic factors influencing the littering behaviours of learners include age, gender, education level, political beliefs, number of children and social norms (Knickmeyer, 2020). Demographic factors are a barrier in rural schools and can present a challenge when it comes to the reduction of waste and recycling. Educators need to be aware of these demographic factors and tailor their environmental education efforts to meet the needs of the learners. In rural schools, learners come from different backgrounds, religion, culture and language.

#### 2.13.10.1 Religion

In rural areas, religious practices contribute to littering and could cause injuries to humans. The breaking of glass bottles along the road junction is a symbol of casting away bad luck. Educators need to be aware of such practices and increase awareness in learners about recycling and aim on home activities that would change behaviour of the parents of learners.

#### 2.13.10.2 Culture and Gender

Rural areas have deeply rooted customs and values that certain individuals should always adhere to. For example, in the villages, it is customary for women to keep the surroundings clean. Men are not allowed to clean and that might support the study, which states that men litter more than women. Gender should be known as a factor that affects littering in schools. Research by Ayeleru et al. (2023) has found that women participate more actively in recycling compared to their male counterparts. Therefore, it is the duty of an educator to raise awareness in schools to cultivate the proper disposal of waste in boy and girl learners.

#### 2.13.10.3 Language

For proper disposal of waste in rural schools, educators must use the language that caters for all learners in schools. In rural schools, there are learners who cannot read and write. Many learners of such calibre are favoured by government policy of Promotion and Progression Policy (Department of Education, 2015) to progress them to the next grade until matric level. Quick Progress Policy is a government initiative that promotes learners to the next grade due to age and number of years of repeating the grade. The educator must accommodate such learners when teaching about proper plastic disposal in schools. Although it is time-consuming to teach and translate the 3 Rs concepts in class, the educator must use language that learners can understand to reduce waste in schools. Many learners who are progressed need to be assisted in their home language like Sepedi or Xitsonga to participate in recycling of wastes.

#### 2.13.10.4 Age

Age is also an influential factor that increases littering in schools. Littering was found to be higher amongst the youth than old people in the community. To close the gap between young and old, educating the youth to recycle to reduce waste in schools and the surrounding areas is essential. The study has found that young people are aware of the negative effects of littering, but they lack knowledge of sorting wastes. Educators in rural schools need to educate and make learners to be aware. A study conducted by Coco Chin et al. (2023) realised that older students in university show a more positive attitude in sorting waste at source than youth in secondary schools.

#### 2.13.10.5 Income

Thakur et al. (2023) indicated that people with higher levels of education are more likely to participate in waste management and recognise the importance of environmental protection. They may also have more ideas on waste management and able to encourage their families to support and participate in waste management. Learners coming from high income sort and recycle than the lower-income class learners. Thakur et al. (2023) found that lower income class learners have poor knowledge of plastic pollution and its impacts. Therefore, they cannot separate waste and recycle plastic at school.

#### 2.13.10.6 Political belief

Lack of political will in rural areas is also a contributory factor which leads to increased waste production in schools and the community. The people living in rural and peri-urban areas are not provided with adequate waste collection from the municipalities. The communities do not have an anti-littering organisation or the political power to report poor service delivery to the municipality. Lack of organisers to deal with mass protests in the municipality has resulted in large heap of wastes accumulating in the rivers and streets of communities. A study by Kubanza (2024) indicated that PIKITUP is failing to collect waste from the residents of Windsor East of Johannesburg and the residents lack power to protect it.

In the villages, waste collection is often hampered by local headmen who demand certain amount of money from the service provider. If the service provider does not have money, waste collection services are not rendered. The village chiefs and councillors are consulted to grand authority to the municipal initiatives to render service collection by paying a certain amount of money (Modiba, 2023). Often, these incentives are not provided on time and the villages would have wastes pilling their surroundings. In support of lack of communication, Modiba (2023) indicated that there is little communication arranged amongst community members and between community leaders as well as the municipality and the community.

By raising awareness about the danger of plastic pollution to learners, environmental responsibility character would be built in them. Educators could help them to practice writing a memorandum to the municipal manager. The manager could be told that uncollected waste is burned in the communities and the smoke contributes towards global warming. For this reason, the learners could arrange themselves and submit the memorandum to the offices of the municipality. This was confirmed by Della Porta and Porto (2023), who stated that in a recent climate change strike, youth used political activists to influence governments to take steps to deal with climate change.

In that climate change strike, the youth demanded the government to ban plastic and other waste materials that could lead to climate change. A study by Boulianne et al. (2020) revealed that 1.4 million youth protesters around the globe joined the strike against climate change arranged by Swedish teenager Greta Thunberg. In addition, under the hashtag Fridays for Future, which took a year, learners walked out of their

schools to protest on the streets for government to act against climate change. Further, in 2020, youth went back to the streets to challenge the governments to act against climate crisis. The climate change strikes are an eye opener to the government to reduce the production of plastic. Thus, the government would take the necessary steps to ban plastic and encourage environmental-friendly products.

Boulianne et al. (2020) stated that some youth protests are taking place over social media platforms. These protests either support or oppose actions of the government, media, governmental or political organisation related to the climate issues. Though learners in rural schools would feel the need to voice their complaint over social media, they do not do so. A study by Boulianne et al. (2020) found that learners are afraid of negative reactions. This makes them reluctant to express their views on media online platforms. The educator can persuade learners to lodge a complaint to the local municipality by educating them to do so using social media. The opinions of other learners would help the government to be held accountable for their actions. In cases of uncollected waste in schools and the community, the local government would respond to the grievances and start to collect the waste. In that way, educators would create responsible learners who understand that it is their right to live in a clean environment. A study by indicates that the community of a certain village once protested poor service delivery in Tzaneen municipality. The municipality managed to render services to them after the protest.

#### 2.13.10.7 Number of children

The implementation of education for sustainability in rural schools is affected by the number of households. Research has found that learners coming from large family households' litter more than those from few households with few family members. These learners can throw the plastic waste in the surrounding area or drop it either in the water bodies or along the streets. Large family households of 6 members produce more waste than few families with one (Modiba, 2023). In schools, educators need to provide education and awareness to cater for learners coming from large households. This is because a study has shown that waste management practices are influenced by the size of households (Fadhullah et al., 2022; Noufal et al., 2020). In such families, parents often struggle to maintain discipline. The children can influence other learners to carry out ill-discipline behaviour associated with improper waste disposal.

### 2.13.10.8 Social Norms

Social norm is a major obstacle that can hamper the implementation of environmental education for sustainability in rural schools (Farage et al., 2024). Research has shown that when educators in rural schools pay special attention to social norms, learners can be committed to sorting and recycling plastic wastes. Farage et al. (2024) stated that identifying families, friends and neighbours as determinants of social norms that drive learners to litter or recycle is important. Social norms are rules that govern what is right or wrong in the community (Farage et al., 2024). The learners learn about recycling or littering from the community that lives with him. If the family of a learner has never recycled plastic waste, the learners would continue to litter at school (Farage et al., 2024). Farage et al. found that learners who litter more at school are influenced by friends. They stated that in most cases, friends lack knowledge and education about recycling. Therefore, educators need to put more effort into teaching recycling to the peers of learners to commit such learners to recycling.

### 2.13.11 Attitudes

The attitudes of educators are essential when it comes to decreasing plastic waste in schools. Studies have found that several initiatives were taken to include environmental education (EE) in curricula all over the world, and littering was reduced (Molstad et al., 2020; Uddin, 2023). Uddin (2023) found that the negative attitudes of educators made EE to face limitations and implementation issues. Positive attitudes from educators inspire learners to take part in environmental activities. Research findings conducted in Greece by kevrekidis et al. (2024) showed that educators presented ocean literacy with positive attitudes. Through positive attitudes, environmental stewardship amongst learners developed. A positive attitude about environmental issues and engaging learners in practical activities is essential. Araújo et al. (2023) indicated that through positive attitudes, learners aged 12- 14 were taken to contact with marine environments. The results showed that learners developed citizenship characters.

Uddin (2023) suggested that educators should be well-informed about environmental education for implementation to become successful. Through educators, future generations would be aware of the environmental issues. This in turn would help them in finding potential solutions. However, a discrepancy between educators' attitudes

and their actual behaviour was observed to be an obstacle to EE success (Van Rensburg et al., 2020). Consequently, researchers propose that educators should not only display a positive attitude, but demonstrate environmental protection behaviour (Molstad et al., 2020; Kevrekidis et al., 2024). Therefore, committing learners to separating waste into different bins and recycling plastic requires the positivee attitude of the educator.

### 2.13.12 Internet access

Educators are failing to implement environmental education due to shortage of technological tools such as smartphones, computers and internet access. Learners from rural schools do not have computers and smartphones to access EE information from the internet. This statement is supported by (Garcia-Mora and Mora-Rivera, 2023), who found that the shortage of internet connection affects low-income household learners. Al-Taai et al. (2023) defines internet access as learners' access to internet connectivity through personal computers, laptops, tablets and smartphones to obtain information from the internet. Most learners from rural areas have parents who earn little amount of money and cannot afford to buy computers and smartphones with internet access. Basar et al. (2021) contended that schools need to have computer laboratories for learners to access the internet and uncover new information.

Internet access is essential for learners to learn environmental issues through online learning. According to Mansor et al. (2021), internet access is important because learners could revisit their lessons by re-watching recordings made by the educator to strengthen their knowledge. In some cases, learners need online learning to deepen their understanding of an environmental issue. Online leaning is described as any form of pedagogy delivered using digital technology (Basar et al., 2021). Online learning is important for educators and learners as it allows them to communicate when they are outside the classroom. Basar et al. (2021) stated that through online learning, educators and learners` bilateral communication could be conducted. Thus, online learning with internet access allows educators and learners to hold meetings through video calls or chat on WhatsApp. Internet access gives learners an opportunity to view videos on an environmental issue and allow them to have conversations about it. According to Basar et al. (2021), internet access helps learners to access pictures and videos, navigate 'YouTube', and interact with each other.

Internet access, computers and smartphones help learners to play games that demonstrate recycling, reuse and reduce. Jiachen (2024) added that nowadays smartphones and computers are equipped with serious games. Those games have serious intention to promote proper waste disposal and to motivate learners to recycle. For example, ‘’Fox the Recycler’’ is a game intended to boost recycling activities in schools (Santti, 2020). The game was tested by learners at Kuopio (Finland) apartment. The results of the pilot indicated that learners’ recycling rate of plastic increased from 25% to 84%. Therefore, the Department of Education should build computer laboratories with internet access in rural schools for learners to use games to recycle plastic and reduce littering.

## 2.14 Theoretical Framework: Community Based Social Marketing Theory

This section introduces the Community Based Social Marketing Theory (CSBM) as a framework of the study. CBSM has five steps that the researcher needs follow to change behaviour of individuals. The section also explains that CBSM theory has different strategies that can be applied to change the behaviours of individuals. The section also indicate that commitment was used as an intervention strategy that would change the behaviour of learners in schools.

This study used the Community Based Social Marketing Theory developed by an environmental psychologist Dough McKenzie-Mohr as a research framework. The behavioural science especially social psychology in the theory provided insights and guiding principles on CBSM (McKenzie-Mohr, 2011). The principle governing CBSM is creating a sustainable community through behaviour change programs. McKenzie-Mohr asserted that CBSM stems from the premise that behaviour change initiatives can be effectively successful when carried out at community level using personal contact.

The effectiveness of CBSM theory in changing behaviour is due to a five-step pragmatic approach, which induces sustainable behaviour by developing a community programme, which shifted from the information-based programme. This is because McKenzie-Mohr (2011) discovered that information-based programmes only

increased awareness and results in change attitude but fail to elicit behaviour change. According to McKenzie-Mohr, this results in the creation of a gap between a person ‘s attitudes and actual behaviour. The gap poses a challenge to many social researchers because they wish to involve people in changing behaviour. For this reason, the CBSM can close the gap between knowledge and behaviour.

The pragmatic approach consists of five steps: selecting behaviours, identifying barriers and benefits, developing strategies, programme piloting, and broad-scale implementation and evaluation. These steps aid the programme developer to approach the behaviour change empirically and systematically. In this way, the intervention employed would become successful.

### 2.14.1 Below are five-steps to a pragmatic approach to encourage sustainable behaviour

#### 2.14.1.1 Step 1: Select behaviour

Step one assists the programme developer to choose a variety of behaviour that needs to be promoted (McKenzie-Mohr, 2011). When the behaviour was chosen then the researcher needs to select the target group. This study selected litter reduction. The learners will perform litter reduction in the school community.

#### 2.14.1.2 Step 2: Identifying the barriers and benefits

McKenzie- Mohr (2011) stated that this step allows the programme developer to identify barriers that impede people from performance of sustainable disposal behaviour. McKenzie-Mohr also advised the developer to identify benefits of engaging people in sustainable behaviour. The developer of a programme is recommended as well to make use of literature reviews, observations, focus group interviews and questionnaires. According to McKenzie-Mohr (2011), the information-seeking tools mentioned above would assist to find out internal, external and structural barriers.

The researcher distributed the questionnaires to learners and educators, conducted focus group discussions with learners and key interviews with educators, and took pictures of school litters for observation and review of literature. Learners’ questionnaires were analysed, and internal barriers were found. Thus, waste separation was not practiced in schools due lack of information. The waste separation

was also caused by structural barriers such as shortage of dustbins. The benefits would involve recycling waste to overcome the barriers mentioned above.

#### 2.14.1.3 Step 3: Develop Strategies

McKenzie-Mohr (2011) advised that once the barriers and benefits were found, the developer can develop the strategy to remove the barriers and promote the benefits. Programme developers are required to use social science techniques to change behaviours of individuals. As part of the requirements, the chosen strategy tools should use personal contact. This is because in social science, research individuals are most likely to change their behaviour when someone appeals to them directly. In this study, the developer introduces education about plastic awareness and three dustbins for sorting waste into categories. To perform waste separation and promote the recycling of waste in schools, the study employed a commitment strategy to encourage learners to sort waste and reduce littering.

#### 2.14.1.4 Step 4: Piloting the Programme

The programme developer is required to pilot the selected strategy through small scale before implementing the programme in large scale (McKenzie-Mohr, 2011). This involves randomly selecting the control group and providing them with questionnaires. The questionnaires are given to measure behaviour change against the test group. This also ensures that the language in the questions is well understood, and proper answers are given. According to McKenzie-Mohr, when the pilot test does not need adjustment and yield better results, then the developer can implement the project with the broadscale community. In this study, the questionnaire questions were tested with other group of learners. This study sought to find out if learners can answer questions in English because most learners speak Xitsonga and Sepedi. The study also sought to check mistakes and rectify them before it is carried out by the test group.

#### 2.14.1.5 Step 5: Broadscale Implementation

According to McKenzie-Mohr (2011), the programme developer in this step evaluates the implementation of a behaviour change programme on an ongoing basis. The evaluation of behaviour change programme informs the developer to employ a direct measurement of behaviour change. The behaviour change measurement involves the

recording or documenting of behaviour using direct measures and observations. This study documented the length of direct observation when learners were sorting waste in two schools. The study also documented the results of post interview and questionnaire as well as pre-interview and questionnaire. The results were compared to prove that an intervention strategy was successful.

### 2.14.2 CBSM Theory intervention strategy: Commitment Pledge

This section introduces intervention strategies that Community Based Social Marketing Theory stated could be employed to elicit behaviour. Commitment in this section is described as the best tool suitable for enforcing behaviour change amongst the youth and adults. It also explores the domains where commitment was successful. The reasons why making commitment effective were explained. Lastly, two types of commitment were described.

CBSM theory is made up of various intervention strategies that could elicit a change in behaviour, for example, incentives, feedback, prompt and information, social modelling and commitment. These interventions are powerful in inducing waste sorting and recycling and reduce littering. Amongst all six strategies, commitment was proven to be a powerful behaviour change tool (Deng et al., 2022; Knickmeyer, 2020, Lindemann-Matties et al, 2021; Ugwu, 2021) that also produces long lasting behavioural changes Commitment is broadly defined as “a pledging or binding of the individual to behavioural acts” (Kiesler and Sakumura, 1966 as cited by Deng et al., 2022).

Alremeithi et al. (2023) stated that the commitment-making technique was mostly tested using adults’ population than youth population. In adults, the researchers found that commitment-making advanced pro-environmental behaviour and yielded considerable behaviour change (Deng et al, 2022; Jacob et al, 2021). Though most previous studies discovered a huge impact of commitment-making in adult population (Alremeithi et al., 2023), there are few which discovered the effectiveness of commitment on youth population aged 14- 19 (Deng et al., 2022; Lindemann-Matties et al, 2021). The study shed light that commitment could also be applied on the young generations. The young generation age 13- 20 are targeted in the study. The reason is that educating them about committing to recycling could cultivate responsivity that could be transferred to the future generation (Zeiske et al., 2021).

### 2.14.3 The Domains where Commitment Pledge of CBSM was successful

Commitment-making has been found to be a powerful tool in shaping people's behaviour in a variety of domains, such as recycling and sorting (Jacobs et al., 2021; Lindemann-Matties et al., 2021). Since commitment changes is capable of changing littering behaviour of individuals to protect the environment. The present study chose it to change the attitudes of learners towards sorting and recycling plastic waste in schools.

### 2.14.4 Effectiveness of Commitment Pledge of CBSM

Many research fields using the commitment pledge believe that a human behaviour is guided by two principles, commitment and consistency (Isenberg & Brauer, 2022). Additionally, Isenberg and Brauer (2022) elaborated that people have a tendency of keeping consistency with their self-concept, self-presentation, values and behaviour. This idea makes commitment and consistency efficient in building behaviours of people.

Commitment is an act that binds people to future behaviour. For this reason, it provides a mechanism for people to develop consistency (Isenberg & Brauer, 2022). In this case, when a person makes a commitment to perform to sort and recycle waste, they can follow through that behaviour (Isenberg & Brauer, 2021). For instance, Lindemann-Matties et al. (2021) narrated that a person who voluntary makes a commitment to alter a particular behaviour for a particular period, like shopping plastic-free, he or she would often go shopping with an environmental-friendly bag. Thus, how the person lined their self-concept with the committed behaviour. Ugwu et al. (2021) stated that people value more a consistency between what they say and what they do. This persuasive nature of commitment-making fosters skilled behaviour for a short or long term (Deng et al., 2022).

Another way that shows that commitment is the best instrument that shapes behaviour is when a person encounters dissonance, which is line with the Festinger (Festinger, 1957 as cited by Ugwu, 2021) theory of Cognitive dissonance. The theory proposed that people have an internal motivation to retain attitudes and behaviours in harmony to minimise cognitive dissonance. They become uncomfortable and restless when their attitude is not in line with their behaviour. Ugwu (2021) revealed that without

hesitation, people take steps to reduce the state by changing their behaviour or their attitudes. Thus, when learners' litters after commitment they would feel quilty and start picking the waste and throw it appropriately into the dust bin. They would do so without being told by anyone. Such drastic steps happen when commitment was drawn without any pressure and voluntarily. Moreover, Ugwu (2021) stated that moment makes an individual to feel free to act differently. The situation compelled them to admit responsibility for the consequences of their behaviour. This also makes them to believe that they can become their own best persuader. Ugwu (2021) advised that previous researchers have used this strategy to influence people's attitudes and practices. For instance, commitments were also used successfully to encourage participation in a curb side recycling trial in United Arab Emirates (Alremeithi et al., 2023).

### 2.14.5 Public and Private Commitment tools of CBSM

For commitment to be potent in changing behaviour, it should be written in public or in private. Lindemann-Matties et al. (2021) gave a distinction between public and private commitment. When making a public commitment, others are aware of commitment. They expect that person to change the behaviour they are committed to. However, taking private commitment, others are not aware of the commitment made. Therefore, they are not expecting that person to make alterations to the behaviour that they are committed to. They do not know that the commitment was made. In this case, van der Werff et al. (2019) stated that private commitment to save energy would not change the extent to which one sees himself as a pro-environmental person. For this reason, in this study written and public commitment would encourage recycling and sorting of waste more than written private commitment.

## 2.15 Conclusion

The literature review provided insight into plastic material as a commodity that is versatile and durable. It is also presented as an essential item that is valuable to the life of a person. It saves lives in hospitals, is used to make furniture, clothes, build houses, among others. These characteristics encourage people to use it more intensively than glass, steel and wood. The global problem with plastic is that most of them are made to be used once. This study has also shown that plastic manufacturers are producing more single-use plastic than reusable packaging. People in turn are

disposing it improperly in the environment. The major problem with plastic is that it does not decompose; rather it breaks down into smaller pieces. The result of its improper disposal is that it suffocates marine bird species, reduces the aesthetic value of countries, and incurs the cost of cleaning it. Plastic affects the life of people feeding on marine animals and causes climate change.

Different countries around the world have found a strategy to reduce the consumption and disposal of plastic. Many countries have adopted Extended Producer Responsibility, but the lack of funds hampers the progress of EPR, which has reduced plastic disposal in European countries. In some governments, plastic ban is not promoted by plastic producers who fund political parties to oppose plastic ban. In some rural areas of South Africa, plastic littering is caused by lack of littering policy, funds for dustbins, insufficient education and lack of training to teachers, amongst other things. The literature review also gave insight knowledge into the framework that the study employed. This framework contains a power tool called Commitment that could help learners to recycle, reuse and reduce plastic.

# 3 CHAPTER 3: RESEARCH METHODOLOGY

## 3.1 Introduction to the Methodology

This chapter covers the methods used to answer the study's research questions and objectives. It gives an in-depth account of the study area, the data collection techniques used (quantitative and qualitative), the sampled respondents, ethical clearance and the selection of learners and educators. It also explains the research design and approach that were selected and why. The chapter explains that structured questionnaires were designed to gather quantitative data. The procedures of the study are outlined. Interview guides also explained that they were made to gather qualitative data from educators in Key Informant Interviews (KII) and from learners in Focus Group Discussions (FGD). An audio-recorder was used as a method of collecting interview data. The method of collecting data from qualitative, quantitative, interviews and observation was done through triangulation. The qualitative data was then analysed using thematic analysis, which looked for patterns in the data set. The study used the observation strategy to observe learners sorting waste procedures after taking the Commitment pledge. The statistical methods technique, paired t-test, was used to analyse quantitative data. The ethical considerations during data collection are discussed. The validity and reliability of questionnaires are discussed.

## 3.2 Ethical Clearance

All data collection study procedures used in this dissertation were approved by the Human Research Ethics Committee (Non-Medical) of the University of the Witwatersrand, Johannesburg, South Africa (Clearance Certificate Number H19/11/58 – Appendix 1). This study was approved by the ethics committee as having a low risk to the learners.

The researcher was granted permission to conduct the study in selected schools by the Head of the Department of Education in Limpopo Province (Appendix 2). After receiving permission, the researcher contacted the principals of the two selected schools, A and B, where the study was conducted to obtain permission.

Once the two school principals allowed the researcher permission to conduct the study, the researcher provided educators with participant information letters to read, and they then signed the consent form.

Learners were permitted to participate in the study if they presented an assent form, and after parents had signed a consent form to allow them to participate in the study if they were below the age of 18.

### 3.2.1 Confirming participants have given informed consent

Nijhawan et al (2013) define informed consent as the agreement of participants to take part in a study after they were fully informed of the nature, purpose and the likely outcomes of the study. Educators and learners over and below 18 years of age were given sufficient information about the study to make an informed decision about whether to take part. Learners under the age of 18 required parental approval to take part in the study, and those who were allowed had their assent forms signed at school once consent from their parents was returned. The researcher clarified the purpose of the study to parents telephonically as restrictions of Covid-19 at the time limited access to the school premises. Parents' signature on the consent form assured the researcher that learners were granted parental permission to receive information on all aspects of the research study. This principle entailed three equally important elements: 'consent', which meant asking people to agree to take part in the study without any coercion; 'assent', which meant asking the learners for their assent to take part in research; and 'informed', which meant giving them sufficient information on which to make a realistic judgement on the possible consequences of taking part in the study (Felzmann, 2009).

All learners and educators were informed that their participation in the study was completely voluntary and that should they feel uncomfortable with the interviews at any stage, they were free to withdraw. After the briefing, the learners and educators were asked if they had any questions or concerns about the study.

A total of 40 learners' and 10 educators' questionnaires were completed. A Focus Group Discussion (FGD) was conducted with a group of 20 learners and Key Informant Interviews were conducted with 5 selected educators in each school.

### 3.2.2 Ensuring no harm to participants

Affirming no harm came to participants, as explained by Sales and Folkman (2000) meant that the study participants should not be harmed or suffer distress in any way while participating in the study.

Interviews were held at the educators' or learners' convenience in an environment that upheld honesty and confidentiality as there was no audience that could have had an impact on the responses. No information that could expose the learners or educators, such as names or ID numbers were captured. The researcher made an extra effort to explain that the research results remain anonymised, that educators' and learners' perceptions would be used for improvements and not as a punitive measure if differing views were offered.

### 3.2.3 Confidentiality and anonymity

According to Saunders et al. (2015), the term 'anonymity' meant that the researcher/s would conceal the identity of the participants in all research findings (including research seminars, conference papers, journal papers and book chapters). To protect the anonymity of the study's participants, names and other contact information were not collected. Additionally, all the data was stored in a password-protected electronic file.

The term 'confidentiality' meant making clear who had the right of access to the data provided by the participants (Kaiser, 2009). Usually, it was the researcher or researchers alone, but what exactly was it that they kept confidential? In such cases, while you could protect anonymity, you were not, strictly speaking, protecting a participant's confidentiality. Whenever data for a study was collected, confidentiality of the findings needed to be assured. To protect the identities of the school, they were referred to as School A (Appendix 3) and School B (Appendix 4).

All interviewees were assured of the confidentiality of the interview. Participants were not required to provide any personal identifiers. The researcher took care to store information securely on a password-protected laptop which is kept safely in a locked office. The hard copies of the questionnaires were stored in a locked drawer to ensure confidentiality. Finally, the researcher provided her contact details should the research participants need to contact her.

### 3.2.4 Ensuring that permission is obtained

Research participants older than 18 years gave consent and minors gave assent before participating in the study. Written consent was obtained from participants as well as parents of learners under and above 18 years prior to all data collection activities. The consent forms were translated into the local languages for the parents.

## 3.3 Research Design

An intervention research design strategy was incorporated into this study as it focuses on changing behaviour of individualss. It refers to the process of designing and implementing a behaviour change program (Ross & Myers, 2017). They stated further that the main aim of designing a behaviour change program is to resolve problem and promote positive change among individuals. Ross and Myers (2017) stated that the intervention design program consists of six-stage process. First stage being analysis, where a researcher identifies and analyses the problem and stakeholders. In this study, learners and their littering behaviours were identified and analysed. In Second stage is design, in this case, the researcher design intervention objectives, goals and strategies. As expected from intervention design, the researcher in the present study designed objectives, goals and strategies for tackling littering problems in two schools. Third stage involve development in which the researcher develops materials, protocols and procedures. In this study, the researcher presented about plastic pollution and its impact, this was followed by presentation about school environmental policy that learners would follow when disposing of plastic waste. Then, the dustbins were gathered and labelled according to waste types. In the fourth stage is implementation in which a researcher deliver intervention, train staff and monitor process. The learners in this study were trained to dispose of plastic waste separately into the dustbins in

their schools. Then, the researchers asked and trained learners in school A to write a public commitment pledge to protect environmental resource. However, in school B, learners were asked and trained to write a private commitment pledge to protect and preserve environmental resources. Then, the researcher observed learners sorting plastic waste in schools A where written public pledge was made. The researcher also observed learners sorting plastic waste in school B where written private pledges was made for four weeks. In stage five is evaluation which the researcher is expected to assess intervention effectiveness, efficiency and sustainability.Therefore, the researcher in the present study assessed learners who made written public pledge in schools A and found that learners sorted plastic waste more than in school B where written private pledge was made. That proved effectiveness of a public commitment pledge in school A because learners sorted plastic waste as they have promised the public audience. In the private commitment pledge learners did not promise anyone to sort waste everyday. That in turn resulted in plastic waste being sorted less in school B. Sixth stages involve revising and improving the intervention based on evaluation findings. The present study research revised and improved written public intervention by observing learners in a follow-up week and encourage them to recycle plastic waste.

### 3.4 Research Approach

This study used the pragmatic approach that deals with practical things rather than theoretical things. The present study followed pragmatic approach because learners would be shown to practical to sort and recycle plastic waste. According to King (2021) pragmatic approach is a transactional experience that seek to investigate theory and action and not description of reality. This stance makes pragmatic beneficial to educational research. This is because it is an approach that acknowledges epistemological and oncological awareness. King stated that its influence on educational research shows that it focusses more on solving problem and not on the knowledge of the problem. The central part of this study was also based onsolving practical part of sorting and recycling plastic waste. This theoretical position of pragmatic approach is nestled on positivism and constructivism. As an approach in research, pragmatic encompasses qualitative and quantitave methodology and method to make its inquiry practical. The mixed methods of pragmatic approach help

to address research aim and researchquestions. This study used first observation, questionnaires and interviews to inquire about littering behaviours of learners to practically help them to dispose of waste properly. As pragmatic paradigm embraces qualitative and quantitative methods that shows that it is not committed to oncological or epistemological stance (King, 2022). King (2022) indicated that when one accepts to study social scientific knowledge with the approaches of pragmatism and not the stance of epistemological or oncological brings such researcher would be brought to abductive approach. Therefore, this study approach is pragmatic because it is concerned with application of plastic separation knowledge and reduces its impact on the environment. That means when learners had knowledge of plastic pollution, they are more likely to practically to sort and recycle plastic waste. In that way learners would reduce disposing plastic waste improperly in schools.

### 3.5 Sampling

This study was conducted in two selected high schools in Motupa Circuit, which has 13 primary schools and 9 secondary schools. The circuit is around Tzaneen town and falls under Mopani West District in Limpopo Province, South Africa. Motupa circuit schools are in rural areas up to 32 kilometres away from Tzaneen town. They are in Education Quintile 3, which means they are in the category where parents do not pay fees. The government's Nutrition Program supplies nutritious food to learners who come from low socio-economic income level families.

School A has 448 learners and 16 educators, and school B has 564 learners and 20 educators. The researcher selected 5 teachers from school A and another 5 educators from school B. The study used purposive sampling. According to Lune and Berg (2017), purposive sampling is a type of sample that is thought to be typical of the population regarding characteristics under study. Purposive sampling is used in a case study when working with small samples where the selected cases are particularly informative about the subject under the study. In this study, the participants were purposively chosen according to the subjects they teach, which deals with environmental issues. The learners were nominated by their educators and invited to participate in the study. The educators helped the researcher to select 20 learners from school A and another 20 learners from school B to participate in the study. In school A, 9 males and 11 females were selected, and 10 males and 10 females from

school B. Since the learners were minors under the age of 18, parental or guardian permission was sought. The assent of learners was sought after parents signed consent forms.

Attached to each of the two schools that were selected to participate in the study are properties owned by Greater Tzaneen Municipality. Each property has large skips that are used as drop-off centres for schools and the community to dump their waste, which would be collected and taken to the landfill site outside Tzaneen when they are full. The researcher chose these two schools because educators are struggling to control the littering of items from the government National School Nutrition Programme, plastic packaging from the food items sold by vendors in the school, and tuckshops surrounding the schools.

## 3.6 Study Instruments

### 3.6.1 Questionnaires

The questionnaire of this study is a compilation of questions derived from existing questionnaires; but in this study, those questionnaires were modified to suit the current research. The questionnaires of this study were adopted from authors such as (Almasi et al., 2018; Barata et al., 2017; Cheung et al., 2018; Dai et al., 2018; Dornack, 2018; Fagnani & Guimaraes, 2017; Garg & Mashilwane, 2015, Hatami et al, 2017; Mapotse & Mashiloane, 2017). The authors indicated have investigated the littering behaviours of learners and educators in schools. This study used the structured questionnaire to collect quantitative data from the learners and educators. The structured questionnaires are usually used to collect specific information related to the problem (Architha aithal et al., 2020). The study employed structured questionnaire to collect data about littering behaviour of educators and learners from two schools. Architha aithal et al. (2020) added that structured questionnaire can supplement data, formulate enquiry, investigate previously collected data and validate hypothesis. This type of a questionnaire uses multiple choice based close-ended questions. In this study, educators and learners were provided with close-ended questionnaires with multiple choice answers for them to choose the correct answer. Architha aithal et al. (2020) advised that structured questionnaire must be piloted to a small group before it is

assigned to a large group. This piloting allows the researcher to notice questions that confuses the respondents. In addition, they stated that piloting gives the researcher a rough idea of whether there is enough variation in responses. They indicated further that enough variation in responses allow the researcher to continue with questionnaire to large-scale implementation. This study used five learners from two schools who were not part of the study participants. Architha aithal et al. (2020) also advised the researcher to check consistency of the questionnaire results obtained from pilot study. They stated that consistency of the results is verified by determining the reliability of questionnaire. Reliability helps in identifying errors in demographic characteristics, acceptance score or measurements. The consistency and reliability are evaluated by making use of internal consistency (Architha aithal et al., 2020). They indicated that questionnaire is reliable if the same results are obtained under the same conditions.

Architha aithal et al. (2020) termed internal consistency as an inter-correlation between items of the questionnaire and consistency of intended construct measurements. The popular method of calculating internal consistency is found using Cronbach' s Alpha Coefficient value (Architha aithal et al., 2020). They also provided the interpretation of the Cronbach's alpha coefficient value. They elaborated the meaning of the value of cronbach's alpha coefficient when it is above zero and when it is equal one. When cronbach's alpha coefficient is above zero, it means items on the questionnaire are strongly interrelated. Moreover, when the value is equal to one, that meant perfect internal consistency. Thus, all items on the questionnaire perfectly correlated with each other. Therefore, in this study, the measure consists of three constructs with reliability measures of 0.91 for school and family, 0.97 for knowledge, and 0.98 for environmental awareness. That shows that the cronbach's alpha value equal to one, meaning that all items on the questionnaire intercorrelated with each other. That make this study questionnaire to be reliable and valid.

### 3.6.2 Triangulation

This study employed the triangulation method to navigate and find more insights into learners' and educators' behaviour through the mixed method technique. Donkoh and Mensah (2023) stated that the key to using triangulation is that theories, observers

and methods are combined in a research study to overcome biases arising from the use of a single method. For this reason, explained that the triangulation methodology is used to collect data from several methods such as interviews, questionnaires, sources and observations. In this study, triangulation was used, and the data was collected through literature review in websites such as goole scholar, science direct, mdp, springer and researchgate, questionnaires, interviews and observations. Similarly, in this study the causes of littering in two schools amongst learners and educators was collected using survey questionnaires, interviews, observations, literature reviews of above-mentioned websites, research institutes and observations. Through triangulation the results of quantitative can be confirmed and validated by qualitative results. The qualitative results of this study were confirmed by qualitative results. The participants in this study pointed on the questionnaire that they use plastic products and that they dispose it incorrectly on the school grounds. These quantitative results were confirmed by the interviews where they reported that they disposed of plastic waste improperly on the school yards. Triangulation also allow the researcher to employ qualitative and quantitative data collection instruments, procedures and data analysis on the same study (Donkoh & Mensah, 2023). This study used data collection instruments, procedures and analysis qualitative and quantitative data simultaneously. The study collected data using questionnaires, conducted interviews and observation and analysed the results of these methods on the same study. When using triangulation different people can be provided with questionnaire, observed or interviewed to collect same data at different time and place (Donkoh & Mensah, 2023). In this study, educators and learners from two schools were given questionnaire, interviewed and observed. The tools were used to collect the same data in different years and in different learners and educators due to interruptions of Covid-19 diseases. Triangulation elevates validate and reliabity of the findings. The respondents responded positively to qualitative and quantitative instruments and there was significants differences in the results. This is because (Donkoh and Mensah, 2023) stated that only triangulation can reveal the indepth information than any other method of collecting data. They stated that because triangulation can search indepth information about respondents, it is popular among American researchers.

### 3.6.3Validity and Reliability of the Instruments

Reliability and validity are valuable concepts in any research that indicates the quality of a measurement. Donkoh and Mensah (2023) explained reliability as the degree to which a measurement is repeatable or consistent over time and different circumstances. They referred validity as the degree to which a measurement reflects the true criterion or value being measured. It is critical to select instruments that have been tested and validated in previous studies, and to ensure the reliability and validity of instruments used in a dissertation. A good way to do this is to read the literature to identify instruments that have been used in similar studies. It is also important to carefully consider the psychometric properties of the instrument and to assess its reliability and validity in the framework of the study. This was done using a pilot study, which provided valuable information about the reliability and validity of the instrument, as well as other aspects such as the time required to complete the instrument. Additionally, it is vital to use appropriate statistical methods to analyse the data from the instrument, and to assess its reliability and validity. By taking these steps, the researcher could ensure the validity and reliability of instruments used in the study.

Before the main study commenced, a pilot study was conducted to test the scales' reliability in the questionnaires using Cronbach's Alpha Coefficient value (Donkoh & Mensah (2023). Five learners were chosen from each school to be part of the pilot study. The measure consists of three constructs with reliability measures of 0.91 for school and family, 0.97 for knowledge, and 0.98 for environmental awareness. High reliability was achieved showing that the questions in the questionnaire were relevant. No further changes were made to the questionnaire as an excellent Cronbach's Alpha was recorded.

### 3.6.4Educators' Questionnaire

The educator's questionnaire (Appendix 5) had 23 closed-ended and 6 open-ended questions which were grouped under the following sections.
*Section A*: background and demographic information,
*Section B*: school environmental policy to investigate if the school has policy,

*Section C*: school and family to find out if environmental education can change littering behaviour and if the participation of parents and learners can also influence the littering behaviours;

*Section D*: knowledge and attitude to discover if they know what environmental education refers to;

*Section E*: motivators, barriers and support needs to discover the obstacles impeding teachers from using outdoor activities to encourage learners to care for their surrounding environment;

*Section F*: asked the teachers to agree or disagree to statements to whether they used dustbins using a 5-Likert point scale;

*Section G:* environmental education view;

*Section H*: intends to find out if the teachers view environmental education as education that should include outdoor activities to connect learners to nature, and they did so by agreeing or disagreeing with the statement that uses 5-Likert scale; and lastly

*Section I:* environmental education practices, where teachers would agree or disagree with statements about whether they are able to implement environmental education using a 5-point Likert scale.

### 3.6.5Learners' Questionnaire

The learners' questionnaire (Appendix 6) had 1 open-ended and 36 closed-ended questions which were grouped under the following sections:

*Section A*: is demographic information-seeking demographic information of learners and their parents;

*Section B*: school environmental policy needs to find out if the school had waste management policy;

*Section C*: litter monitoring at school asked learners if their school had a litter pick-up the roster;

*Section D*: knowledge that aimed to research about the level of environmental knowledge of learners, and they should use yes or no;

*Section E*: school and family was designed to determine if both parents and learners participate, their littering behaviour would change;

*Section F*: environmental awareness that sought to find out if learners are aware that being involved in an outdoor activity could change their behaviour towards littering. They answered using a 5-point Likert scale to agree or disagree; and

*Section G*: knowledge of, and participation in environmental protection activities which deal with whether learners had been engaged in environmental protection activities at school.

### 3.7.5 Measurement of the Effectiveness of the Intervention

Following Westlander (2006), an evaluation of the intervention study was conducted by dividing it into three phases: the period before the implementation of the commitment pledge, the period of its implementation, and a period following its completion. Participants were asked to answer standardised questions before and after the intervention, which allowed for the measurement of the intervention's effect as a statistical difference between the two (Karltun, 2006). Photographs were taken at schools before and after the implementation of the commitment pledge to illustrate the changes in the amount of litter in the school grounds. These photos, which depicted litter left on the ground and pied crows pecking at a small plastic bag containing leftover achar food, were then showcased to committee members.

The intervention was implemented at the beginning of the third term of 2020 for a period of one year (August 2020 to August 2021). The researcher monitored the amount of litter in the dustbins. Litter decreased as learners were coming to school with their own containers, which were used when they purchased food from vendors and the tuckshop. The learners also reduced the purchase of soft drinks in plastic bottles. They started buying drinks in returnable bottles. In addition, the educators provided learners with projects about waste material generated at schools. Learners were given a project to reuse the plastic bottles, shopping plastic bags, and sweets wrappers to design respiratory diagrams and coffee met.

### 3.6.6 Semi-structured Interviews

The study employed semi-structured interviews and focus group discussions. Fox (2009) has shown that when using semi- structured interviews, the researcher can ask each participant the same questions in the same way. They also added that the researcher can control the tone and pace at which interviews takes place. Semi-structured interviews consist of a series of open-ended questions found on the topic areas the researcher desires (Muzari et al., 2022). In addition, it also provides opportunities for participants to discuss a few topics in more detail. Muzari added that when the participants express difficulty in answering a question or provides only a passing reaction, the researcher can resort to using cues or encourage the participant to consider the question further. Semi-structured interviews are of importance when probing attitudinal information or when the study is exploratory where there is little known about the subject area (Muzari et al., 2022). For this study, semi-structured qualitative interviews were done in English with both educators and learners. The interview guide used asked questions related to participants' understanding of littering, why they would litter and how littering could be curbed. The guide had 13 main questions with probes for in-depth information from participants.

A focus group discussion was used with learners. Lune and Berg (2017) described a focus group as a meeting planned for small groups of unrelated individuals and is formed by a researcher to discuss exact topics as a group. Cresswell (2021) stated that when using this approach, researchers should strive to learn about conscious, semi-conscious and unconscious feelings or perceptions of a particular group. To add more, the researcher should also learn about the psychological, socio-cultural characteristics and processes among various groups. The focus group discussion usually comprises six to eight people who share common characteristics (Muzari et al., 2022). However, in this study, the Focus Group Discussion (FGD) used five learners who were purposively selected for being knowledgeable in environmental issues. Pre- and post-intervention interviews with the learners were conducted when the school day was over to avoid interfering with the learning process. The FGDs were held before and after the commitment pledge was implemented, and they took 30 minutes. The Key Informant Interviews (KII) with educators were done right before and after the implementation of the commitment pledge which also lasted for 30 minutes.

Learners' interviews were utilised to comprehend their views and opinions of the research programme as well as littering in general. The educators' interviews were conducted to learn more about their perceptions of the success of the study. Educators' interview examined if they could affect their learners' behaviour of littering before and after the intervention.

## 3.7 Study Procedures

### 3.7.1 Permission from schools

Following the granting of ethics clearance and permission from Limpopo Department of Education for the study, the principals of the two selected schools were approached, and the researcher explained the aims and objectives of the study. The researcher requested the two school principals to inform the School Governing Bodies (SGBs) about the project. After being informed, the SGBs called separate meetings in which the researcher presented the idea of alleviating littering in schools to them before implementation. The aims and objectives of the study were explained. The project required electing and forming an environmental policy committee as well as the adoption of the Environmental Policy on waste management, as stipulated by the National Environmental Management Act, (Act No. 107 of 1998) (NEMA). The SGB was involved since they are responsible for the establishment of subcommittees in schools as stipulated by SEC, 30(a) of the South African Schools Act (Act 84 of 1996) SASA. The Anti-Litter Policies developed for the schools as a product of the study are as shown in Appendix 1.

### 3.7.2 Formation of Environmental School Policy

The researcher asked permission from the principals to hold 20 minutes presentation to launch the School Environmental Education Committee (SEEC). The presentation and formation of SEEC took place at the schools over two days. The inclusion criterion in the SEEC was that an educator had to teach one of the following subjects: Geography, Economics, Life Sciences, Life Orientation or Agricultural Sciences. A learner was supposed to be a member of the Learner Representative Council (LRC). A School Governing Board (SGB) member at each school was nominated by other SGB members to be a member of the litter committee. In total, each school had seven

members of School Environmental Education Committee (SEEC). The function of each member of the committee was to draft the circular economy policy with the guidance and support of the researcher. Secondly, the SEEC would present the Circular Economy principles (3 Rs) to the learners.

Once the committee was launched in each school, the researcher a made presentation to the SEEC members, and demonstrated photographs of waste lying in different locations of each school. The members were also shown photos of the pied bird pecking, tearing and swallowing small plastic bags. The bird is well known to all members for its behaviour of feeding on the plastic waste. The pictures of dead whales, an albatross bird and seals with plastic packed in their stomachs were also displayed. The other practice that the researcher highlighted was of taking the waste to the landfill site. The researcher also indicated that plastic in the landfill side leaches the chemicals into the ground and this affects ground water.

At the end of the presentation, the researcher invited the SEEC to introduce Circular Economy (CE) strategies, 3Rs and the sorting of waste. The strategies were meant to ensure that learners protect the natural resources and reduce waste in schools. The researcher gave each school a week to draft the School Environmental Policy for the learners to participate in sorting and recycling waste. The idea would be adopted by friends and eventually the community at large. The researcher advised the committee to search for litter policies for high schools on the internet. When they find one, they must draft and endorse it and inform the researcher. The SEEC were told that they are going to present the policy to learners. After presentation, the researcher would ask the learners to commit. In school A, they made a written public commitment. In school B, they make a written private commitment. In both schools, they promised to practice 3Rs, sort wastes and use the trash bins.

The tenets of the circular economy are as follows:

i. Reduce - to cut back on the amount of trash generated.
ii. Reuse - find new ways of using material that otherwise would have been thrown away.
iii. Recycle - turn something old and useless (like plastic bags) into doormats.

### 3.7.3 Presentation to learners and educators

The researcher asked for permission from the school principals to conduct a 10-minute presentation on the 3R's (Reduce, Reuse, Recycle) for two days at each school. The presentation took place in the mornings before school lessons commenced and was attended by all learners in schools A and B. The researcher was accompanied by the newly elected committee. The learners were shown pictures of discarded items on the school grounds as well as a photograph of a pied crow. The pictures were used to educate them on the negative consequences of plastic waste in their local environment. This helped them to understand why it is important to dispose of waste, and how to properly dispose of plastic waste and make wise choices to protect the environment.

Following the presentation, the researcher introduced the school environmental policy committee members. Mitigation measures that were required to curb littering were introduced. A commitment pledge was also introduced to the learners which they were invited to write and sign (Figure 3.1). Its procedure is discussed below.



Figure 3. 1 Pied crow picking at plastic bag with achar remnant

A commitment pledge was developed by the learners, with the researcher assisting in refining the message at each school. Along with the pledge, photographs were used to encourage the proper disposal of waste. Education and teaching on environmental littering allowed learners to make a pledge as a group by grade, to help them understand what to conserve at school. The detrimental effect on littering on wildlife was demonstrated with a photograph of a pied crow bird eating a plastic bag with achar oil remnants (Figure 3.1). Learners from school A wrote and sign a public commitment pledge. This was followed by informing all learners in their school about their intention to sort waste. The Public Commitment was done in front of all school learners during assembly in the morning before classes commenced. In school B, learners wrote and signed private the commitment pledge. This was carried in the classroom in the presence of the researcher only. In two schools, only learners who were chosen to participate in the study were invited to take the commitment pledge. The learners who wrote and agreed to sign the pledge were informed about the commencement of the sorting times. The sorting of waste was carried out for four weeks during lunchtime and observed by the researcher. The pledge outlined what the learners would do to mitigate environmental littering and why it was important to them. Data collection

during the first and second terms was hindered by Covid-19 lockdown restrictions as teachers and learners were busy trying to complete the curriculum topics.

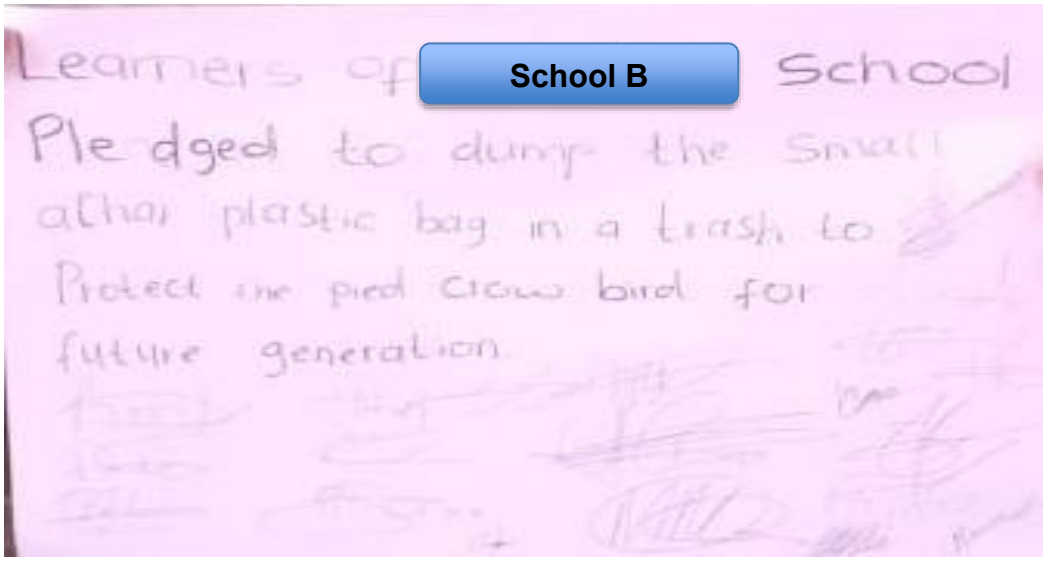



Figure 3. 2 Example of commitment pledge drafted by learners from school B

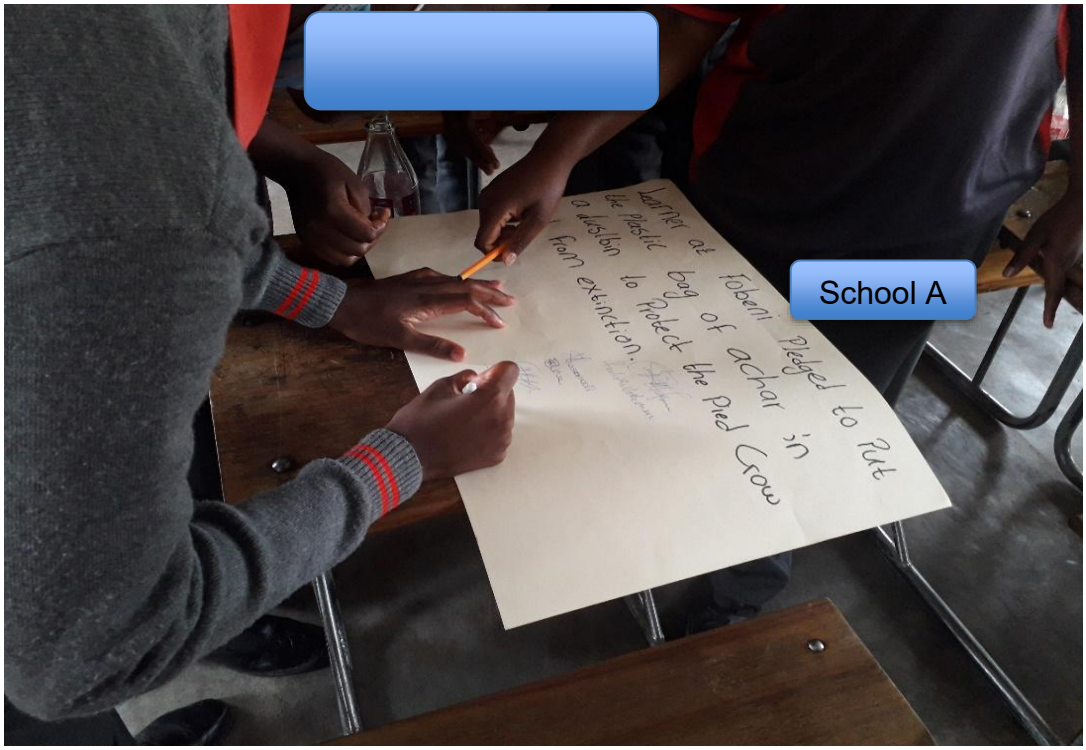



Figure 3. 3 Example of commitment pledge signed by learners in school A

The daily 10-minute presentations allowed learners to pledge according to their respective grades about the species of birds they needed to protect through reduced

environmental littering on the school grounds. The pledge was intended to strengthen the behaviour of learners before they start their sorting of waste.

The intervention commenced with an educational presentation by the researcher and the environmental committee to learners in both schools, thereby highlighting the extent of littering on the school grounds and the impact it had on the immediate surrounding. Photographs of waste lying on different locations of the school grounds were taken before the implementation of the commitment pledge and were used as visual material to educate learners about the effect of littering in attracting unwanted snakes, termites, mice, rats and wild birds to food left lying on the school yard. Photographs were also used after the implementation of the commitment pledge strategy to ensure the effectiveness of the intervention strategy.

### 3.7.4 Observation

Observation is a form of data generating procedure used mostly in qualitative research. Denzin and Lincoln (2008) regarded observation as a systematic, purposeful, and selective way of watching and listening to an interaction as it takes place. Muzari et al. (2022) pointed out that during observation, the researcher must write analytic notes of the real events that is transpiring. In the study, an observation technique in conjunction with photography was used to collect data (and pictorial illustrations) at the two schools, and to directly observe and assess learners as they sorted waste into different trash streams. Through observation, the researcher was able to collect data continuously, which offered in-depth insight into the perception of learners and teachers towards littering, and the effectiveness of the intervention strategy. Observation commenced after learners had completed questionnaires, interviews, and presentation by the researcher.

### 3.7.5 Baseline interviews

Baseline interviews were conducted to gauge learners' and educators' understanding of the environmental issues. A baseline survey is research that is done prior to the commencement of a project to collect information on the status of a subject before any type of intervention is implemented, and therefore make a benchmark against which future progress can be assessed or comparisons made (Eurostats, 2022). Baseline

interviews and questionnaires were conducted on the 15th of August 2020. During the survey, photographs were taken to show the improper disposal of waste (Figure 3.5 and Figure 3.6).




Figure 3. 4 School A littering before commitment pledge intervention.



Figure 3. 5 School B littering before the commitment pledge intervention

After the baseline interviews, preliminary data analysis was conducted where the outcomes were presented to both learners and educators. The need for an intervention

to reduce the waste and minimise environmental pollution was then introduced to both learners and educators. The photographs taken at the time of conducting the baseline interviews were used to introduce the commitment tool as an intervention strategy to encourage proper disposal of wastes.

### 3.6.7 Post- intervention Data Collection

Post-intervention interviews were conducted on the 28th and 29 th August 2021 in both schools. The interviews were used to assess if the intervention had resulted in any changes in the behaviour and the extent of littering among the learners. At the end of the study, a similar questionnaire was administered to reduce bias in a selected group of 20 learners from among the group that participated in developing and implementing the commitment pledge as part of the study design. Twenty learners were sampled such that the collected data was manageable and easy to analyse. The questionnaire was issued again at the end of the study to check if the intervention had resulted in a change of behaviour among the learners. The information was compared using Paired sample t- test to determine if there were statistically significant differences in behaviour before and after intervention. Thus, post intervention results were compared to pre-intervention data to check if the intervention was successful in encouraging litter pick-up and the sorting of litter into categories and the dustbins allocated. The information was then entered into a Microsoft Excel spreadsheet for storage.

## 3.8 Data Analysis

### 3.8.1 Qualitative Analysis

In this study, the qualitative research method was utilised to investigate behaviour change before and after commitment pledge intervention. According to Klenke (2016), qualitative research involves a naturalistic approach that seeks to gain an in-depth understanding of social phenomena within their natural context. In this study, qualitative method of interviews was analysed using thematic analysis. Harden et al. (2018) showed that thematic analysis allows the researcher to know, analyse and describe themes within a set of data. Thomas added that the researcher needs to acknowledge that the interpretations formulated are not independent of researchers' epistemological and theoretical commitments. By acknowledging the interpretations, Harden et al. (2018) meant that analysis is influenced by the researcher's

understanding of the data collected from interviews. In this case, Thomas meant that analysis was attempting to show explicit meanings in the data to provide relevant themes in rich description as opposed to covering all data to address the research questions. Since Braun and Clarke (2006) stated that analysis was conducted in six steps, this study began by transcribing the interviews while identifying and linking themes throughout the data. The next step includes producing codes systematically from ideas and themes identified. The identified codes represent features of the researchers' analytic interest. Step three involved organising and integrating the codes into potential themes, which were then reviewed for step four to check all combined information, clear patterns and find out if the chosen themes represented the whole data set. This was done by constructing thematic map of the analysis. Step five required defining and refining the themes and the data within them to produce a succinct analysis. The final step produced a non-repetitive, logical and succinct, analytical narrative about the research questions. The approach was manually executed across all interview transcripts of learners and educators.

### 3.8.2 Quantitative Analysis

Quantitative and statistical data analysis in this study was performed on Python (Python Software Foundation (CWI), Amsterdam, May 1995."), using the Pandas Module (McKinney et al., 2010). The qualitative analysis of this study used Descriptive data analysis and the Natural Language Processing Kit (NLPK) Module (Mckinney et al., 2010). Qualitative data was collected, coded, entered, tested and analysed using the paired t-test. The paired t-test was used to compare if there were significant differences between educators' and learners' behaviour change prior to commitment and post commitment pledges. According to Harden et al. (2018), the paired t-test was used to calculate mean difference between two sets of observations. With two sets of data, Harden et al. (2018) stated that the paired t-test is used to measure subjects twice to indicate pairs of observations. In this study the educators and learners' behaviour were tested twice, before and after commitment pledge to find the changes. The p-value was used to measure learners and educators twice to produce pairs of observations.

Through paired t-test, the researcher can find one of the two hypotheses: the alternative or null hypothesis. This study was able to formulate hypothesis. The results of t-test are decided by looking at p-value (≤0.05) (Harden et al., 2018). This p-value showed the probability of identifying the test results under null hypothesis by either rejecting or accepting the hypothesis. P-value in this study was obtained to find if the hypothesis was rejected or accepted. Kazdin (2016) posited that when the p-value is higher, the probability of obtaining weak evidence against the null hypothesis becomes higher, leading to the acceptance of the null hypothesis. Similarly, the null hypothesis was proven to be accepted or rejected when the results are discussed in chapter 5. In addition, Kazdin (2016) indicated that when the p-value is lower, the probability of getting strong evidence against the null hypothesis becomes lower, resulting in the rejection of the null hypothesis. Apart from p-value calculation, the Cohen's d effect size was calculated to describe the magnitude of the effect. According to Cohen's d effect, sizes are classified into small (±0.2), moderate (±0.5) and large (±0.8). Osteen and Bright (2010) showed that these classifications are used to indicate the strength of the results. The general analysis of pre and post behaviour change through the commitment pledge was detected using p-value. The results of the study in general obtained 95% confidence level as $P \leq 0.05$ was considered statistically difference. All the pre and post data results of behaviour change through the commitment strategy was analysed and presented in percentages form using the bar graph.

## 3.9 Conclusion

This chapter covered the qualitative and quantitative research methods used. The sample of the study consisted of 10 educators who were teaching subjects with environmental topics, and 20 learners who were purposively selected at each school. The study further used questionnaires, interviews, photographs and observations to collect data. The chapter covered the procedures used to collect qualitative data such as Focus Group Discussions with learners and Key Informants with educators. Both interviews were face to face with learners and educators recorded using an audio-recording. Qualitative data was analysed using thematic analysis. Quantitative data was collected using questionnaires before and after the Commitment pledge to compare the measurements of behaviour change and was analysed using paired sample t- test. The test can determine if there were statistically significant differences

in behaviour before and after intervention. The statistical difference was analysed using the Python Software. The chapter also covered the introduction of plastic awareness which the researcher used to introduce the Commitment Pledge as an intervention strategy. The procedure for commitment was explained, and learners were provided with dustbins to sort waste. Then, the researcher observed learners sorting the waste for four weeks. The following chapter presents the results of the questionnaires in percentages using bar graphs

# 4 Chapter- 4 Results

## 4.1 Introduction

This chapter describes the qualitative and quantitative results obtained from both case studies. The primary purpose of this study was to investigate the effectiveness of the intervention. The feedback and experiences from both learners and educators gave useful insights into the research questions addressed in the study. The study initially gathered the baseline information on both learners and teachers. The data from post-intervention was compared with data from baseline. They were executed to check if the intervention had an impact on littering in the schools.

In this chapter, the results and analyses are aligned with the six research objectives. Descriptive statistics were used to analyse the results. The findings of the study are addressed with supporting evidence, which includes thematic quotations.

## 4.2 Research objectives

The six research objectives that guided this study are:

1. To evaluate the level of knowledge towards environmental problems and concerns among village school learners.
2. To evaluate the level of knowledge towards environmental problems and concerns among the teachers.
3. To evaluate the attitude of village school learners and teachers towards proper waste management.
4. To assess current environmental practices among village school learners.
5. To assess how increased learners' knowledge and practical skills can help learners to commit to anti-littering.
6. To evaluate the interaction between teachers' knowledge, attitude and practices compared to the learners.

## 4.3 Demographics of the research respondents

The sample of the study consisted of 40 learners and 40 parents of participating learners from a rural area. Learners were drawn from grades 8 to 12. Parents were from different villages. The level of education of parents, age, gender, and the language of both learners and parents are illustrated in Table 4.1 below.

**Table 4. 1 Distribution of the level of parental education and learners and parents' gender, age and language**

| **Demographic** | | **Proportion of respondents - n (%)** |
|---|---|---|
| Gender | | |
| Male | | 22 (55%) |
| Female | | 18 (45%) |
| Age Groups | | |
| 13 | | 6 (15%) |
| 14 | | 7(17.5%) |
| 15 | | 5 (12.5%) |
| 16 | | 9 (22.5%) |
| 17 | | 5 (12.5%) |
| 18 | | 4 (10%) |
| 19 | | 4 (10%) |
| Language | | |
| Sepedi | | 25 (62.5%) |
| Xitsonga | | 15(37.55%) |
| Parents Education | *Mother's education* | *Father's Education* |
| Lower than Matric | 28 (70%) | 12 (30%) |
| Certificate | 3 (7.5%) | 15 (37.5%) |
| Diploma | 8 (20%) | 12 (30%) |
| Degree | 1 (2.5%) | 1 (2.5%) |

This survey was conducted with 40 participants in school A and school B. The gender proportions of the respondents were 55% males and 45% females. The age groups of the participants varied, with most of the learners' respondent aged being 16 (22.5%)

and 17 (12.5%). Most of the participants spoke Sepedi (62.5%) and a minority spoke Xitsonga (37.5%). When it came to the level of education of the parents, most of the respondents had parents who had no matric education, with 70% of mothers and 30% of fathers having attained this level of education. The rest of the parents had attained tertiary qualifications, with a small proportion of 2.5% of fathers and 2.5% of mothers having obtained a degree.

### 4.4 School Environmental Policy

The learners were initially unaware of their school's environmental policy or waste management policy. However, following the implementation of the commitment pledge, all were aware of the existence of the policy. The educators also agreed that the policy was being implemented properly afterwards. Reasons given for the absence of knowledge of the policy included ignorance of its existence and the belief that the Department of Basic Education (DBE) was responsible for introducing it to the schools.

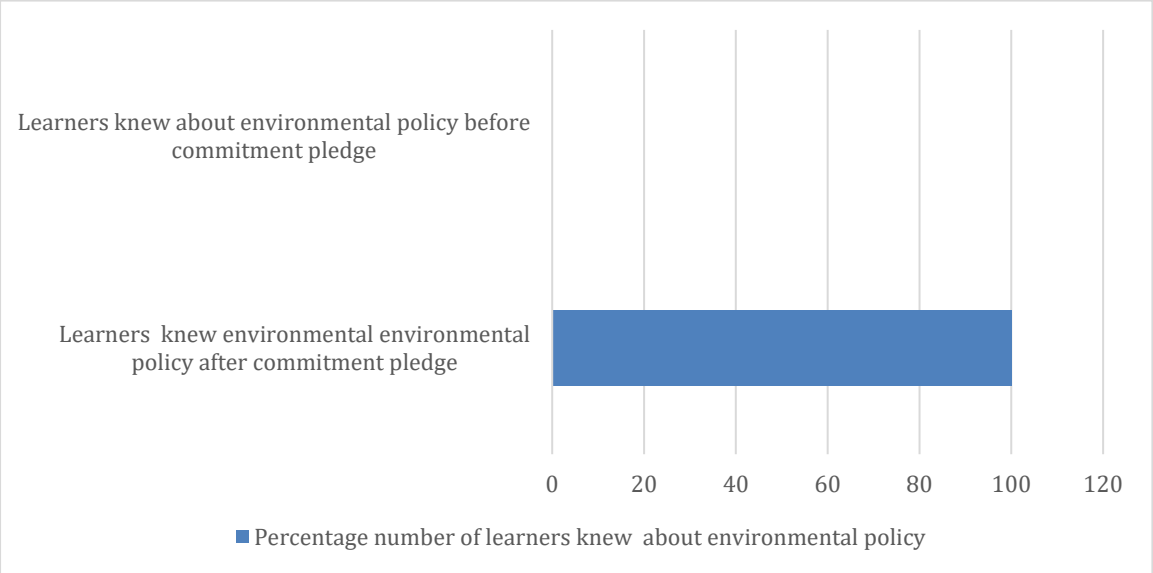



Figure 4. 1 School Environmental Policy

## 4.5 Litter Monitoring at School

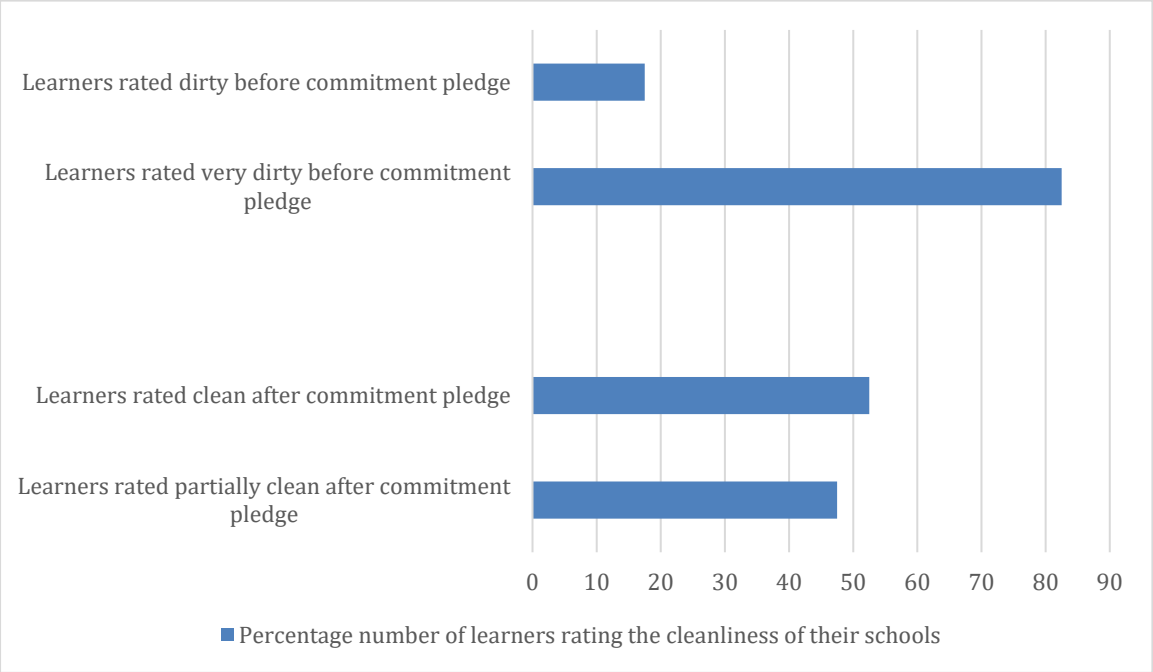



Figure 4. 2 Litter monitoring

Many learners' responses claimed that their school was either very dirty (82.5%) or dirty (17.5%), with no knowledge of any environmental policy in place. However, after the introduction of the commitment pledge, the situation improved with a 47.5% high score of learners reporting that their school was now clean, and 52.5% saying it was partially clean.

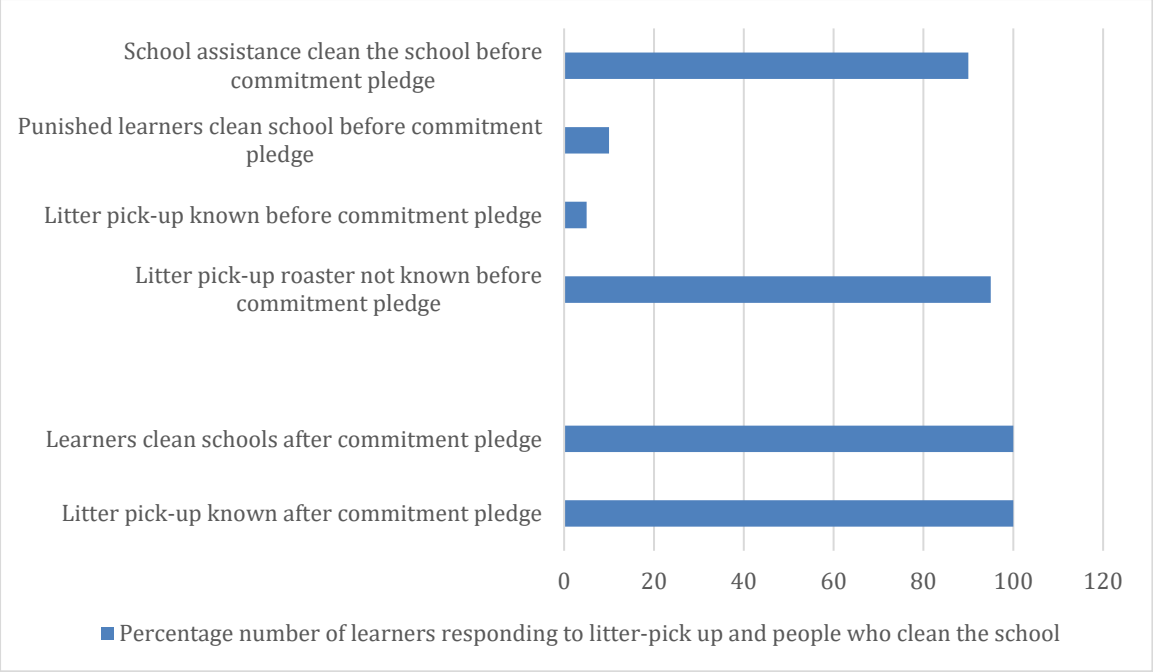



Figure 4. 3 Litter pick-up and people who cleans

When the learners were asked about roster pick-up and how many times it occurs, 95 % of respondents showed that they had no idea of a roster for picking up litter around the school, while only 5% knew of its existence with litter being picked up twice a week. Roster pick-up is a programme that takes one or two days in a week to clean a highly polluted surrounding (Mapotse & Mashiloane, 2017). The surveyed learners asked learners who clean the school because they have no litter pick-up roster. 10% stated that learners who had been punished for various offences were used to pick up litter every day. About 90% of learners stated in the survey that the government-hired cleaners were responsible for cleaning. After the commitment pledge, all learners were knowledgeable about the litter pick-up roster and were seen encouraging others during lunch to pick up dropped litter. Both educators and learners noted an improvement in the cleanliness of their school grounds with litter being collected.

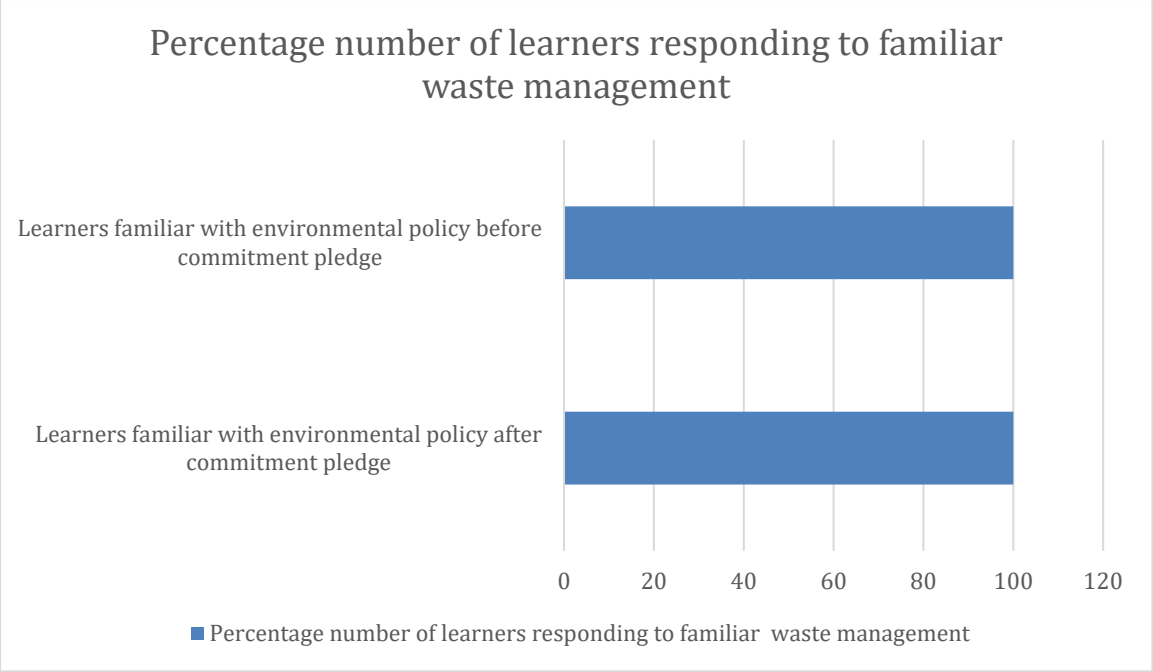



Figure 4. 4 Waste management at school

Learners were not involved in activities to dispose of garbage properly into the garbage bins. When they were asked if they are familiar with waste management, all learners stated that they do not know about waste management. The presentation highlighted that proper water disposal helps to protect garbage from accumulating on the ground and attract rodents and flies that transmit diseases. Learners made a commitment pledge, 95% disposed of their litter in the dustbins and 5% did not place their litter in the bins in the school yards.

## 4.6 Knowledge and attitudes

Responses to the open-ended query indicated a range of definitions of environmental education. This indicated varying levels of awareness of its purpose and objectives. Most of the respondents noted that environmental education is a process of educating people about the environment and developing their skills, knowledge, values and experiences. The study used word cloud to sum up the definitions given by learners.

### 4.6.1 Word Cloud

In this study, 40 learners were asked to explain environmental education in their own words or knowledge or understanding. The study collected different explanations from

the open-ended questionnaire given by learners and recorded similar keywords. Su et al. (2023) advised that to create a general visualisation of learners' texts, keywords are loaded into WordArt program, a form of Web 2.0 tool used to generate word cloud shown in Figure 4.5 and Figure 4.6. Word cloud is a famous technique used to formulate expressions of textual responses (Li, Dong & Yuan, 2018). According to Denzi and Taşçi (2023), frequent words are converted into a visual representation. Kurtulus and Tatar (2021) added that frequently used words are situated at the centre. The size of the most frequently word is larger than other words. Other words that are used frequently appear close to the bigger words and are medium in size when compared to bigger ones. The less frequently used words are far away and are smaller. The interpretation of bigger words does not show meaning. Fuchs (2021) confirmed that prominent words usually have no meaning, but words that follow them in size offer perspectives with regards to learners' perceptions about the need for environmental education. Based on this word cloud, prominent words used often by learners to explain environmental education were "Skill" and ''Environment'. The words that followed and bordered prominent words in size provide the first lead into the thematic analysis of the explanation (Fuchus (2021). In this study, the words are ''Individual'', ''Education'' ''Environmental'', "People", ''Process'' and ''Future''. Figure 4.5 means that environmental education can develop skills for individuals and people to change behaviour towards the environment and act upon environmental issues.

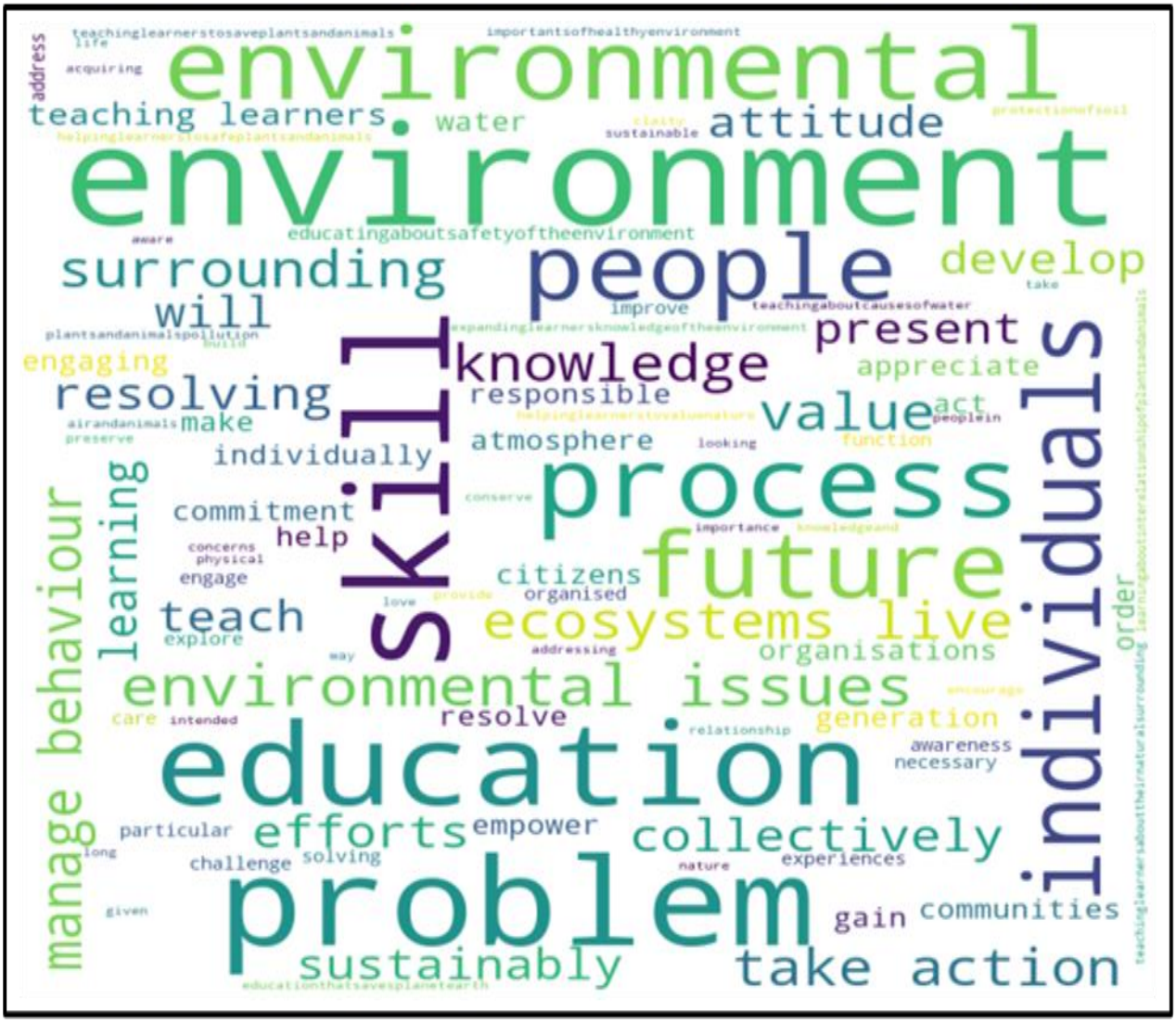



Figure 4. 5 Word cloud 1

Environmental education raised the issue of plastic pollution to the learners and educators. The main aim was to raise awareness about the impact of plastic littering on water, animals, soil, air, plants and human lives. To compound the problem, learners made a commitment pledge to sort waste, reduce, reuse and recycle plastic waste. The word cloud in Figure 4.6 shows that the central word given by learners was ‘’Education”. The words that give education meaning are ‘’Skill, ‘’People’’, ‘’Environment ‘’ and ‘’People’’. The translation meant that learners are concerned about the development of skills that people need to protect the environment.

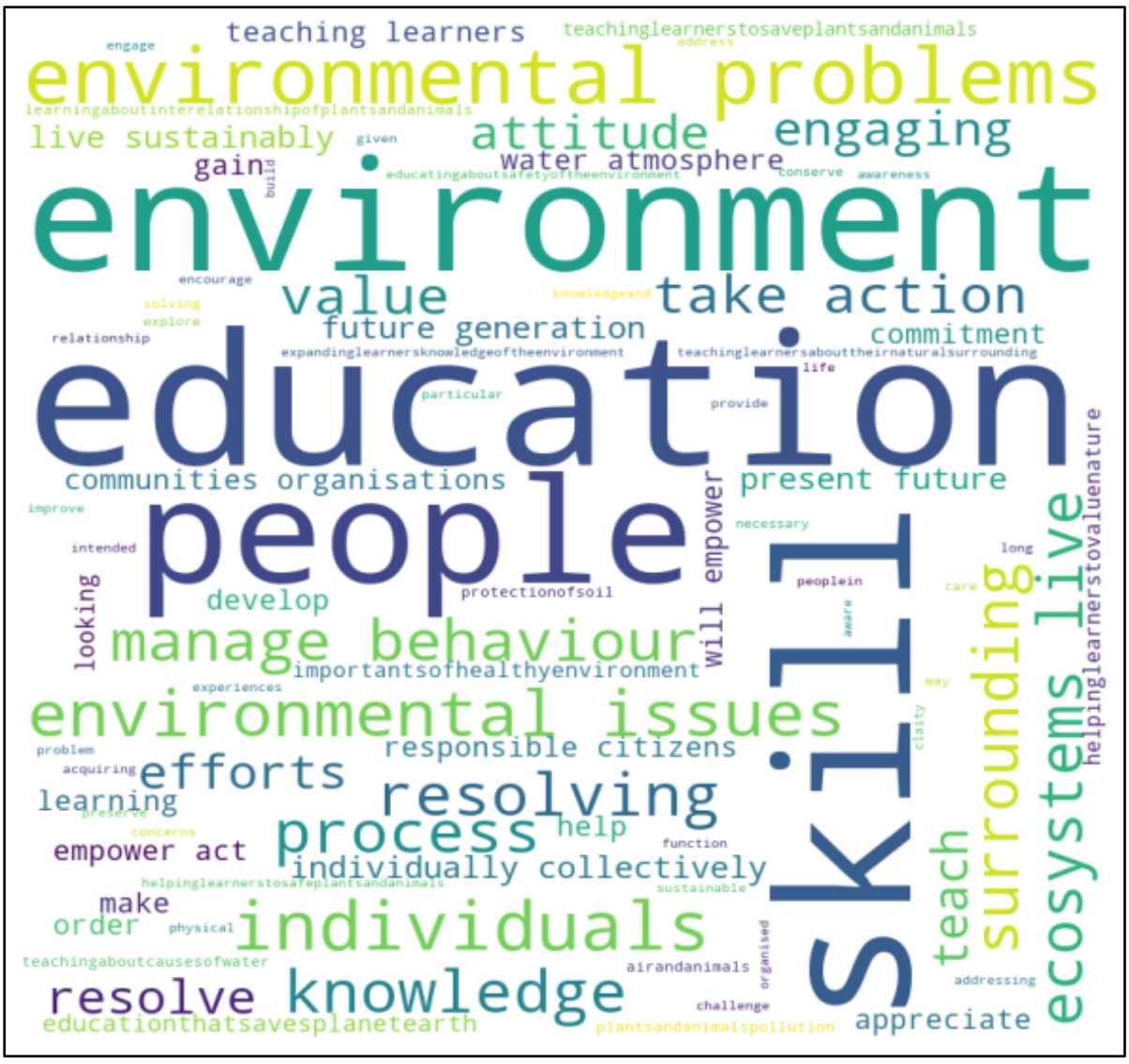



Figure 4. 6 Word cloud 2

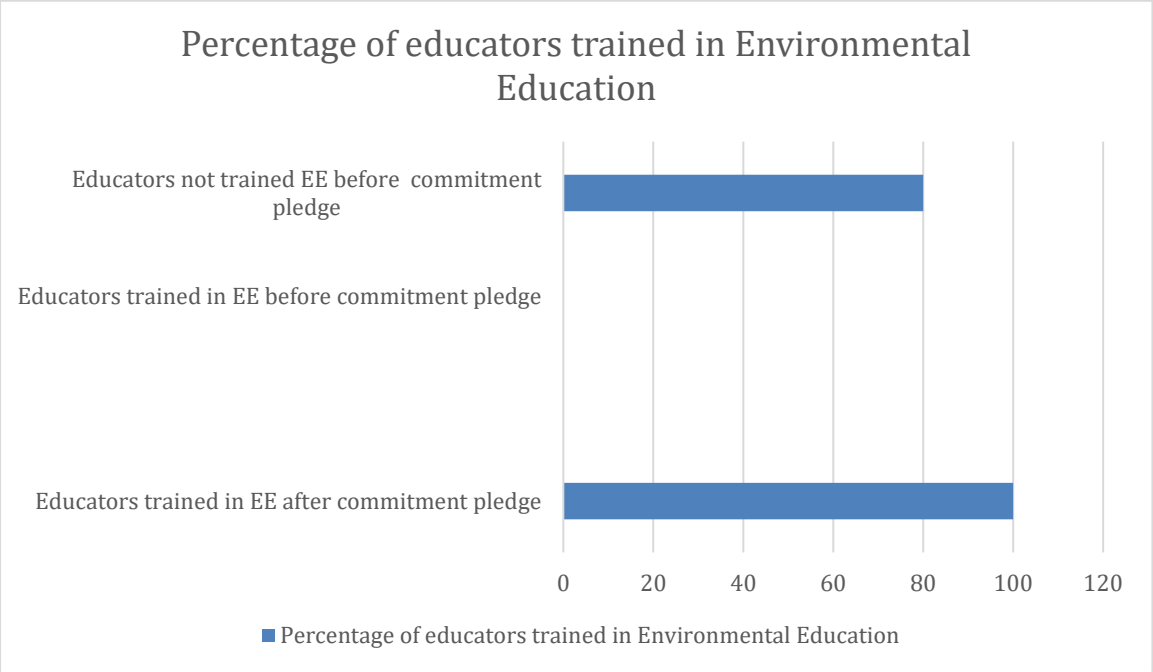



Figure 4. 7 Environmental education training

Educators were asked about their tertiary training in environmental education following the responses of the definition of environmental education. All educator respondents were never trained. The results indicate that the majority were not exposed to environmental education during their training programmes. All the educators reported that the curriculum and the available resources in schools did not support the teaching of environmental education. They required professional development as most were not trained in environmental education. In addition, the survey indicated that they need resources/materials to support them in teaching environmental education. On the survey funding, administrative support and collaboration with colleagues were pointed out as barriers that impede them from helping the learners learn more about environmental education. The introduction of the Commitment Pledge helped educators with training how to present littering using photographs. The training was followed by engaging learners in sorting and recycling waste to resolve the environmental issue. To resolve the issue about educating learners about environmental issues needs to be coupled with a participation task.

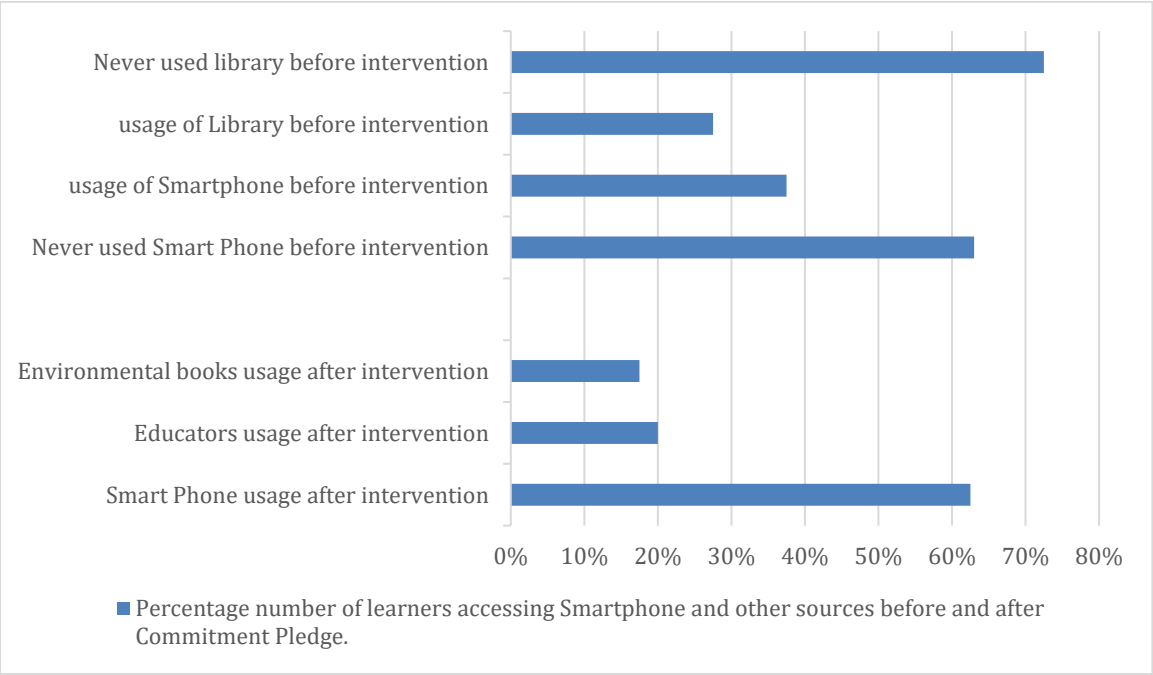



Figure 4. 8 Smartphone access and other sources

Learners were asked about access to smartphones or other sources to increase environmental knowledge. The results revealed that 72.5 % of the learners never went to the library to access environmental information. Only 27.5 used libraries for environmental knowledge, 37% accessed environmental information through smartphones. About 63% of the learners had never used smartphones to find environmental information. However, the commitment pledge taken in schools increased their awareness and 62% of learner respondents had started using their smartphones due to internet access. 20% rely on educators as learners use them to clarify some difficult information. And 17.5% had relied on environmental books because there were fewer books in school libraries.

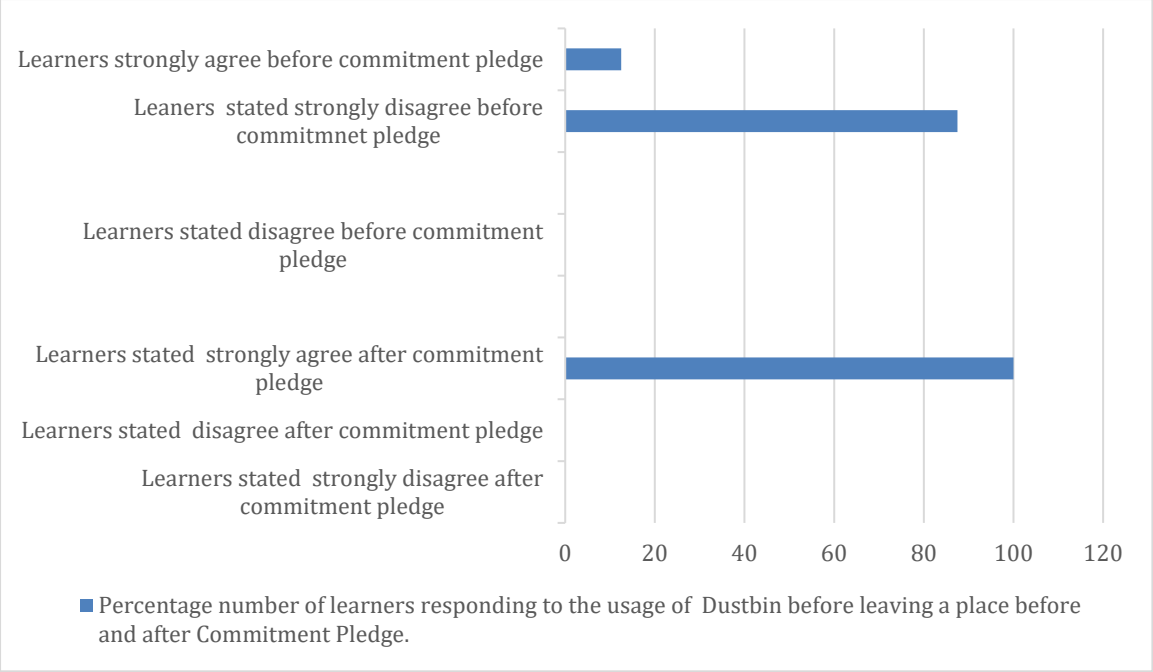



Figure 4. 9 Use of dustbin

The use of dustbins before a person leaves a place and not leaving a trash where the lunch was taking place is important. The survey showed that only 12.5% of learners were throwing their garbage into the dustbin before leaving a place, 87.5% of them strongly disagreed to using dustbins to dispose of waste after eating their lunch Following the commitment pledge, learners used different dustbins to sort waste in school. They sorted wastes properly for four weeks and encouraged others to do the same. Therefore, the survey showed that 100% of learners used dustbins after being engaged in commitment-making.

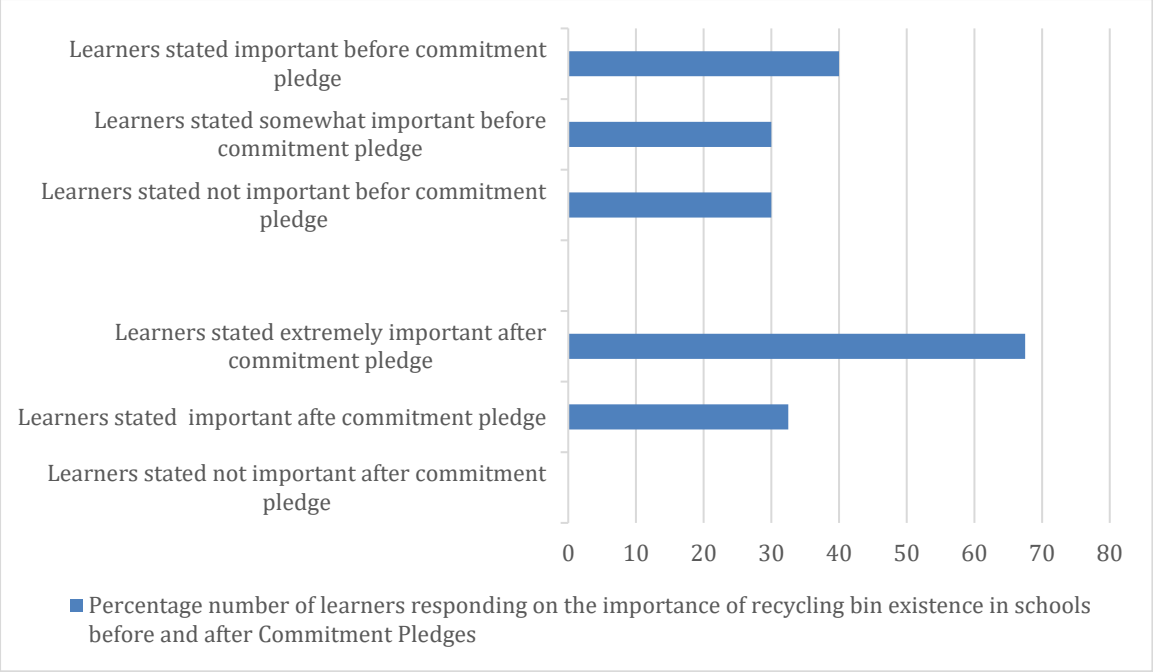



Figure 4. 10 Importance of recycle bin existence

The availability of a recycling bin in schools is important. When learners were asked about how important the existence of a recycling bin in school is, 40% agreed that the recycling bins were important, 30% said somewhat important and 30% said not important. The commitment pledge made learners to use different trash bins to sort waste into different categories. 67.5% of the learners stated that recycling bins were extremely important and 32.5% said that they were important. None stated that a recycling bin is not important after the commitment was made.

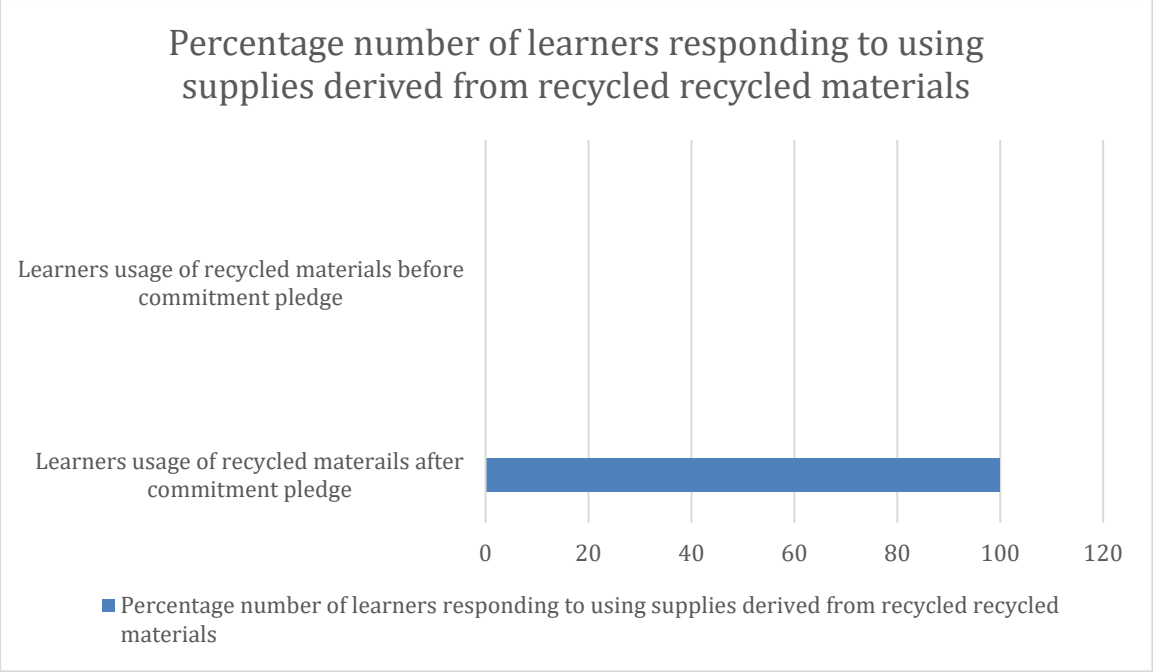



Figure 4. 11 Use of supplies from recycled material

No learners had known if their schools can use supplies derived from recycled materials. The commitment pledge inspired educators to provide learners with projects that involve plastic waste derived from home. The learners gathered more plastic waste and designed artwork with them. Then, all learner survey respondents became aware of this.

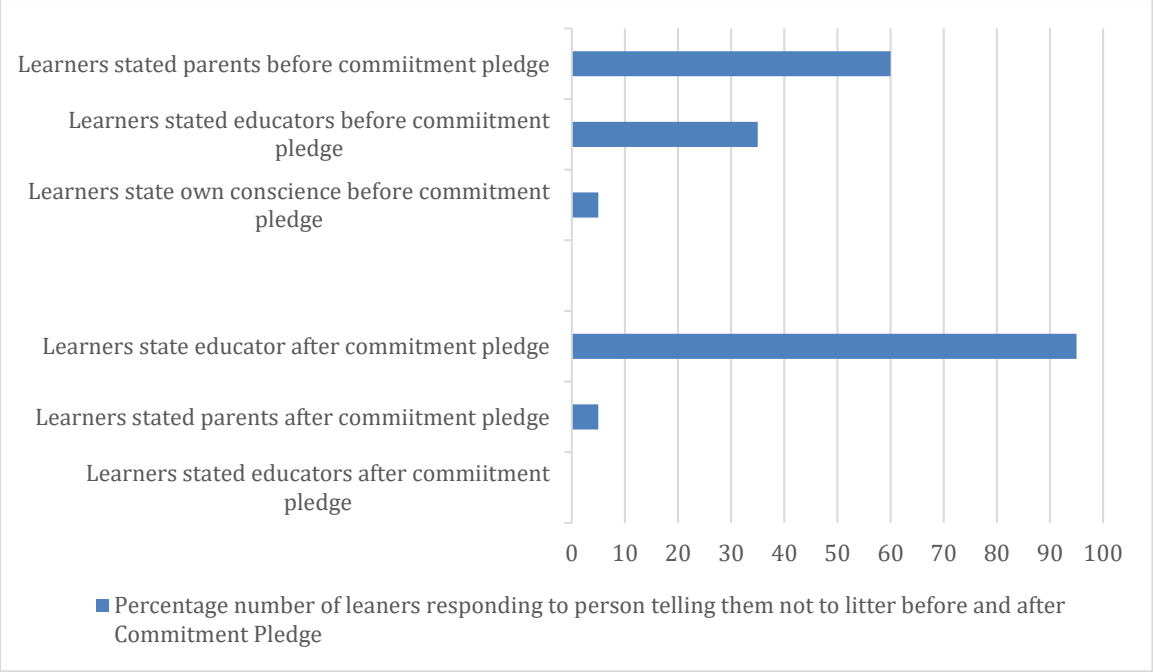



Figure 4. 12 Person telling learners not to litter

Concerning the issue of who always tell them not to litter most, 60% of the learners' said parents, 35% said educators and 5% relied on their conscience. The commitment pledge was written in school, and educators started to practice teaching learners and provide them with hands-on activities such as recycling plastic. In this way, educators raised awareness of learners on plastic waste recycling. In response, 95% of the learners pointed to educators and 5% were still being told by their parents. None relied on their consciences.

### 4.7 School and Family

Both the school environment and family have a significant influence on the littering behaviour of learners. The school environment influences the behaviour of learners through rules and regulations that are established and enforced by the school. If rules and regulations regarding littering are established and enforced, learners would be less likely to litter. In addition, the school environment can influence the behaviour of learners by providing them with appropriate waste bins and encouraging the recycling of materials.

The family also has a significant influence on the littering behaviour of learners. Families can teach their children the importance of keeping their environment clean by modelling responsible behaviour and by talking to them about the consequences of littering. Parents can also make sure that children have access to appropriate waste bins and help them to develop a feeling of satisfaction in keeping their environment clean. In addition, families can support school initiatives to reduce littering, such as providing extra waste bins or educational resources on the advantage of keeping the environment clean.

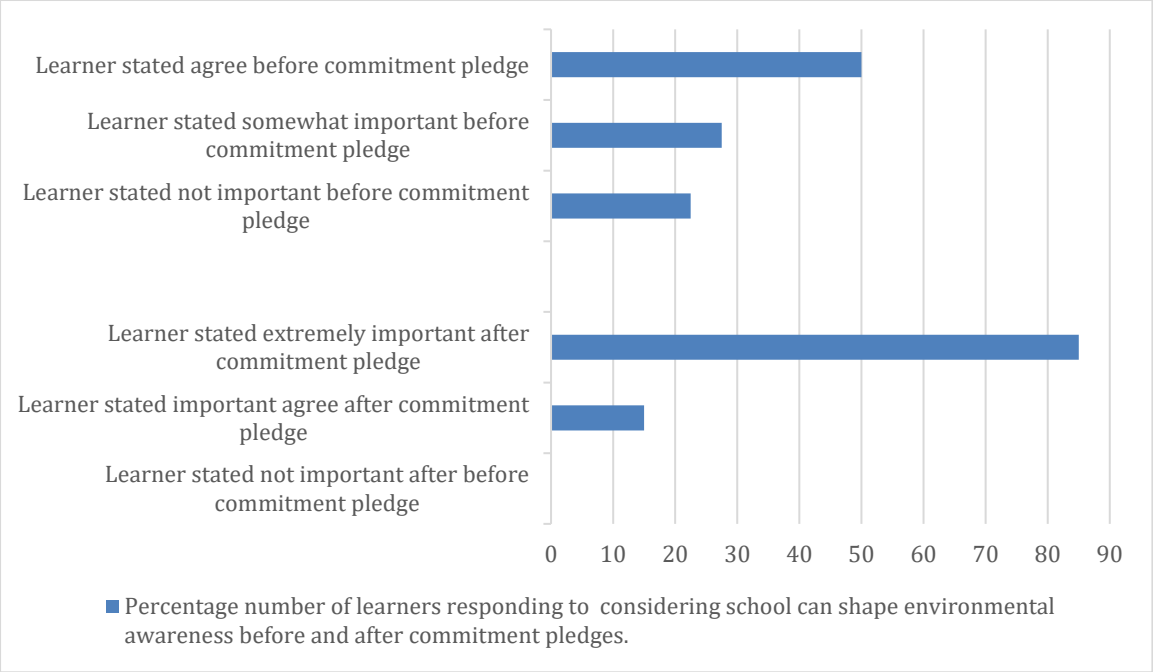



Figure 4. 13 Consider school to shape awareness

The question about how important learners considered the school's contribution in shaping their environmental awareness was posed, about 50% agreed, 27.5% said somewhat important and 22.5% said not important. Since the Commitment pledge was written, learners were exposed to plastic litter education and awareness. They gained knowledge of dealing with plastic littering. 85% of them said that the school was extremely important and 15% said that the school was important in shaping their conscience.

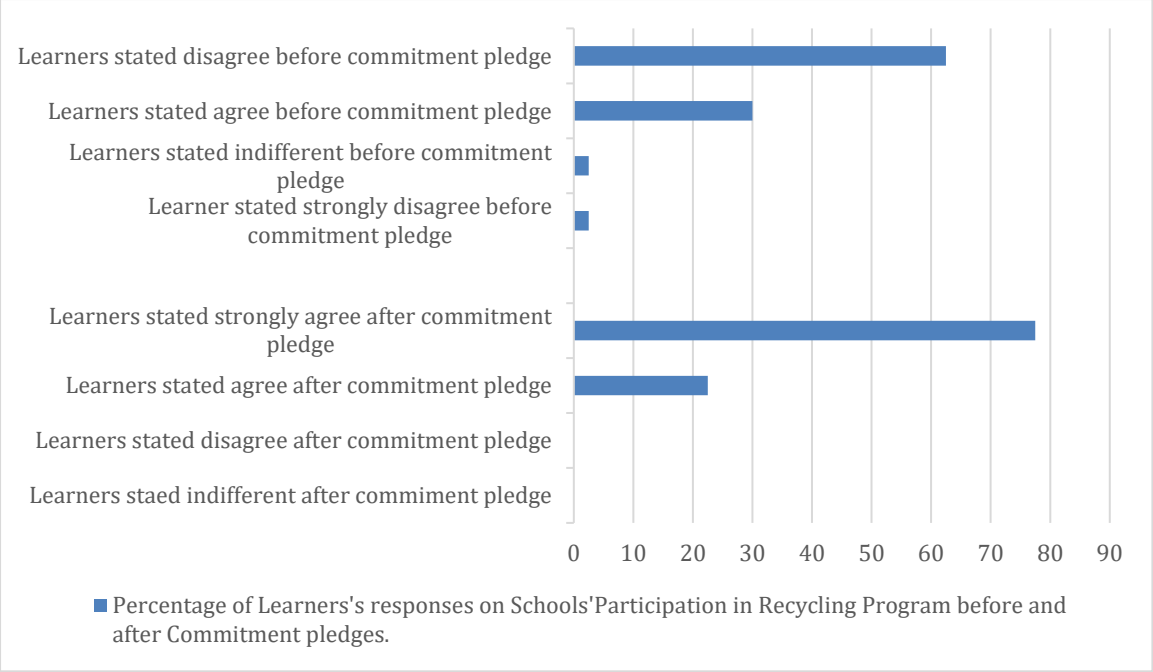



Figure 4. 14 School participating in recycling program

Learners' responses varied when asked about whether their schools should participate in recycling programmes, 62.5% disagreed, 2.5% strongly disagreed, 2.5% were indifferent and 30% agreed. Commitment pledges compelled them to participate in sorting and recycling. Knowledge of recycling reduced littering and helped to protect the environment. About 77.5% strongly agreed and 22.5% agreed that their school should participate in recycling programmes. No one disagreed and indifferent about the participation of school in recycling programmes.

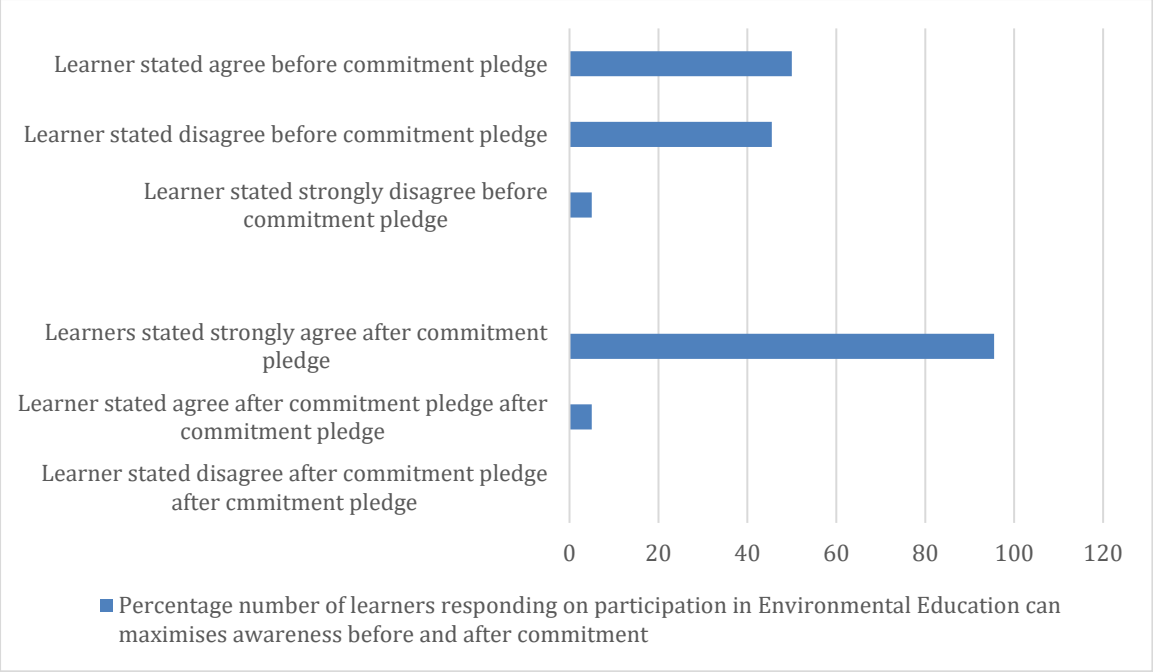



Figure 4. 15 Participation maximises awareness

Learners' responses varied when asked about whether participation in environmental education activities maximised environmental awareness, 45% of the learners disagreed, 50% agreed, and 5% strongly disagreed. The commitment pledges guided educators to engage them in circular economy principles such as recycling. 95% strongly agreed, 5% agreed, and none disagreed that their participation in environmental education activities maximised environmental awareness.

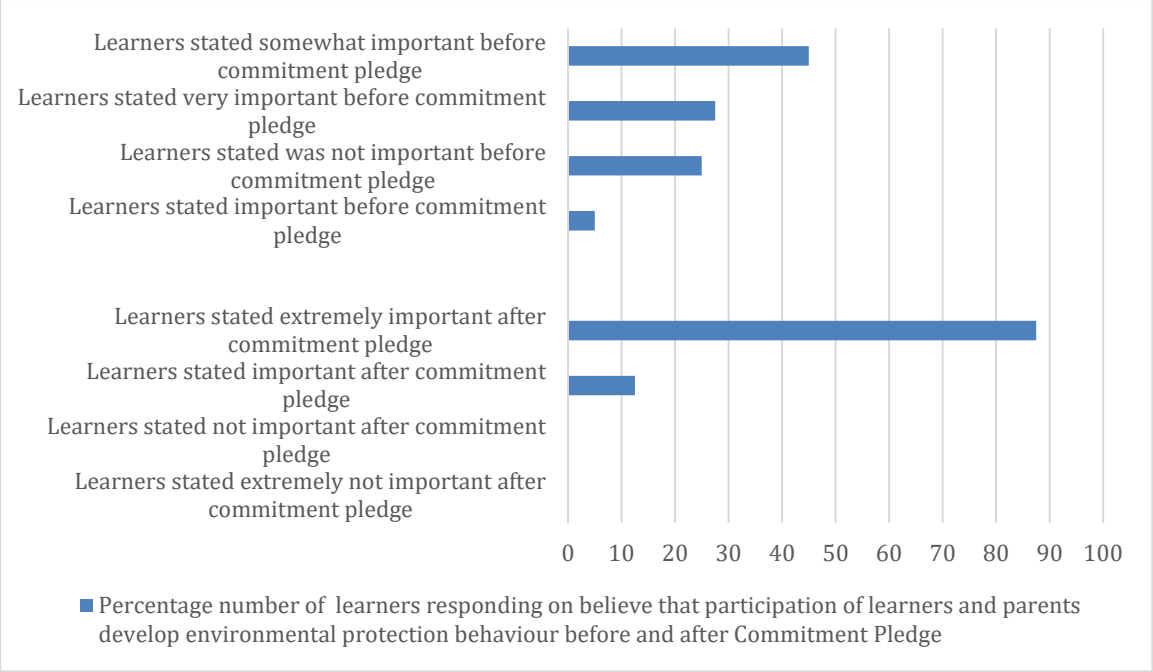



Figure 4. 16 Participation of learners and educators

Learners' responses varied when asked about whether they believed that the participation of learners and parents will help in developing environment-protecting behaviour, 2.5% of the learners said that it was important, 27.5% said it was very important, 25% said that it was not important and 45% said somewhat important. The commitment pledge helped them to work together with parents at home to recycle plastic. 87.5% said that it was extremely important and 12.5% said it was important that parents and learners working together will help in developing environment-protecting behaviour.

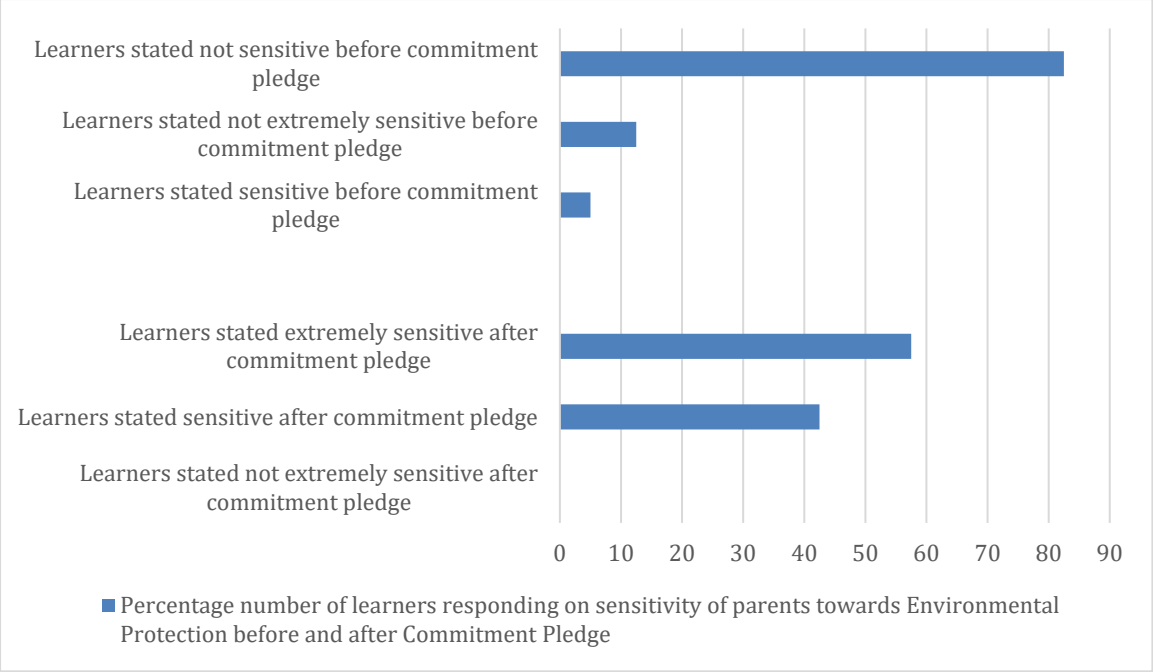



Figure 4. 17 Sensitivity of parents to environmental protection

Learners were asked whether their parents were sensitive to environmental protection, 82.5% thought that their parents were not sensitive while 12.5% thought that they were not extremely sensitive and only 5% of the learners thought that their parents were sensitive. After the implementation of the commitment pledge, 57.5% of the learners thought that their parents were extremely sensitive, 42.5% said they were sensitive to environmental protection, and none thought they were not extremely sensitive.

## 4.8 Relationship between Environmental Knowledge and Attitudes and Background Factors

The existence of links between environmental knowledge and attitudes has been broadly researched in recent years. This study has sought to apprehend the influence of various factors on individuals' attitudes and knowledge about the environment. By understanding how these two factors influence one another to protect the environment, it would be imperative to create strategies to promote better attitudes and behaviours towards the environment. This section will discuss the key findings of the study into the link between environmental knowledge and attitudes.

## 4.9 Environmental Awareness

From international scholarly literature, there is strong evidence which suggests that awareness and attitudes towards waste generation and management are critical. They support the human race's endeavour to address poor waste disposal management practices. This evidence suggests that learners in secondary school levels pose positive high awareness and attitude about environmental issues (Debra, Vidal & Dinis, 2021). They added that the only problem that they lack is practical education from their educators to guide and involve them in waste management practices. Educators are failing to involve learners in the management of waste programmes in schools. A study by Martínez-Borreguero (2019) indicated that educators have no knowledge of practical education because they were not trained in EE. The current study sought to train educators in practical activities that would reduce littering in schools.

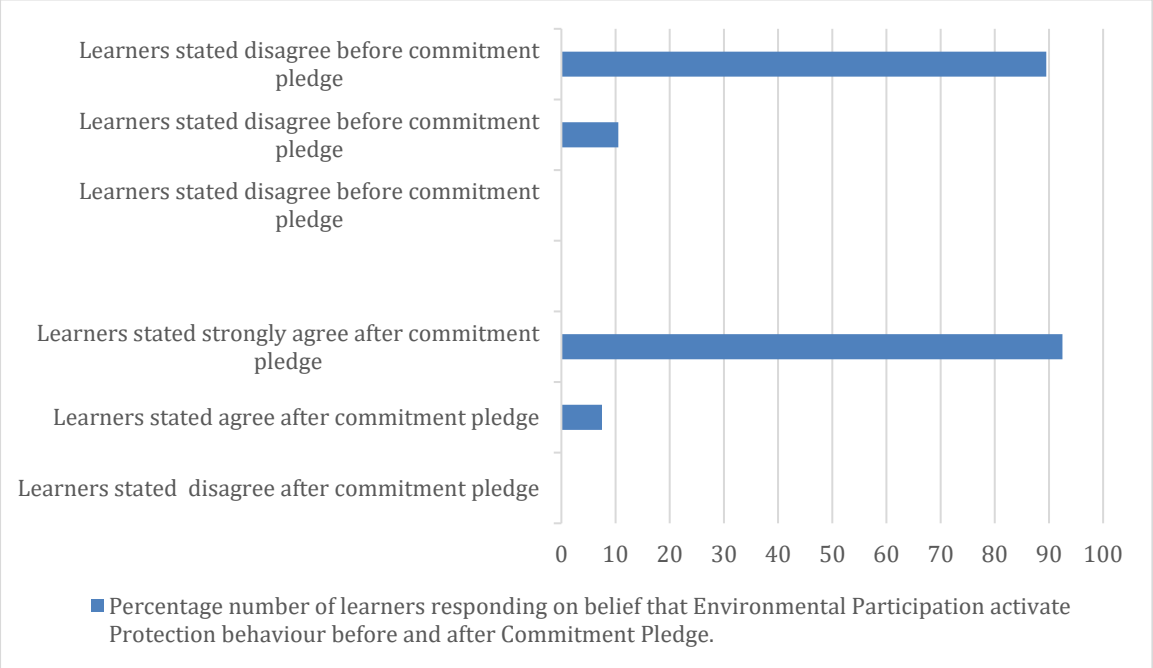



Figure 4. 18 Believing in environmental participation

Participation in waste management activities such as sorting waste encourages learners to take responsibility for saving the environment. Learners were asked whether they believed that environmental participation would activate environmental protection behaviour. 89.5% disagreed, while 10.5% agreed and strongly agreed. The

implementation of the commitment pledge resulted in 92.5% of the learners believing that environmental participation would activate environmental protection behaviour and 7.5% agreed and none strongly disagreed.

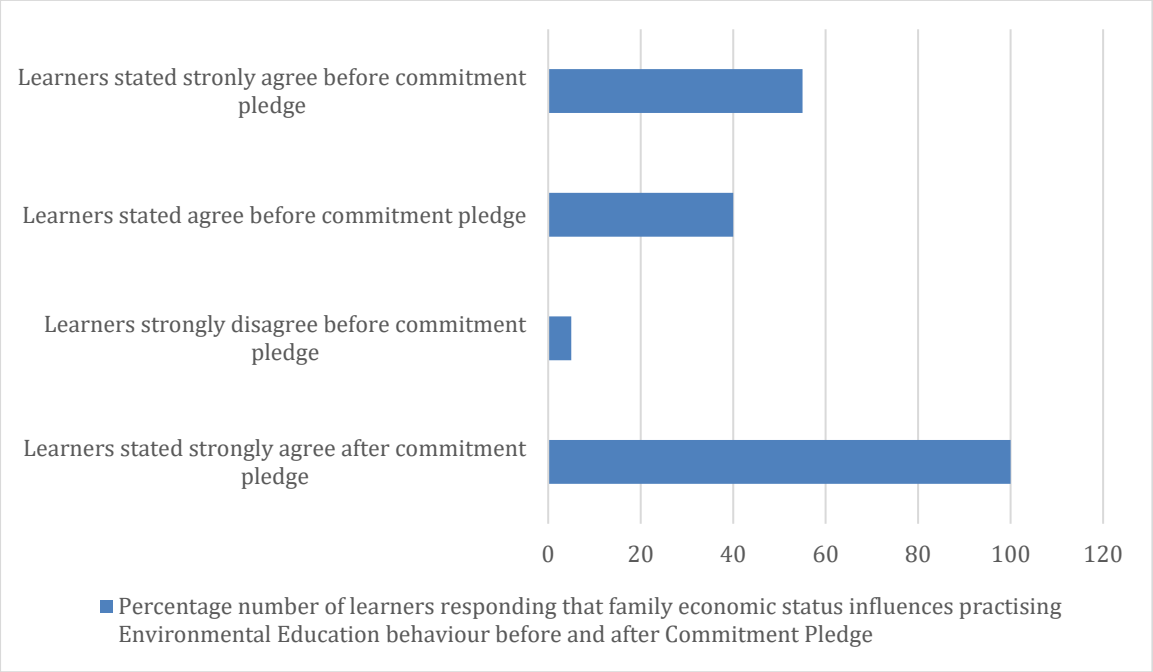



Figure 4. 19 Family economic status

The learners were asked whether they believed that their family's economic status played a part in practicing environmental education behaviour. 5% strongly disagreed, 55% disagreed, 40% strongly agreed. After the implementation of the commitment pledge, all the learners believed that their family's economic status did not play a part in practicing environmental education behaviour. Economic status played a role to some because they stay alone because their parents are working out of Limpopo Province. These parents never taught them to sort plastic and recycle it, but participation at schools helped them to do so.

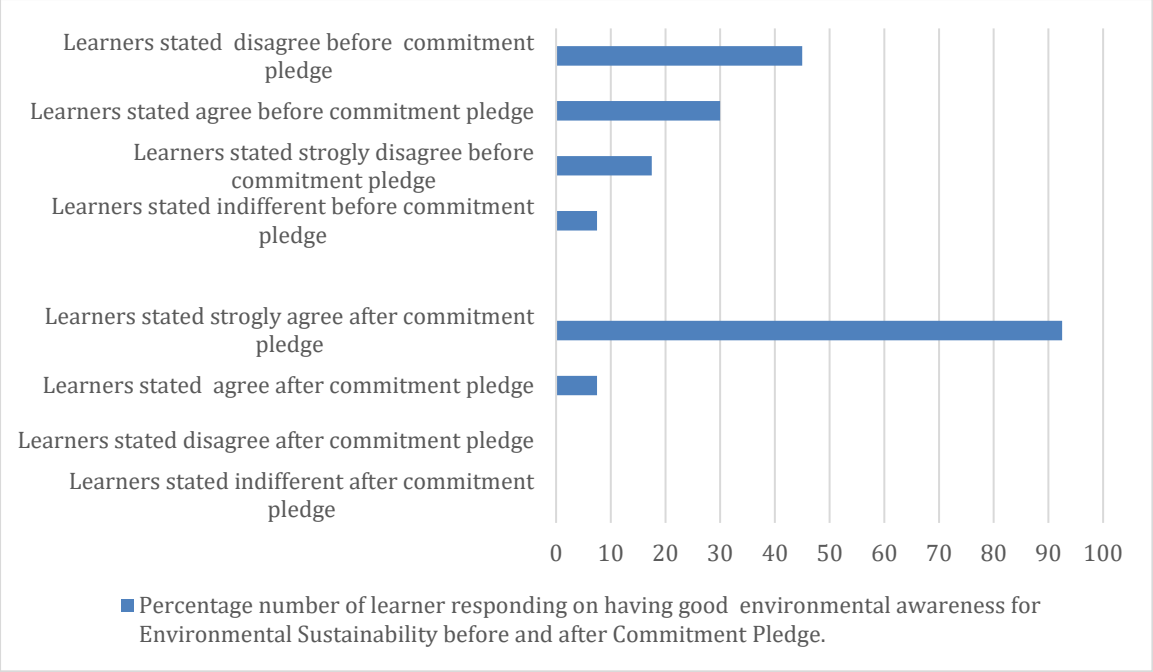



Figure 4. 20 Environmental awareness for sustainability

The learners were asked whether they thought that they should have good environmental awareness for environmental sustainability. 17.5% strongly disagreed, 45% disagreed, 30% agreed and another 7.5% of them were indifferent. After the implementation of the commitment pledge, the learners were heightened by sorting waste and recycling plastic waste. 92.5% of them strongly agreed and 7.5% agreed that raising awareness has helped them to sustain the environment.

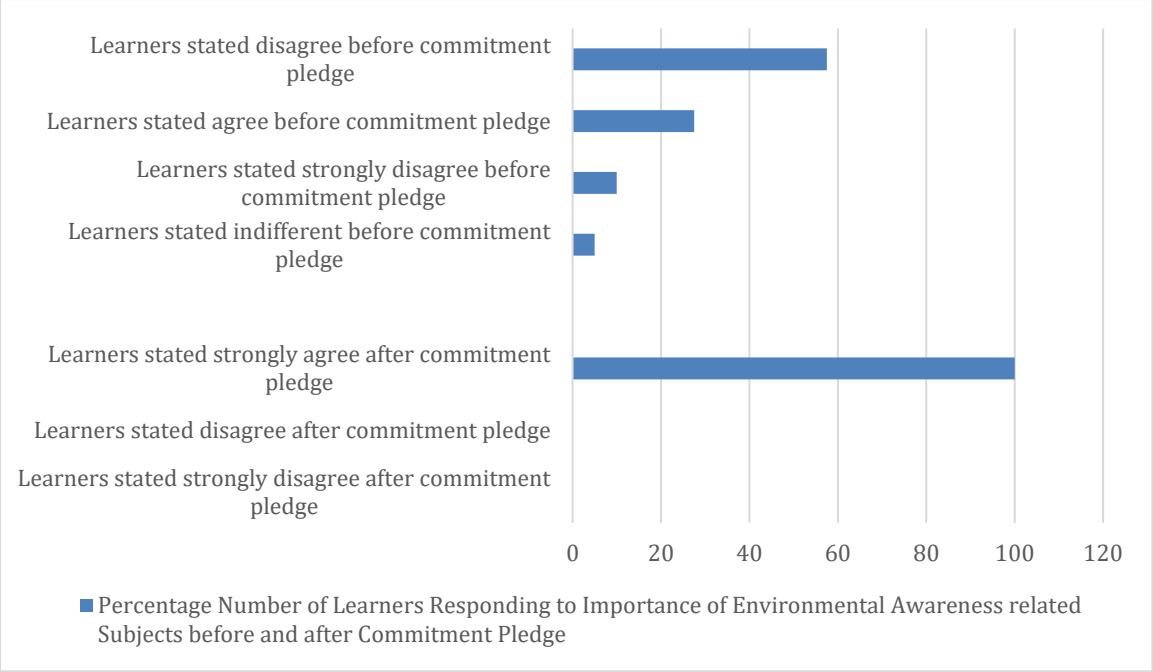



Figure 4. 21 Taking environmental related subjects

Learners were asked whether it was essential for them to take up environmental-awareness-related subjects. 10% strongly disagreed, 57.5% disagreed, 27.5% agreed and another 5% of the learners were indifferent. The commitment pledge encouraged them to find more information about pollution and recycling waste in subjects like geography and life sciences. All the learners strongly agreed that it was essential for them to take up a subject-related to environmental awareness.

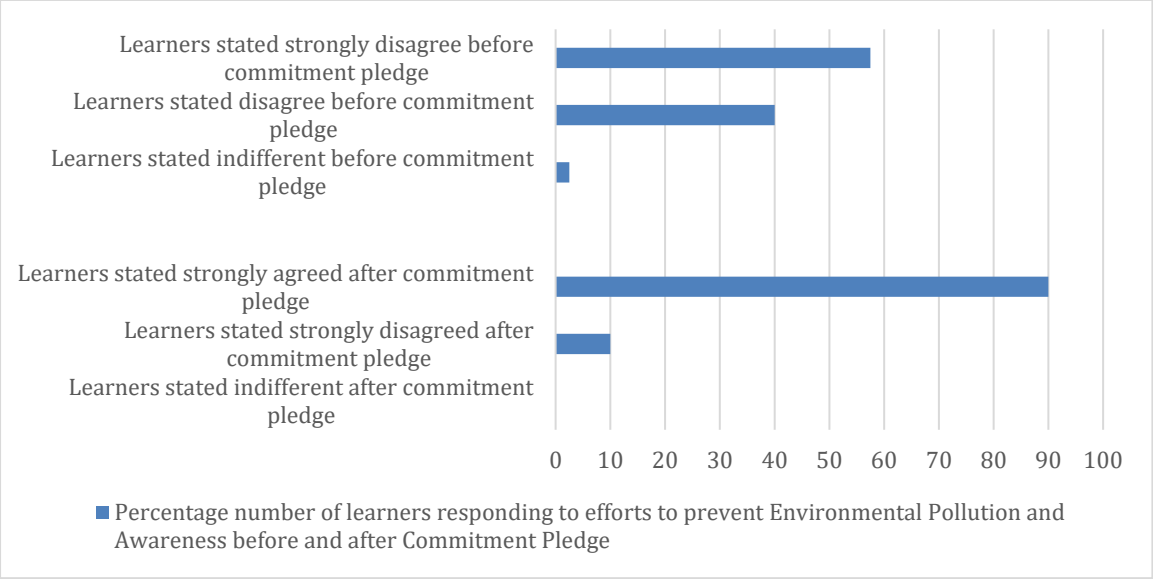



Figure 4. 22 Efforts to prevent environmental pollution

When learners were asked whether they showed their utmost efforts to prevent the pollution of the environment and showed awareness, 57.5% strongly disagreed, 40% disagreed, and 2.5% of them were indifferent. After the implementation of the commitment pledge, 90% of the learners strongly agreed and 10% agreed that they showed sufficient efforts to prevent the pollution of the environment and showed awareness.

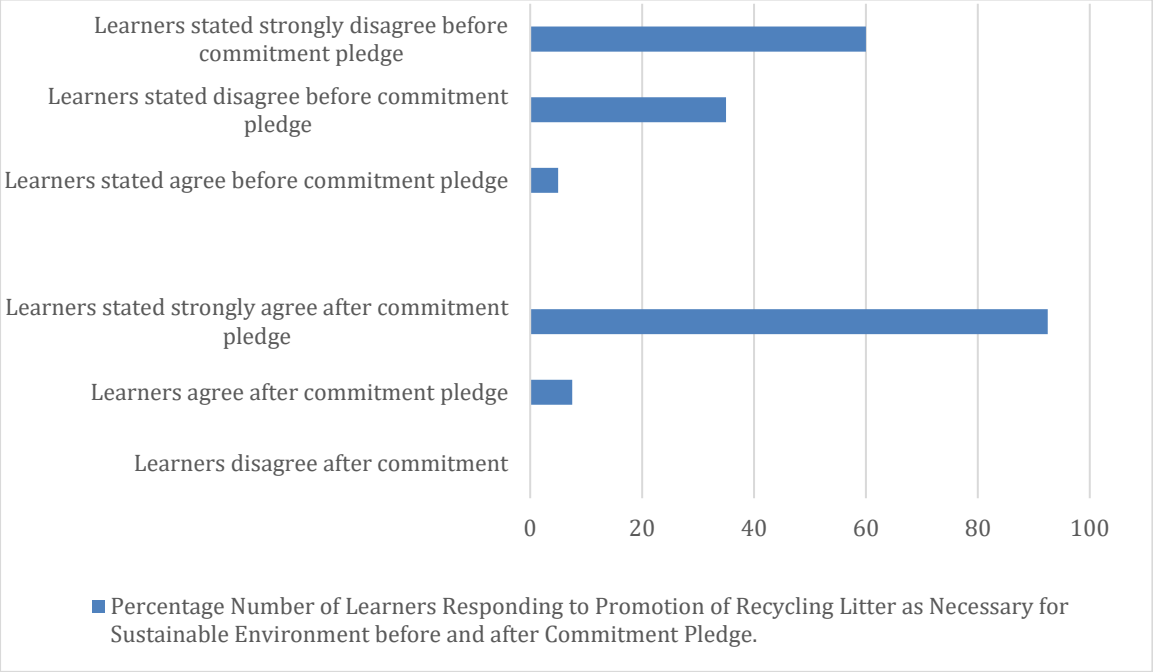



Figure 4. 23 Promotion of recycling litter for sustainability

The survey imposed a question to learners on whether they saw the promotion of recycling litter as necessary for sustainable environment. 35% strongly disagreed, 60% disagreed, and 5% agreed. The implementation of the commitment pledge allowed educators to teach learners about recycling waste and avoiding plastic because it does not decompose. 92.5% of the learners strongly agreed and 7.5% agreed that they saw the promotion of recycling waste/litter as necessary for a sustainable environment.

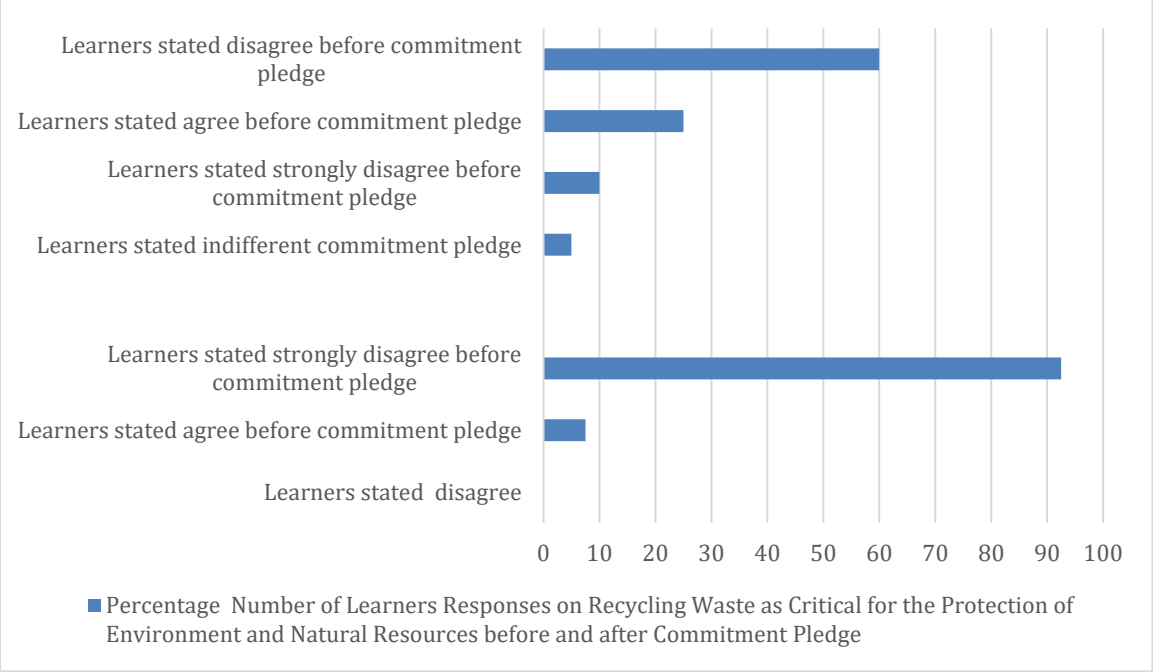



Figure 4. 24 Recycling waste for protection

The learners were asked whether recycling waste was critical for the protection of the environment and natural resources, 10% strongly disagreed, 60% disagreed, 25% of the learners agreed and 5% were indifferent. After the implementation of the commitment pledge, 92.5% of the learners strongly agreed and 7.5% agreed that they believe that recycling waste was necessary for protecting the environment and natural resources.

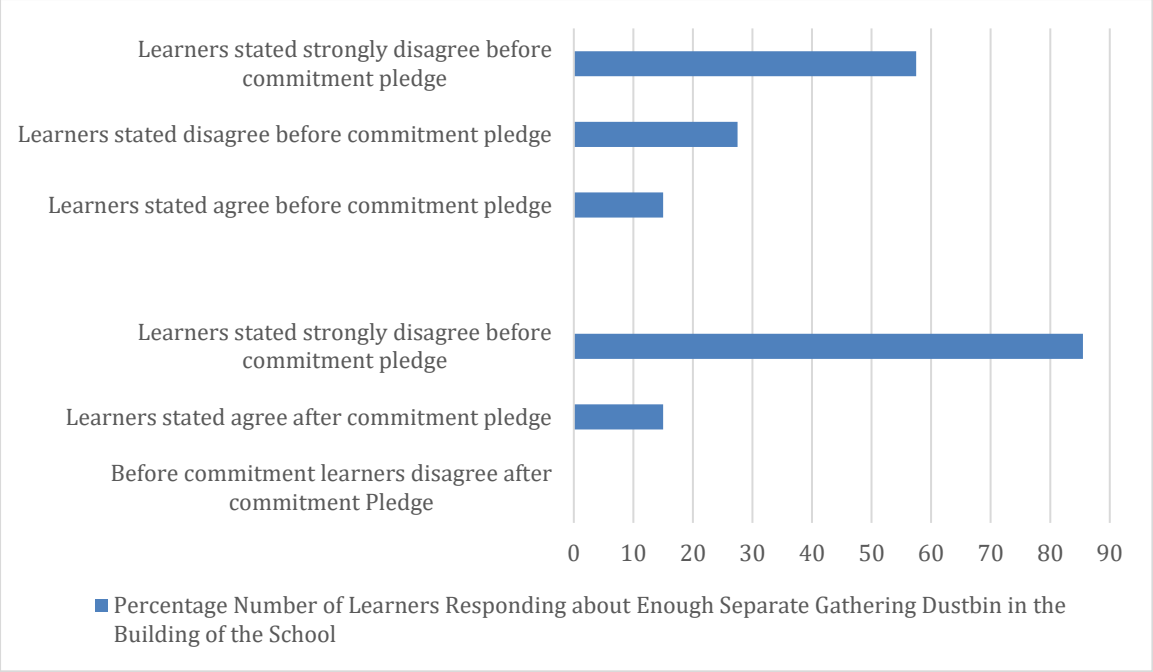



Figure 4. 25 Enough separate gathering bins

When learners were asked whether there were enough separate gathering dustbins (plastic, metal, paper) in the buildings of their schools, 57.5% strongly disagreed, 27.5% disagreed and 15% agreed. After the implementation of the commitment pledge, 82.5% of the learners strongly agreed and 17.5% agreed that there were enough separate collection dustbins (plastic, metal, paper) in the buildings of their schools.

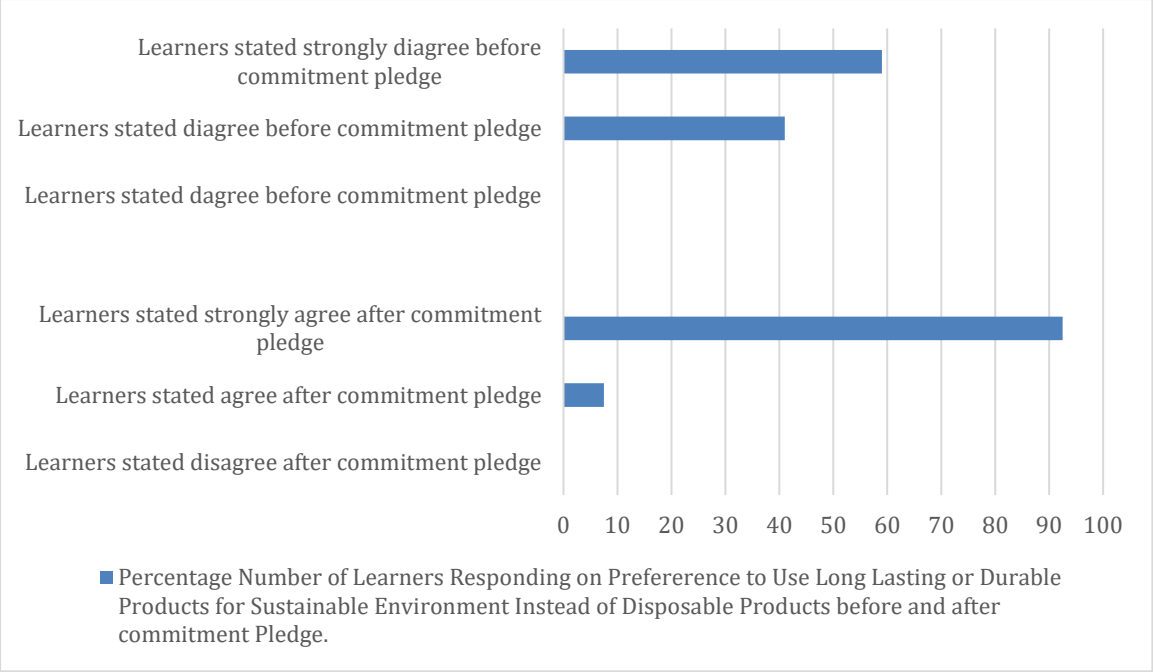



Figure 4. 26 Preference of long-lasting products

Learners were asked whether they preferred to use long lasting or durable products (rechargeable batteries, cloth bags) for a sustainable environment instead of disposable products. 59% strongly disagreed and 41% disagreed. After the implementation of the commitment pledge, learners learned about using recyclables. 92.5% of the learners strongly agreed and 7.5% agreed that they preferred to use durable products (rechargeable batteries, cloth bags) for a sustainable environment instead of disposable products.

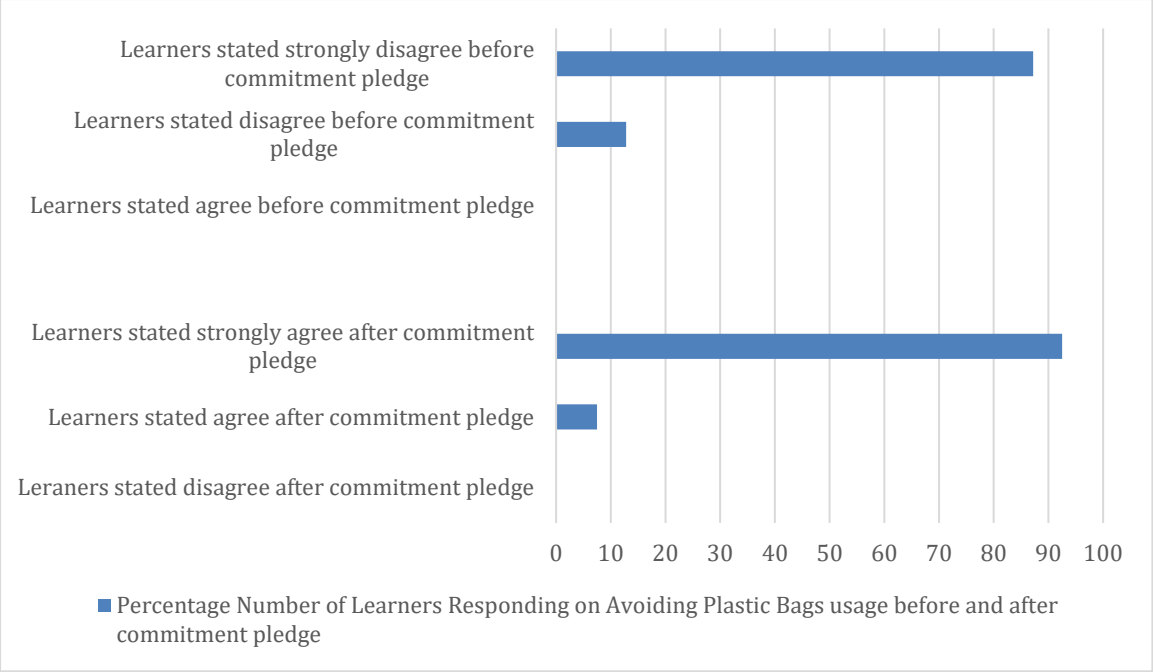



Figure 4. 27 Avoid plastic

When learners were asked whether they would avoid using plastic bags, 87.2% strongly disagreed and 12.8% disagreed. The implementation of the commitment pledges motivated educators to encourage learners to use reusable products. 92.5% of the learners strongly agreed and 7.5% agreed that they would avoid using plastic bags.

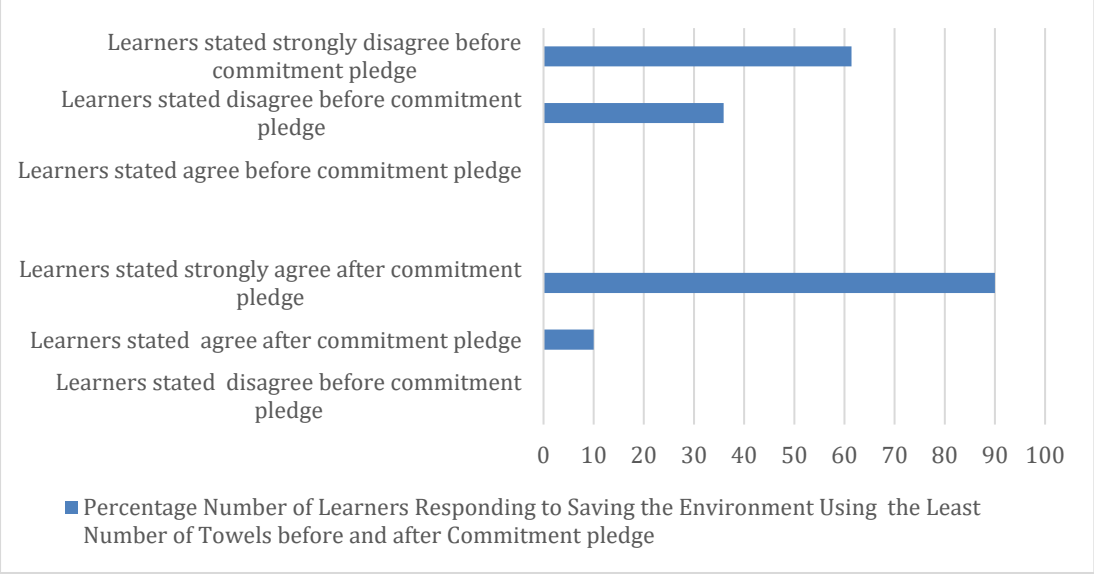



Figure 4. 28 Saving the environment with least paper

The question was posed about whether learners tried to save the environment by using the least number of paper towels. 64.1% strongly disagreed and 35.9% disagreed. After the implementation of the commitment pledge, 90% of the learners strongly agreed and 10% agreed that they tried to protect the environment by using the least number of paper towels.

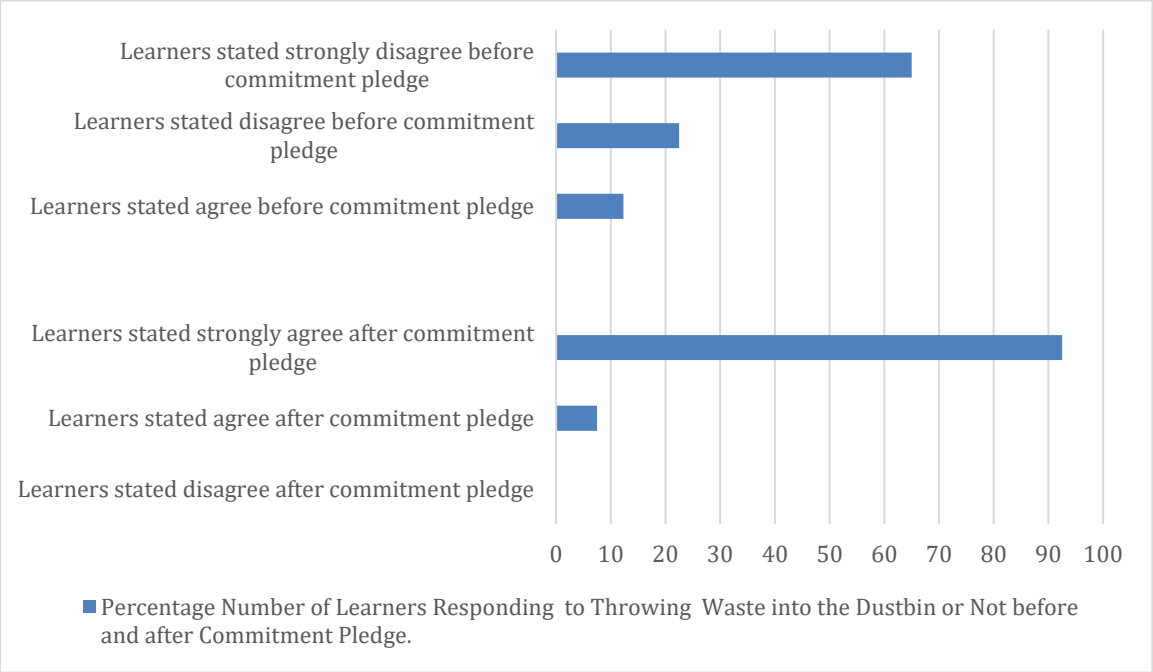



Figure 4. 29 Throwing waste into dustbins

When learners were asked whether they threw their wastes into dustbins before leaving a place and not leaving any trash, 65% strongly disagreed, 22.5% disagreed, and 12.5% of the learners agreed. After the implementation of the commitment pledge, 92.5% of the learners strongly agreed and 7.5% agreed that they threw their waste into dustbins before leaving a place and not do leave any trash.

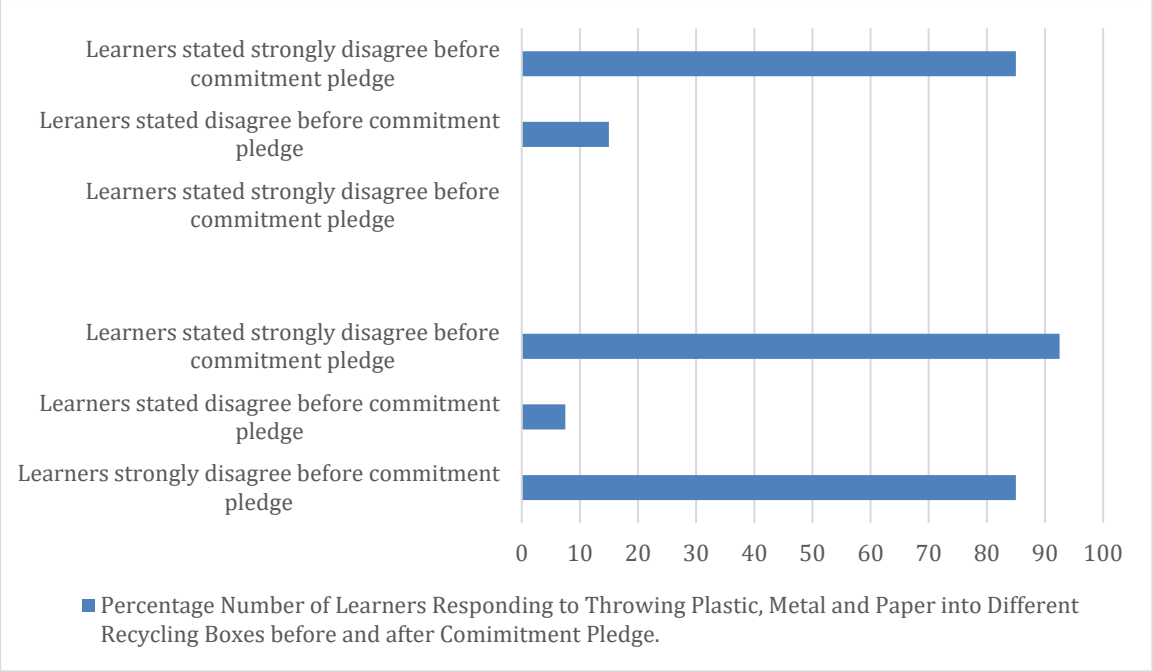



Figure 4. 30 Throwing materials into the boxes

When learners were asked whether they threw the plastic, metal and paper into different recycling boxes, 85% strongly disagreed and 15% disagreed. The commitment pledges motivated them to separate waste into different dustbins. Therefore, 92.5% of the learners strongly agreed and 7.5% agreed that they threw plastics, metals and papers into different recycling boxes.

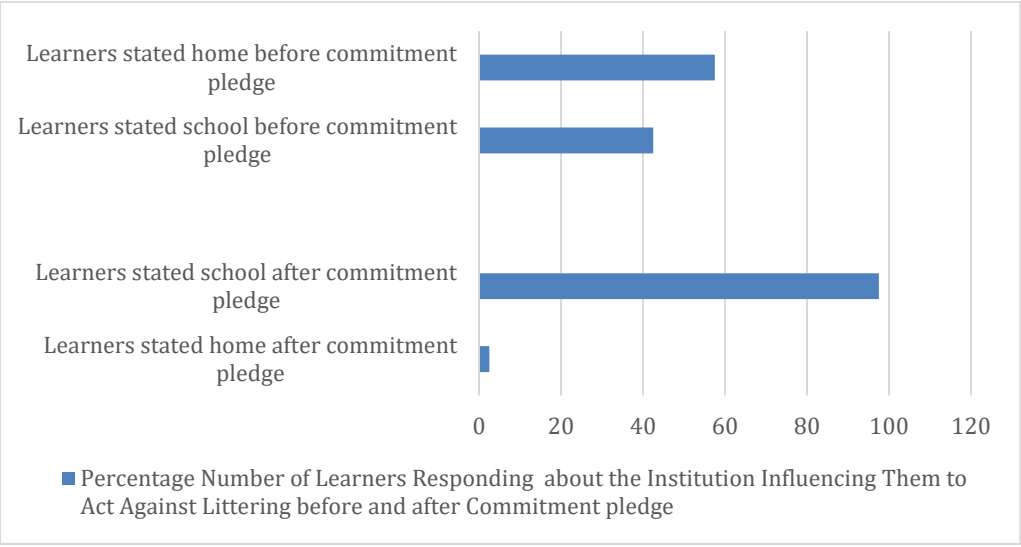



Figure 4. 31 Influence of institution to be against littering

The learners were asked which institution they thought influenced them the most to act against littering. 57.5% said home, and 42.5% mentioned school. After the implementation of the commitment pledge, educators started to monitor learners to sort waste properly. 97.5% of the learners to mentioned that schools encouraged them to act against littering and 2.5% cited books as the greatest influence.

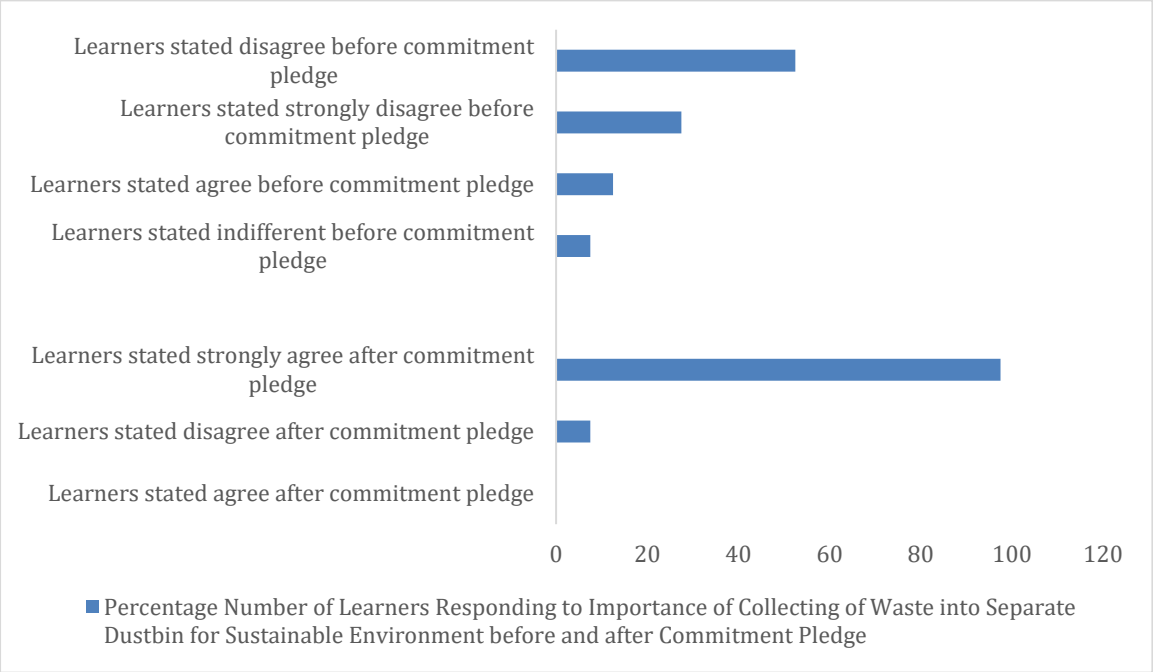



Figure 4. 32 collection into separate bins

The importance of collecting waste into separate dustbins for a sustainable environment was posed to learners. 27.5% of the learners strongly disagreed, 52.5% disagreed, 12.5% agreed and 7.5% were indifferent. After the implementation of the commitment pledge, learners picked up litter and sorted it. 92.5% of them strongly agreed and 7.5% agreed that the collection of waste in separate dustbins was important for a sustainable environment.

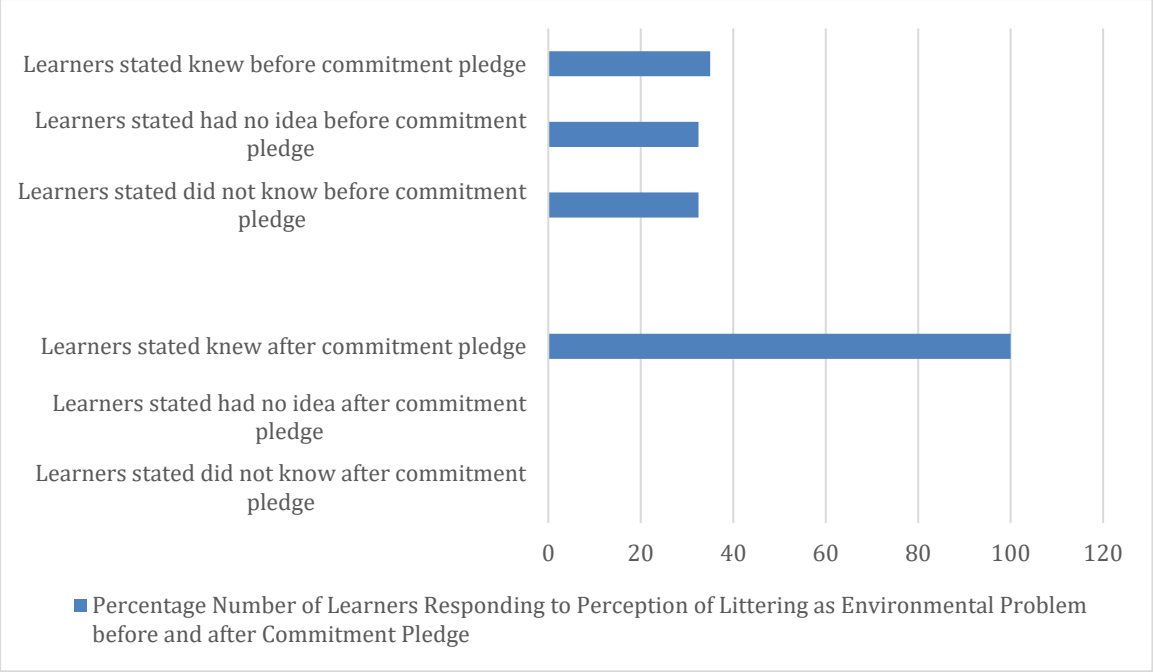



Figure 4. 33 Littering as environmental problem

The learners' perceptions of littering as an environmental problem varied. The question asked about their perception of littering as environmental problem. 32.5% of learners did not know, 32.5% had no idea if it was and 35% knew that it was an environmental problem. After the implementation of the commitment pledge, all the learners knew that it was an environmental problem. They have seen the detrimental effects of littering on photographs of marine organisms displayed on the internet and local livestock.

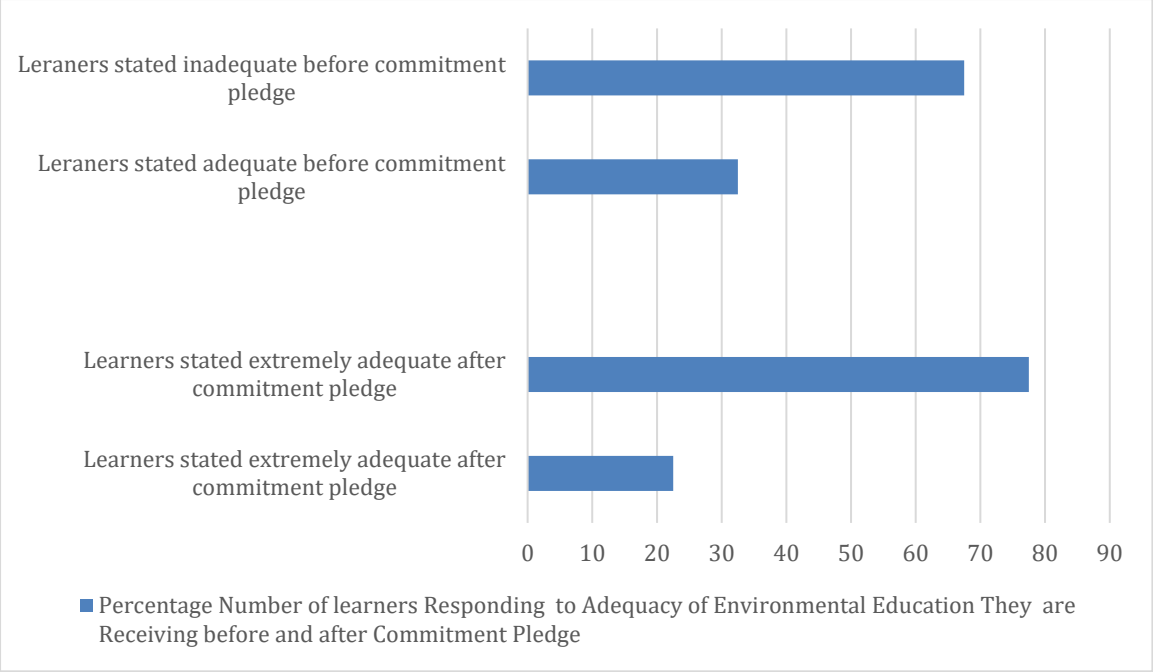



Figure 4. 34 Adequacy of environmental education

When learners were asked about how they felt about environmental education that they were receiving, 67.5% said inadequate, while 32.5% thought that it was adequate. The Commitment pledge seemed to have increased their level of education. 77.5% said that it was extremely adequate and 22.5% said that it was adequate.

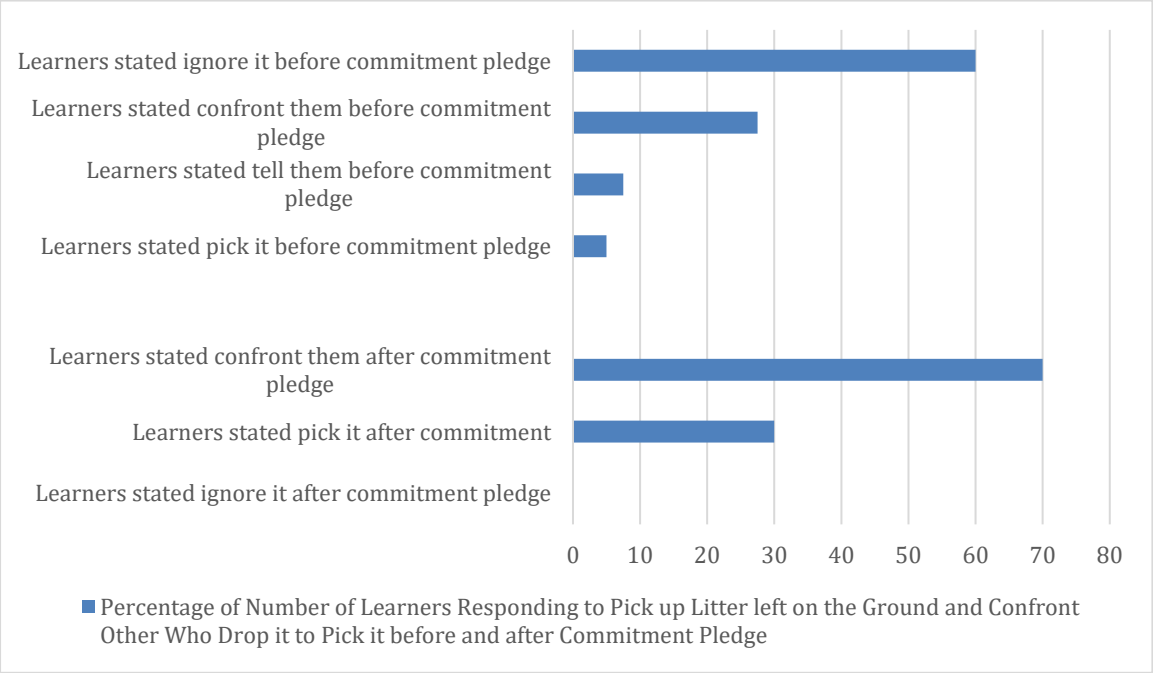



Figure 4. 35 Picking up litter on the ground

Before learners' awareness about littering was increased, they were asked to respond to whether they would pick up litter, ignore or confront others who drop the litter to pick it up. 60% stated they would ignore anyone throwing the litter onto the ground, 27.5% said they would report them, 7.5% had the courage to confront them and tell them to pick it up and only 5% picked up litter that was not theirs. By making a commitment pledge, learners started to pick up litter and sort it. 70% of the learners said that they would confront the learners throwing litter onto the ground and 30% picked it up.

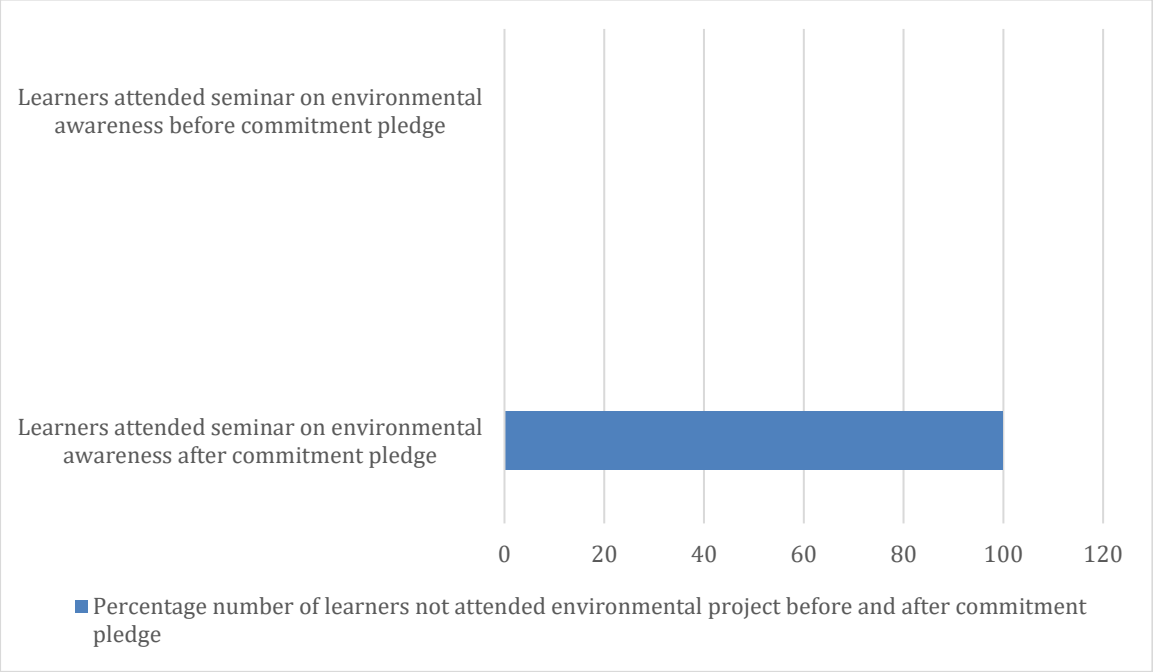



Figure 4. 36 Attendance of seminar or project

Not learner had attended any project or seminar to acknowledge the environmental awareness before the project, but 100% had done so after the implementation of the project.

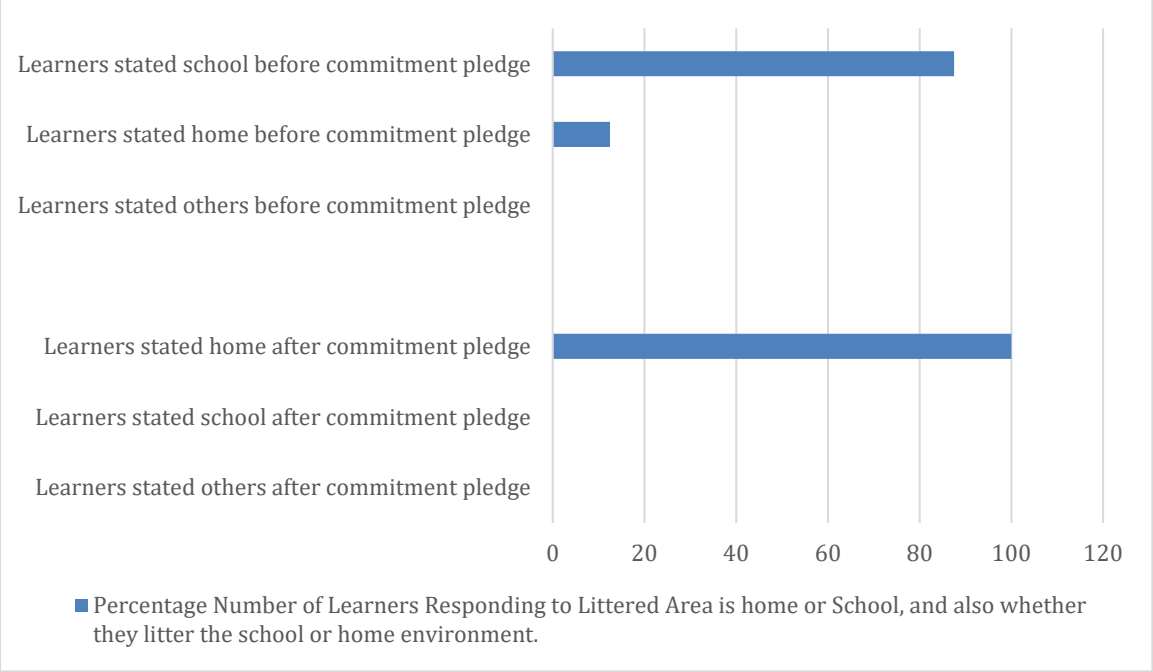



Figure 4. 37 Most littered area home or school

When asked which area they thought was littered most, 87.5% of learners said that the schools and 12.5% said their home. However, the commitment pledge was introduced, and all the learners mentioned the home as the most littered place because picking and sorting of waste was done at school.

### 4.10 Recycled plastic products

Recycled plastic products are becoming increasingly popular in schools, as they provide a sustainable, eco-friendly way to reduce waste. From tables and chairs to playground equipment, recycled plastic products are an excellent way to encourage learners to think more sustainably. These products are not only good for the environment, but also provide a durable and reliable option that is sure to last for years to come. Additionally, they are often made of vibrant and colourful materials that can help make classrooms more inviting and fun for learners. All in all, recycled plastic products are a great way for schools to reduce their impact on the environment and provide a more sustainable learning environment. As a result of the efforts, the learners also started to make craftwork from the waste materials collected around the school, as displayed by the learners in the picture below. The products helped the school to raise funds to buy environmental equipment such as spades, gloves, grass

cutlery, wheelbarrows and many more. Products like sleeping mats above is a highly demanded commodity amongst the elderly in the village.



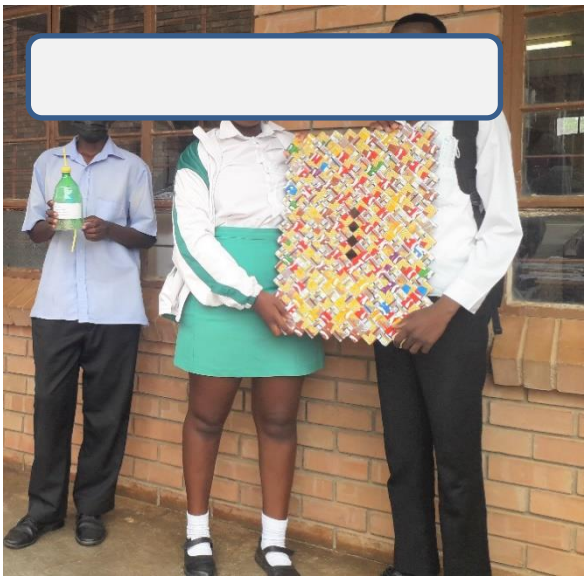


Figure 4. 38 Products made of SUP

Since educators play a crucial role in advancing environmental education amongst the learners, the researcher asked for their views on environmental education and the importance of practicing environmental education in the schools. EE promotes active learning, citizenship and student leadership. It empowered the learners to confidently share their voice and make a difference at their school and in their communities. As demonstrated in the pictures below (Figure 4.34), the learners engaged in some activities to protect the environment by recycling the plastic bags into door mats.

### 4.11 Knowledge and Participation in Environment Protection Activities

Knowledge and participation in environment protection activities are important for the health of our planet and the people who inhabit it. Education is the key to increasing knowledge and participation in environment protection activities. Schools, universities and other educational institutions can provide students with information about the environment and its protection. Teaching about the importance of conservation,

recycling, and other activities helps to create awareness of the advantage of protecting the environment.

In addition to educational programmes, governments can also play a part in encouraging knowledge and participation in environment protection activities. Governments can create incentives for businesses to adopt more environmental-friendly practices and can create laws that help to protect the environment. Public awareness campaigns can also aid to educate the public about the benefits of protecting the environment.

Finally, individuals can also help to increase knowledge and participation in environment protection activities. People can recycle, conserve resources, and take part in local clean-up initiatives. Individuals can also get involved in local and national environmental groups and help to spread the word about the importance of protecting the environment. By increasing knowledge and participation, individuals can help to make a difference in protecting the environment.

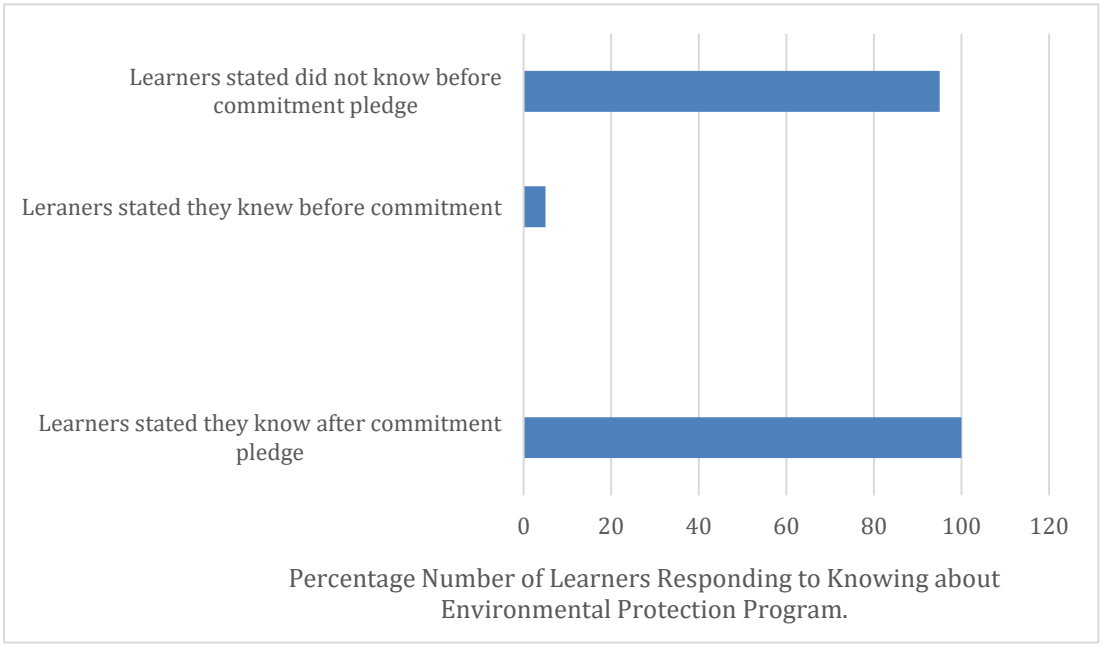



Figure 4. 39 Knowing environmental protection program

When learners were asked whether they knew of any programme aimed at protecting the environment at their schools, 95% did not and only 5% knew about the programmes. After the implementation of the commitment pledge, all the learners knew of a programme aimed at protecting the environment at their schools. To help protect the environment, the learners recycled plastic to make mats and flowers and separated the waste into different dustbins. The learners did not participate in any environment education activities provided at their schools, but all started participating in the activities after the implementation of the commitment pledges. The intervention helped them to understand how their decisions and actions affected the environment around them and helped raise their awareness and skills required to create a healthy environment that was sustainable into the future.

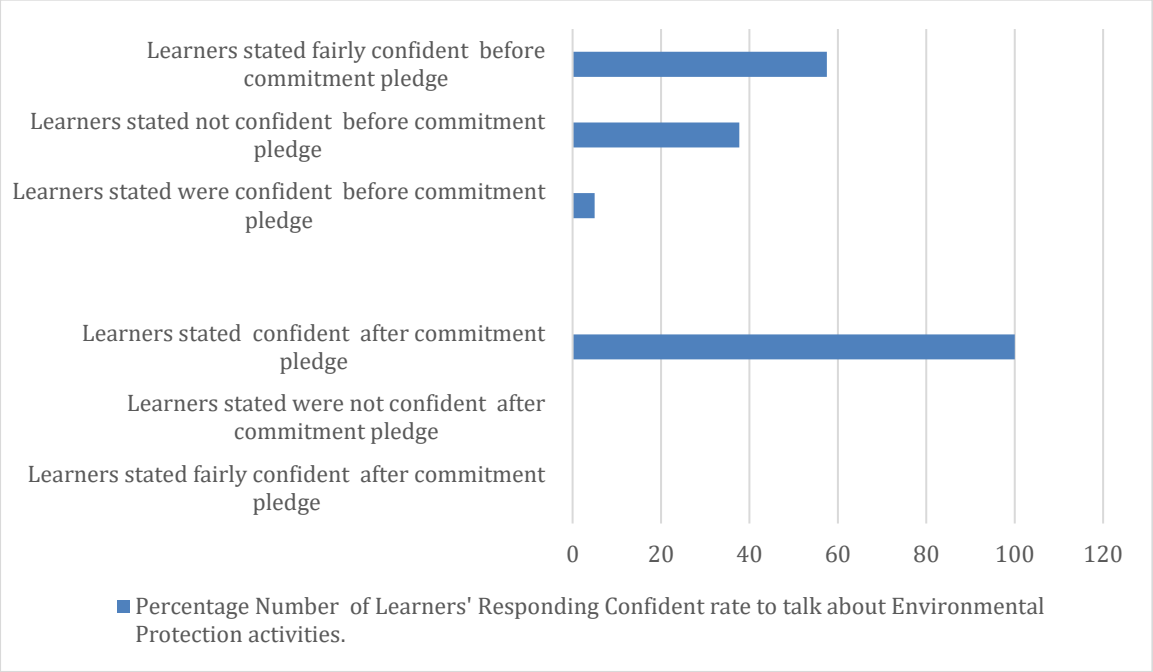



Figure 4. 41 Confidence to talk about environmental protection

When learners were asked about whether they would be confident to speak about environmental protection activities, 57.5% of the learners were fairly confident, 37.5% were not confident, and only 5% were confident to speak out about environmental protection activities taking place in their schools. After making the commitment pledge, all the learners were confident to speak out about environmental protection activities occurring in their schools.

### 4.12 Separation of waste materials generated at the school

The separation of waste materials generated at the school is an important part of ensuring that the environment is protected from the ill-effects of pollution. Separating the waste into different categories such as paper, plastic, metal, glass and organic material helps to ensure that the waste is properly disposed of. It makes it easier to recycle and reuse the materials, preventing them from ending up in landfills. Additionally, when the waste is properly separated, it can be more easily composted, reducing the amount of waste that is sent to the landfill. Separating the waste materials at the school also allows for the efficient disposal of hazardous materials such as paints and chemicals, minimising the risk of contamination in the environment.

Although learners succeeded in sorting waste in both schools, learners in School A wrote the Commitment Pledge, and publicly announced it in front of the whole learners at the school. This means that the Public Commitment Pledge encouraged learners to retain and be consistent with the new behaviour as they have promised the public to always sort waste for four weeks, including the follow-up. The researcher observed that Public Commitment learners sorted waste with confidence and encouraged other learners to do the same during lunch time. School A learners' confidence was boosted by being gathered and provided with feedback. They were told that they are doing sorting well and to keep it up. School B learners wrote their Commitment Pledge privately. No learner at School B knew about their pledge to sort waste. School B learners were not expected by anyone to be consistent with new behaviour of sorting wastes. This influenced the learners to sort waste less because they were not confident in their act; they were shy to encourage other learners to do the same.

The written Public Commitment Pledge has been proven as the best tool in Environmental Education to shape the littering behaviour. The technique is good in maintaining the sustainable behaviour than the written Private Commitment Pledge. Due to the commitment pledge, the learners started cleaning their school premises (Figure 4.42) and the school(s) introduced the waste sorting stations (Figure 4.43) and started to install bins around the school buildings to allow the learners to sort the materials at the time of disposing.



Figure 4. 42 Cleaning of the school




Figure 4. 43 Waste sorted into different bins

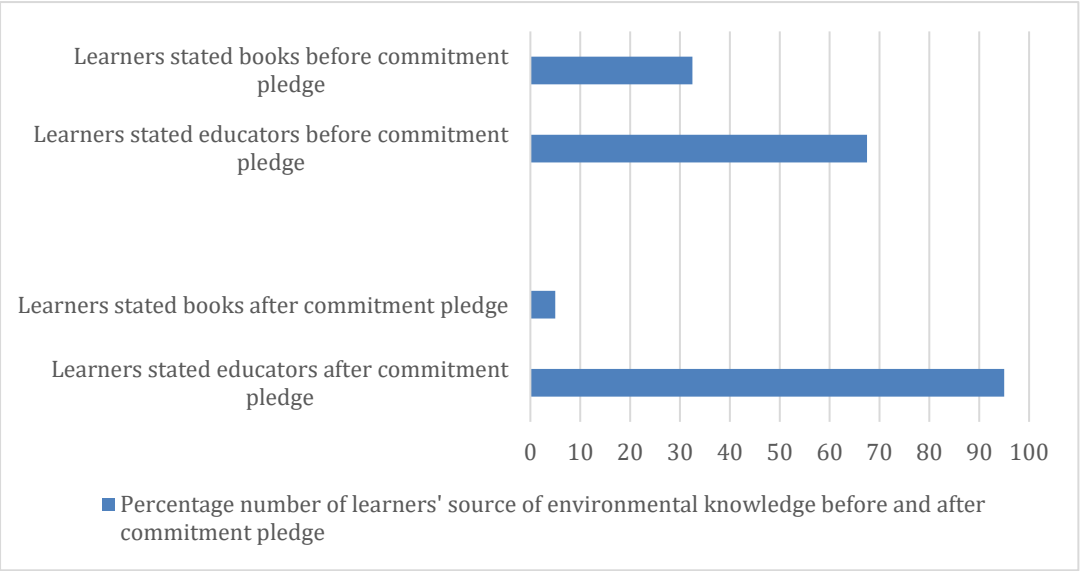



Figure 4. 44 Sources of environmental knowledge

When learners were asked about the source of environmental knowledge, 67.5% stated educators while 32.5% stated books. The commitment pledge was made, and most learners (95%) stated educators after being provided with knowledge about plastic pollution and its impact, and 5% stated books.

### 4.13 Motivator, barriers and support needs

Numerous barriers that prevented environmental education from being implemented in schools and other educational institutions were identified through interviews. These barriers include lack of resources, lack of support from educational authorities, lack of teacher training and awareness and lack of student interest. The study also discusses strategies that can be used to overcome these barriers, including providing resources, training educators, creating awareness, and engaging learners in activities that promote environmental education. The study concludes that environmental education is an important part of education, and that overcoming these barriers is essential for its successful implementation.

To come up with the Table 4.2 below, scales were combined for ease of explanation. 1. strongly disagree and 2. disagree were combined to give a new group [disagree]; 3. neutral [not changed]; 4. agree and 5. strongly agree combined to give a new group [agree]. The responses fell into two groups disagree and agree.

**Table 4. 2 Comparison of the responses to motivation, barriers and support questions before and after the implementation of the commitment pledge**

| Statement | Before – Disagree | After – Agree |
|---|---|---|
| To what extent do you believe that environmental participation would activate environmental protection behaviour? | 100 | 100 |
| Do you believe that your/their family economic status plays a part in practicing environmental education behaviour? | 100 | 100 |
| Do you think that young people should have a good environmental awareness for sustainable environment? | 100 | 100 |
| Is it necessary for all learners to take subject related to environmental awareness? | 100 | 100 |
| I always show my best efforts to prevent pollution of the environment and show awareness | 100 | 100 |
| Do you see that promotions of recycling waste/litter are necessary for sustainable environment? | 100 | 100 |
| Is recycling of waste important for the protection of the environment and natural resources. | 100 | 100 |
| Do you think that collection of waste in separate dustbins is important for a sustainable environment? | 100 | 100 |
| Is there enough separate collection dustbins (plastic, metal, paper) in the buildings of your school? | 100 | 100 |
| I prefer to use long lasting products (rechargeable batteries, cloth bags) for a sustainable environment instead of disposable products. | 100 | 100 |
| I would avoid using plastic bags | 100 | 100 |
| I try to protect the environment by using the least number of paper towels. | 100 | 100 |

| | | |
|---|---|---|
| I throw the garbage into dustbins before leaving that place and not leaving any trash. | 100 | 100 |
| I throw the plastic, metal, plastic, glass, and paper to separate recycling boxes | 100 | 100 |

This part of the questionnaire evaluated the relationship of the educators' environmental knowledge, attitude and concerns of their interests in environmental problems, involving outdoor activities, and involvement in environmental activities. Prior to the study, all educators did not demonstrate any interest in environmental education and associated activities; but after the implementation of the commitment pledge, all the educators agreed that EE (Table 4.2) was critical.

### 4.14 Environmental Education (Views)

Previously, the participants disagreed that environmental education was a high-priority topic for them; that teachers should advocate a particular stance with respect to environmental issues; that environmental education should include a social justice perspective; that it should include an action component; that field trips and activities outside the classroom were essential to environmental education; that visits to Outdoor Education Centres should be an essential component of environmental education; and that outdoor education should be about connecting children to the natural environment. After further discussion, the participants agreed on all these points.

**Table 4. 3 Comparison of the responses to the views on environmental education questions before and after the implementation of the commitment pledge**

| Statements | Before – Disagree | After – Agree |
|---|---|---|
| Environmental education is a high-status topic for me | 100 | 100 |
| In classrooms teachers should advocate a particular stand with respect to environmental issues | 100 | 100 |
| Environmental education should include a social justice perspective | 100 | 100 |
| Environmental education should include an action component | 100 | 100 |
| Field trips and activities outside the classroom are essential to environmental education | 100 | 100 |
| Visits to Outdoor Education Centres should be an essential component of environmental education | 100 | 100 |
| Outdoor education should be about connecting children to the natural environment | 100 | 100 |

This part of the questionnaire evaluated the views of educators about environmental knowledge, attitude, and concerns of their interests in environmental problems, involving outdoor activities, and involvement in environmental activities. Prior to the study, all educators held basically negative views about environmental education, and none believed that it could assist in solving environmental issues. But after the implementation of the commitment pledges, their views changed to those that believed it could assist in solving environmental issues (Table 4.3).

### 4.15 Environmental Education (Practice)

The results of the survey showed that the respondents strongly agreed that environmental education is generally well implemented in their classroom, and that they are successful in getting their learners concerned about the local and global environment. Before the implementation of the commitment pledge, all respondents disagreed that environmental education was generally well implemented in their classrooms; successful in getting their learners concerned about the global and local environment; field trips were central to their environmental education goals; they frequently used Outdoor Education Centre visits to promote environmental awareness; and environmental education was mainly about raising students' awareness and developing critical thinking skills to evaluate environmental issues. After the implementation of the commitment pledge, all respondents agreed that environmental education was generally well implemented in their classrooms; successful in getting their students concerned about the global and local environment; field trips were central to their environmental education goals; they frequently used Outdoor Education Centre visits to promote environmental awareness; and environmental education was mainly about raising students' awareness and developing critical thinking skills to evaluate environmental issues.

**Table 4. 4 Comparison of the responses to the practice of environmental education before and after the implementation of the commitment pledge**

| Statement | Before - Disagree | After – Agree |
|---|---|---|
| Environmental education is generally well implemented in my classroom | 100 | 100 |
| I am successful in getting my students concerned about the GLOBAL environment | 100 | 100 |
| I am successful in getting my students concerned about my LOCAL environment | 100 | 100 |
| Field trips with my class are central to my environmental education goals | 100 | 100 |
| I frequently use Outdoor Education Centre visits to promote environmental awareness | 100 | 100 |

| | | |
|---|---|---|
| In my school, environmental education is mainly about raising student awareness | 100 | 100 |
| In my school environmental education is mainly about developing critical thinking skills to evaluate environmental issues | 100 | 100 |

The educators reported learners' level of knowledge on the topic as being mixed. They further explained that "before the project, some [learners were] very knowledgeable maybe 10%, maybe 50% [were] aware of it, and some just didn't know that much, [they] have no idea".

The throwing of litter anywhere on the school grounds demonstrated low levels of environmental literacy among the learners in both schools. EE encouraged learners to research, investigate how and why things happen, and make their own decisions about complex environmental issues. By developing and enhancing critical and creative thinking skills, EE helps foster a new generation of informed consumers as well as being ambassadors that will help spread the word and increase EE awareness among the communities (Table 4.4).

In conclusion, the study results compared data of educators and learners twice, before and after the commitment pledge. The data was compared twice using paired t-test was to observe behaviour change before and after commitment pledge. The results of this study when compared in general obtained 95% confidence level, as $P \leq 0.05$ value was considered statistically difference. All the pre- and post- data results of behaviour change through the commitment strategy was analysed and presented in percentage form using the bar graph. The sub-section below introduces a semi-structured interview. The intention is to substantiate the views of educators and learners' behaviours from the questionnaires verbally before and after the commitment pledge.

## 4.16 Semi-Structured Interview

This section explains self-reported plastic littering of learners and educators before and properly disposal of plastic after commitment pledge. The section also explains that educators and learners self-reporting that they were lacking knowledge of plastic pollution and its impact before commitment pledge and self-reported that they recycled plastic after commitment pledge. The section explains that semi-structured interview was analysed through thematic analysis, which gave rise to major themes to address the research objectives of the study. The themes and subthemes were detected based on their frequent occurrences in the interviews. They were also determined by the way responses were stressed in the interview. The table below indicates the main themes and subthemes.

| | | | | | | |
|---|---|---|---|---|---|---|
| Consumption | Pollution | Presence of dustbin | Sustainability | Punishment | Responsibility | Recycling programme |
| Disposal | Awareness | Enough dustbin | Sources | Lack of action | Stewardship | Incentives |

Table 4.5 Table showing Main themes and Subthemes

### 4.16.1 To evaluate the level of knowledge towards environmental problems and concerns among village school learners

#### 4.16.1.1 Consumption

Consumption was the most expressed theme throughout the interviews in both schools A and B appearing as the main with subtheme: disposal.

##### 4.16.1.1.1 Disposal before commitment pledge

The participants were asked whether the food they buy had wrappers and how they disposed of the wrappers. The educators indicated that most of the food they consume daily are covered with plastic. Although the minority of educators expressed that they dispose of them properly, the majority stated that they dispose of plastic wrappers mixed with other waste in a single dustbin. Some educators reported disposing of plastic on the school ground. Female Geography educators in school A argued: “Yes, fish, chips and cool drink, [have wrappers] yes, fish and chips are served in a

Styrofoam plate [type of plastic], and cool drink in a plastic bottle and I dump them [wrappers] on the pile of waste on the outside."

Learners' self-reported plastic consumption and disposal varied. Some disposed of the plastic on the school yard and others in dustbins with other wastes. In school B, a grade 11 noted: "Snacks, ice block juice, and chicken feet [have wrappers], yes, chicken feet are in a Styrofoam container which I throw away as I have a container containing porridge from NSNP, snacks, Ice block juice are in a plastic which I also throw away because there are people who will pick them up."

#### 4.16.1.1.2 Disposal after commitment pledge

All participants expressed higher awareness of consuming less plastic and proper disposal to protect the environment. Educators argued that awareness about the impact of plastic helped them to avoid using it. Most educators reported that more knowledge about the negative impact of plastic helped them to teach learners about avoiding plastic use. The educators reported that they have approached the school vendors to introduce returnable plate and deposit of 50 cent. The deposit was paid back to encourage learners to return the plate in exchange for money. Some educators stated that they buy food with their reusable containers to avoid plastic and save the environment. The Economics educator in school B said: "No, fish and chips are placed in my container, and I dispose them properly in their own dustbins and cool drink in a plastic bottle that I return [reuse] at home with to keep water cool in the fridge."

The high awareness of the negative impact of plastic on the environment was supported by learners following a commitment pledge. The learners in both schools were using reusable containers to reduce plastic consumption and protect the environment. A grade 12 learner from school A explained. "No, I also to go to the school vendors with a container to fill it with chicken feet, the 1 litre cool drink is in the glass bottle [reusable] which I return to the vendors when it is empty, and I only dispose bones and banana peels in the same container written compost."

### 4.16.2 To evaluate the level of knowledge towards environmental problems and concerns among the teachers

#### 4.16.2.1 Pollution

The school curriculum was the main theme expressed a lot in both the focus group discussions with learners and key informants with educators. This main theme had subjects as its subtheme as awareness.

##### 4.16.2.1.1 Awareness before commitment pledge

Educators and learners were asked a question to respond if they think lessons learned in class about environmental issues could help to prevent littering. They should also indicate the subjects that they are learning about environmental issues, and about lessons that they are taught. Most educators indicated that the subjects they are teaching had environmental issues or topics. Although fewer educators reported that their subjects do not contain pollution lesson, most educators had knowledge of the danger of littering, and they have learned that littering is dangerous. This was supported by a Life Orientation educator explaining: “yes, in Life Orientation subject, the lesson that could be learned is that it is our right to live in a clean environment.”
There were a handful of learners who reported that their subjects had no environmental issues. However, most of them indicated that their subjects contain environmental topics on issues. In school B a Life Science learner noted: “yes, Life sciences has taught me that more waste are taken to the landfill site, and they are struggling to manage this waste [in landfill site]”.

##### 4.16.2.1.2 Awareness after commitment pledge

The educators stated that the presentation increased their awareness and helped them to search for more knowledge about environmental issues in other subjects. They stated that they have gained more knowledge about the danger of plastic pollution and its impact on the environment following the commitment pledge. They stated that they gained more knowledge that littering affects soil, water and human health. The increased knowledge had encouraged them to teach and engage learners to throw waste into separate bins. The Agriculture Sciences educator in school B

explained: “in Agricultural Science, the lesson is that some waste [plastic] are non-biodegradable and prevent crops from growing and food insecurity would increase”.

The learners indicated that they searched for more information about environmental issues in other subjects following the commitment pledge. They also found that there were more lessons that could be learned from environmental issues. The increased knowledge on environmental issues influenced them to sort and recycle plastic. The grade 11 Life science learners stated: “yes, Life Sciences, the lesson learned is that plastics need to be recycled or reused to keep environment clean because they are non-biodegradable.’’

### 4.16.3 To evaluate the attitude of village school learners and educators towards proper waste management

#### 4.16.3.1 Presence of dustbins

The presence of dustbins was the main theme uttered more often by the participants. The subthemes were enough dustbins.

##### 4.16.3.1.1 Enough dustbin before commitment pledge

Educators and learners were asked if there were enough dustbins inside and outside the classroom. They were asked if the dustbins are well placed and where they think dustbins must be placed. They stated that there are few dustbins in their schools, because wastes are overflowing. They indicated that they are placed far from each other, making it difficult to go and dump waste. The Agricultural Science educator in school A argued: “there are not enough dustbins [inside and outside] there is one on the school ground and on the outside the classroom’’.

Learners also argued that dustbins are available, but the majority stated that they are few. They also stated that the dustbins are far away and the majority dump waste in the nearby dustbins. A grade 9 learner in school A replied: *“*no, there is only one dustbin in the school ground, inside and outside of classroom”.

##### 4.16.3.1.2 Enough dustbins after the commitment pledge

The educators stated that following the presentation and commitment pledge, they put dustbins in places that were easy to reach and into different categories. They stated that the dustbins were written the name of the item to be recycled. The Economics

educator in school B explained: “The dustbins are enough and well placed in the field of the school, inside and outside the classrooms’’.

Learners stated that they were empowered to recycle plastic waste because the dustbins are well located, marked to match waste type and the distance is shorter. For this reason, learners stated that after the commitment pledge, they dump plastic waste properly into different categories. A grade 9 learner asserted: ‘’yes, my school now has dustbin close to the vendors [people selling food], others on the outside and in the inside the class’’.

### 4.16.4 To assess how increased learners’ knowledge and practical skills can help them to commit to anti-littering

#### 4.16.4.1 Sustainability

Another main theme is sustainable measures, and its subtheme is sources of sustainable measures.

##### 4.16.4.1.1 Sources of sustainable measures before commitment pledge

Participants were first asked about the anti- littering messages seen or been told about prior to the presentation of sustainable measures. The participants’ sources of sustainable messages varied. Educators with prior knowledge of sustainable measures started seeing it in their textbooks, documentaries and a variety of packages. Although most educators indicated knowledge of sources prior to the commitment pledge, they have never seen it practised prior to the pledge. A Geography educator in school A stated: “I taught about Reduce, Reuse and Recycle in my class [but never practised it] because it is in my geography textbooks”.

Learners’ self-reported sources of sustainable messages varied. Most learners reported seeing the sustainable messages in their textbooks, on the dustbins, on the bottles and on television. Although the majority have seen messages in various sources, they have never seen it in practice in their schools prior to the commitment pledge. In school B, a grade 10 explained: “I saw messages of reduce, reuse and recycle on the bottle of cool drink, in town and on TV”.

#### 4.16.4.1.2 Sources of sustainable measures after commitment pledge

All educators involved in the study argued that they have gained more knowledge about sustainable messages after seeing and being told about it in the presentation. They stated that the commitment pledge influenced them to practice the messages with learners. A Life Science educator in school B explained: “I was taught about avoid, recycle and reduce by the researcher [during presentation], I know how to practice it with learners to stop littering”.

This was supported by learners who stated that their source of reduce, reuse and recycle is their educators as they are practising the measures at school. The grade 10 learner in school B stated: “environmental school committee taught us about reduce, reuse, recycle and avoid here at school we are practising circular economy measures.’’

### 4.16.5 To assess current environmental practices among village school learners

#### 4.16.5.1 Punishment

Punishment was a recurring and apparent theme throughout the interviews forming a strong theme with a subtheme such as lack of participation.

#### 4.16.5.1.1 Lack of action

Educators and learners were asked about which anti-littering measure was effective and which one was not. Educators’ responses to this question were varied. The majority responded that fewer learners who committed misconduct were involved in litter pick-up as a form of punishment prior to the commitment pledge. The educators stated that the learners were instructed to burn waste in an open fire when the municipality failed to collect it to the landfill site. They stated that punishing troublesome learners was not effective because piles of waste were increasing in the school yard prior to the commitment pledge. The Life Orientation educator in school A explained: “I think the tendency of our school to use learners on punishment is ineffective because they are failing to pick all waste, [accumulating in the school yard]

I think the effective measure would be to choose a day and involve all learners to participate in litter pick-up."

The learners' responses to the question varied. However, most of them supported the educators' views that involving punished learners in school is not resolving waste reduction in schools. In school A, a grade 12 learner responded: "teachers only involve troublesome learners in picking up waste at school and that measure is ineffective, for this measure to be effective in removing waste at school, all learners must take part in doing that.''

#### 4.16.5.1.2 Lack of participation after commitment pledge

Educators and learners stated that the presentation and commitment pledge motivated them to take care of their school environment by keeping it clean. Educators stated that all learners are now participating in litter pick-up every time they finish eating their lunch. They asserted that learners are sorting and dumping waste into separate dustbins. The Life Orientation educator explained: "teaching learners about dumping waste in the bin alone is ineffective, I think effective measure was allowing all learners to participate in sorting and dumping waste in different dustbin''.

The learners were also motivated to pick up waste because the piles of waste were producing bad smell. The learners communicated with educators to clean all piles of waste in the school yard. A grade 12 learner stated: "Teachers were quiet about excessive use of plastic wrappers [improper disposal] and that was ineffective measure, but they asked us to reused items and when we buy some items like cool drink we prefer the glass [its reusable than single-use plastic] because we are able to turn it back and that reduces waste in our school and that measure is effective."

### 4.16.6 Evaluate the interaction between teachers' knowledge, attitude and practice compared to the learners

#### 4.16.6.1 Responsibility

Responsibility was emphasised as a recurring and apparent theme. Its subtheme is stewardship.

#### 4.16.6.1.1 Stewardship before commitment pledge

First, educators and learners were asked what the latter's responses were when they see plastics, papers and other litter lying on the school grounds and how they think their responses could be improved to help reduce litter. Educators responded to the question differently. However, the majority stated that the learners were not taught to encourage each other to pick up waste prior to the commitment pledge. Some educators stated that school assistance should be told to help in picking up waste after lunch. The Life Orientation educator in school A stated: "they [learners] do not pick them up, their responses would be improved by telling school assistance to clean''.

Learners' self-report varied with the majority stating that they do not clean after lunch, and few stated that they pick up waste when they find it on the ground. A grade 9 learner in school B responded: "most of learners do not pick up waste, their responses can be improved by [telling] school assistance to pick them.''

#### 4.16.6.1.2 Stewardship after commitment pledge

Most educators stated that they were encouraged by the commitment pledge to formulate a committee consisting of educators and learners. They stated that a committee assigned a group of learners to monitor compliance with proper waste disposal. The Life Orientation educator in school A stated: "they now pick them up, their responses was improved by constant monitoring [by other learners]''.

Most learners stated that they are picking up their waste after lunch following the commitment pledge. They stated that other learners have been chosen to tell those who litter to pick up waste when they throw it on the ground. Grade 9 learners responded: "they pick them up, their responses were improved by monitoring litter pick-up [team in their school]."

### 4.16.7 Recycling programme

Litter management was a recurring theme throughout the interviews with a subtheme as a recycling programme.

#### 4.16.7.1 Incentive programme before commitment pledge

Educators and learners were asked whether the school has teaching and learning programmes on management of wastes, if they are effective and how they can be improved. The educators' answers varied, with most of them stating that they were not familiar with the waste management programme prior to the commitment pledge. They do not know of any programme that would encourage learners to dump and recycle plastic. The Economics educator in school B stated:" no programme was introduced [to motivate learners to recycle plastic]''.

The learners' responses to the question varied, with most of them suggesting expertise of expanded public works programme (EPWP) to help with initiating the recycling programme in their schools. Grade 12 learners from school B said: "no, teachers must invite Expanded Public Work Programme people to show us how waste are managed''.

#### 4.16.7.2 Incentive programme after commitment pledge

The educators were fascinated to introduce the recycling programme with the help of the presentation about recycling plastic waste and the commitment pledge. Most educators stated that they came up with the project that involves recycling plastic to make artwork. Some educators stated that they collaborated with plastic recycling company to improve recycling in schools. Some educators stated that the school has introduced the cleanest grade competition where learners recycle plastic to be collected by the recycling company. The Economics educator in school B stated: "the school has such program, we have introduced artwork competition project with plastic, and we have collaborated with recycling company to collect plastic and that make our program effective".

The learners' responses varied with the majority stating that they were motivated by the introduction of a recycling competition and reward. A grade 8 learner from school B stated: "plastic recycling projects competition was introduced, the cleanest grade in the school, and the collected plastic waste are taken by recycling company in exchange of money''.

## 4.17 CONCLUSION

The results of qualitative questionnaires and qualitative interview analysis revealed factors that impeded educators from implementing outdoor activities. The results were revealed before and after the presentation and the commitment pledge were applied to change the behaviours of educators and learners in two rural schools. The presentation involved the researcher showing the photographs of waste lying in the school yard, bird eating plastic in the school yards and animals tortured by plastic in marine environments. This was followed by a school environmental policy presenting how the recycling programme would be monitored to ensure that learners comply with the sorting of plastic wastes. The commitment pledge involved learners in school A writing a public pledge and learners in school B writing a private pledge to sort plastic and other waste into a matching dustbin for four weeks. The interviews were used to sum up the factors that impeded educators from carrying outdoor activities verbally from the two schools. The results of qualitative questionnaires were analysed using t-test, which showed a 95% significant different confident level. The significant differences were found between behaviours of educators and learners prior and post commitment pledges and showed that educators' and learners' knowledge of plastic pollution education was low in pre data, but it became higher after the commitment pledges. These results were also confirmed by the thematic analysis of qualitative interviews, where educators and learners reported that their knowledge of plastic pollution and impact were raised by plastic pollution education. The results of the observation showed that learners in school A, who wrote the public commitment, sorted and recycled plastic waste more than learners who wrote the private commitment in school B. Through the quantitative and qualitative results analysis, the commitment pledge intervention has shown that it is a powerful tool that changed the littering attitudes of learners towards proper waste disposal.

## Chapter 5: Discussion

### 5.1 Introduction

This chapter discusses the results of the study based on the objectives, which are discussed using the five steps of the pragmatic approach (McKenzie-Mohr, 2011). The study used the pragmatic approach to uncover barriers that influence learners to litter plastic, how it can be reduced and how recycling can be promoted. The discussion also explains why educators fail to apply environmental education to curb the littering of plastic in schools and the measures they can apply to encourage recycling, reuse and reduce in rural schools. This chapter also discusses how the hypothesis can be proved. The hypothesis is proven correct when the development of commitment, knowledge, attitude and practices in pro-environmental behaviour led to increased environmental sustainability. According to McKenzie-Mohr (2011), the researcher must draw a table with one column for barriers and another column for tools to use to resolve the barrier. Table 5.1 illustrates barriers and tools to deal with the barriers.

| **Barriers** | **Tools** |
|---|---|
| Knowledge | Education and participation |
| Attitudes | Education and participation |
| Structural (dustbin) | Convenience and participation |
| Practices | Education, participation and commitment |

Table 5. 1 Table showing classification of the barriers and tools to deal with proper waste management.

### 5.2 To evaluate the level of knowledge towards environmental problems and concerns among village school learners.

Hypothesis 1. Developing knowledge for pro-environmental behaviour will lead to increased environmental sustainability.

ESD was adopted by UNESCO to equip learners in schools with knowledge and skills to sustain life on earth. UNESCO entrusted educators to be drivers of sustainable consumption, production and disposal of plastics in schools. However, schools in rural areas are battling to implement ESD, and this has increased littering. Below are

barriers that prevent the implementation of ESD in rural schools based on the findings of the study.

ESD was difficult to implement in rural schools due to lack of awareness about plastic pollution and its impact on the environment. Plastic littering was high in rural schools because learners lack knowledge of the effects of plastic on the soil, water, air and human health. This was found by a study by Uddin (2023), that educators provided learners with poor knowledge and awareness of the impact of plastic on the environment. The findings of this study indicated that learners did not know that littering was an environmental problem because they lacked knowledge about plastic pollution. These results resonate with a recent study by Coco Chin (2023), which was conducted with 294 university students in Malaysia. The study found that plastic was littered because students were not aware that littering plastic affects organisms. The students did not know that plastic breaks into microplastic which could be swallowed or inhaled by organisms. These results are not in line with recent quantitative results by Owojori et al. (2022), which was conducted with 376 university students in Venda. The results showed that students disposed of litter properly because they knew that littering was an environmental problem. These results are in line with previous results by Soares et al. (2021), who reported that students disposed of litter appropriately because they have higher knowledge of plastic pollution. A study by Marroquin (2024) advised schools to invite environmental education specialists to enhance knowledge of plastic waste to improve the awareness and attitude of learners towards the environment. Coco Chin et al. (2020) suggested that the government should invest more in citizen science programmes. This programme aimed largely at increasing knowledge and driving people towards eco-friendly packaging.

Besides the lack of knowledge of plastic pollution and its impact, rural school learners lacked critical thinking, which was the biggest barrier contributing to the poor implementation of ESD and littering in rural schools. Learners in rural schools did not know how to critically explain the concepts of environmental education. This was revealed in the results of this study using the word cloud. The results of the word cloud showed that learners failed to indicate that EE provided them with knowledge and skills. Responses of learners are a clear that educators were not engaging learners in critical thinking activities. This resulted in increased littering in rural schools (Lintangsari et al., 2023). Lintangsari et al. (2023) regarded critical thinking as an

individual ‘s ability to evaluate a judgement critically and scientifically. They proposed that for educators to create critical thinking in rural schools, they must give learners research projects about plastic pollution. For the learners to execute the research projects, educators must guide them in gathering, analysing and proposing measures to reduce plastic (Rustamova, 2023). In this way, learners would know that environmental education is concerned with providing them with skills to deal with environmental issues. In addition, Rustamova (2023) explained that for learners to gain knowledge of environmental education critically, educators should involve them in debates, collaborative activities and problem-solving activities. According to Rustamova (2023), these activities would help learners to think critically about environmental challenges and their solutions. Rustamova proposed the use of collaborative projects between learners from different international countries, and that collaborations would broaden the knowledge of local learners. This, in turn, shows that when allowing rural learners to discuss shared challenging environmental issues, a sense of global citizenship and shared responsibility can be promoted (Rustamova, 2023).

Learners in rural schools were littering because they were relying mostly on textbooks with limited information. Schools in rural areas depended on textbooks provided by the Department of Education. However, the books were not enough to cater for schools with overcrowded learners in rural areas. Therefore, a shortage of textbooks coupled with the absence of plastic pollution topics in these books led to the poor application of ESD. Overcrowded schools are filled with plastic waste because learners have no knowledge of plastic pollution and its impact on the environment. Studies have shown that most overcrowded schools in rural areas have a problem of catering for all learners with textbooks (Baloyi, 2020; Molaudzi & Adeyemo, 2022; Njangala et al., 2021). Njangala et al. (2021) added that in overcrowded schools, a group of four learners share one textbook. When educators provided homework, it is accessible to one learner, leading to poor academic performance. In these research results, learners stated that textbooks are their main source of environmental knowledge. For this reason, studies reported that schools that rely on textbooks have a high littering rate because plastic pollution information is not available. This statement is supported by a study by Dalu et al. (2020) with 27 rural primary and secondary educators in Venda. In the results, educators reported that the plastic pollution topic was missing in most

textbooks. The educators stated further that they did not know how the plastic is recycled and that they did not teach learners to recycle it. This statement resonates with a recent study by Mzobe and Msezane (2024) conducted with educators and learners in Kwazulu-Natal. The results showed that classes were overcrowded with learners and fewer textbooks. The educators reported that shortage of textbooks prevents them from practising proper disposal of plastic with learners. The inability to practise proper plastic disposal was that their textbooks did not contain plastic pollution topic. For that reason, educators reported in the study that they only recycled papers. A study by Mkhondo and Mnguni (2021) showed that schools had no libraries to access more information. Educators reported that due to shortage of textbooks, they failed to carry out outdoor activities. Dalu et al. (2020) suggested the introduction of plastic pollution in the textbooks by curriculum planners. When educators and learners have enough textbooks with plastic pollution topics, plastic will be sorted and recycled.

Rural learners were not aligned with the fourth industrial revolution to increase their knowledge about plastic pollution and ways to reduce plastic littering. This is because they were not using computers and smartphones but textbooks alone. Basar et al. (2021) showed that computers and smartphones with the internet offer knowledge about plastic pollution and sustainable measures to deal with plastic waste. In addition, computers and smartphones nowadays are equipped with recycling games that educate learners about plastic pollution and recycling (Basar et al., 2021). Most learners in rural schools are struggling to increase their knowledge of ESD due to lack of computers and smartphones. The shortage of computers and smartphones with the internet was noticed in the literature review, where it is reported that these are commonly found in rural schools (Basar et al., 2021). In these research results, learners reported that they did not have smartphones and computers, and they had no knowledge of recycling plastic waste. This means that learners have never searched the internet to increase their knowledge since books provided them with less information about plastic pollution. Ricoy et al. (2022) recommended that education in schools today is coupled with information communication technology (ICT). They added that digital knowledge in schools is urgently needed than ever before because it contains games aimed at changing traditional education to recent innovative learning. For this reason, Howard et al. (2021) suggested that a multidimensional

approach like ICT in education could easily assist educators to combine theory and practice in schools. A study was carried out to investigate opinions of educators regarding educational games. In a study by Ertuğrul and Karamustafaoğlu (2021), educators stated that ICT motivates lessons, concretises the subject and provides learners with permanent learning. For this reason, universities and schools are now compelled to use smartphones and computers to practise sorting of waste and recycling before attempting it in real life situations. This was confirmed by a study by Gaggi et al. (2020) conducted with 20 university students in Italy, who reported that PadovaGoGreen game helped students to match types of waste with the type of bin for recycling. These results match those from a study by Ricoy et al. (2022) carried out in Northwest Spain with 156 primary and secondary school learners. The study found that learners assimilated new habits such as reduce, reuse, recycle and recovery of plastic, which they learn from watching computer games. They were following procedures displayed on the games to design their own arts. Similarly, the results are supported by another study by Altunbey and Çelikler (2023) conducted with 96 learners in two secondary schools in Turkey, which found that knowledge and awareness of sorting and recycling were raised by game plays called “Who Won the Cup?”, “I Got it?”, “Reflection” and “Ring!”. Matsekoleng et al. (2024) hold a different view and suggests that schools in rural areas could increase knowledge of plastic and recycling through indigenous games. This is because they are not equipped with internet connections and computer laboratories to play technological games. Indigenous games such ‘’Morabaraba’’ and ‘’Kgati’’ could be useful to cater for all learners in school. Morabaraba uses caps of plastic bottles while shopping plastic bags can be weaved to make a skipping rope called Kgati. In this way, learners can use indigenous games to reduce plastic littering.

Education for sustainability in rural schools was poorly implemented because learners had no knowledge of reusing plastic, leading to increased littering. The reuse of materials helps to reduce large amounts of waste and prevent the negative impact of plastic on the environment (Razzaq et al., 2021). They showed that mastering the reuse principle of the circular economy is the biggest step towards achieving sustainable development goals. When plastic and other materials are reused, the energy for producing another product would be saved (Razzaq et al., 2021). Therefore, schools should introduce the reuse principle of circular economy by encouraging the

use of eco-friendly products. It was noted that awareness of the impact of plastic and information about plastic problem encouraged the use of eco-friendly products which in turn save the environment (Pahlevi & Suhartanto, 2020).

The research results showed that most learners did not know how to save the environment by using the least number of paper towels. Debra et al. (2021) suggested that education is a key factor that could help to raise awareness and promote behavioural changes. Phan et al. (2023) suggested that to enhance environmental awareness, learners need education about the plastic reduction programme. Reduce is another principle of circular economy. For this principle to be achieved, learners need training and organised events on the impact of plastic pollution and measures to reduce it from becoming a waste. This idea was supported by Yusliza et al. (2020), who carried out a study with 72 college students in Malaysia. The results indicated that after learners were exposed to environmental issues and plastic reducing activities, they supported school initiatives. These initiatives were supported by disposing of items into the recycling bin and using disposable drink cups provided in the cafeteria. This resonates with a study by Soares et al. (2021), who found that participants showed environmental-friendly behaviours by reducing plastic use, and frequently recycled and placed litter into the appropriate trash bin after receiving education about plastic pollution. The attitude towards environment protection was also an important factor that influenced the willingness of an individual to use disposable alternatives (Lukacs et al., 2021). These findings correspond with results by Phan et al. (2023), which was carried out in Vietnam with 100 rural and urban citizens. The findings revealed that citizens were willingness to join plastic waste management if local policymakers execute single-use plastic ban at schools, state agencies, restaurants and supermarkets. Soares et al (2021) also confirmed that participants were willing to adopt reduce pro-environmental behaviour after a fine was imposed for failure to adopt reducing behaviours. Application of reduce principle of circular economy encourages the use of eco-friendly products.

Learners in rural schools lacked knowledge of collecting and separating plastic waste into different bins, which increased littering. The duty of collecting and separating waste into different dustbins can be easily done where there are enough trash bins that are clearly marked. Zhang et al. (2023) showed that learners recycle more when

trash bins display guidelines on how to recycle such a poster. In addition, Zhang et al. (2023) stated that the trash bins with clear labels that distinguish types of recyclables encourage learners to recycle. However, the results of this study revealed that most rural schools did not have enough dustbins with labels to encourage learners to throw waste into categories. These research results also found that 100% of learners stated that they did not segregate waste by type and the relevant dustbins. The lack of trash bins and knowledge of separating wastes into relevant dustbins were barriers that prevented rural schools from implementing education for sustainability. This resonates with a study by Ampofu (2020) in Ghana, which was conducted with 122 learners, teachers and school management team. The study found that the school had fewer dustbins and learners were mixing wastes in one dustbin. This relates to a study by Omoyajowo et al. (2021) with 102 students in Nigeria. The research results revealed that 69.6% of students did not place waste according to types and matching dustbins. This also complements with recent qualitative results by Harman and Yenikalayci (2022) in Turkey with 11 students, which revealed that students did not separate waste into types and proper dustbins. Nolasco et al. (2021) perceived that when waste separation is coupled with recycle, reduce and recycle, waste would be diverted to landfill sites. When waste is thrown properly, learners can be educated about its economic, environmental and aesthetic benefits. Minhai et el. (2021) found that plastic pollution education is necessary because it leads to reduced transmission of diseases. Razzaq et al. (2021) stated that economically, employment would be created if learners are educated about the recycling of plastic waste. Environmentally, natural resources would be protected when learners are educated about plastic waste recycling (Razzag et al., 2021). For this reason, education should be encouraged to become a central part of the sustainable programme in rural schools (Boateng et al. 2023) Therefore, introduction of dust bins illustrating the type of waste to recycle are needed in rural schools to encourage separation of waste.

Learners in rural schools did not have knowledge of attending community campaigns to encourage them to recycle plastic waste. Kasmuri et al. (2023) stated that campaigns authorised by government, public figures and private agencies are known to influence learners to separate waste and recycle them. The literature showed that collaborations between schools, experts, NGOs and plastic-producing companies is important as it encourages the sorting of plastic waste in schools (Valladolid & Blase,

2023). However, the literature showed that Tzaneen municipality appointed EPW P programme to run a waste separation campaign (GTM, 2022). The programme has never introduced the campaign as directed by the municipality. For this reason, in these research results, learners revealed that they have never attended a plastic recycling campaign. Therefore, schools in rural areas are dominated by the littering of plastic because learners lack knowledge of waste separation at source. Therefore, lack of seminars or campaigns are barriers that affect the implementation of ESD in rural schools. Those who are in support of seminars or school clubs stated that it helps to encourage learners to separate waste at source. This is in line with a study by Virsta et al. (2020), which indicated that learners attended workshops held by local authorities, which motivated them to reduce, reuse and recycle. These results correspond with a study by Beach (2022), who showed that after attending a green club presentation, learners were able to sort, reduce and recycle waste. This is consistent with a study by Assuah and Johansen (2023), who indicated that learners attended a plastic pollution education project held by an environmentalist. The results showed that after attending the plastic pollution education, learners started to sort, reduce, reuse and recycle waste. Boateng et al. (2022) recommended the introduction of environmental school clubs for learners who know how to teach other learners about recycling. Mashaba et al. (2022) recommended the introduction of community clubs because it uses stage dramas for learners to display environmental issues and plastic recycling.

The hypothesis was proven correct because increased knowledge correlated with increased attitudes towards sorting and recycling of plastic waste.

### 5.3 To evaluate the level of knowledge towards environmental problems and concerns among teachers

Educators in rural schools have inadequate knowledge of sorting and recycling because they lack training. The literature review indicated that educators provided inadequate education and awareness about plastic pollution. This is because they were not trained in the recycling of plastics (Uddin, 2023). The results of this study indicated that learners were receiving inadequate awareness and education about plastic pollution. The inadequate provision of education about plastic pollution turned

out to be a barrier that prevents the implementation of ESD. Studies have found that learners who litter are offered inadequate education about plastic pollution and its impact on the environment. These results correlate with previous research results by Dalu et al. (2020) conducted with 27 primary and secondary educators in Thohoyandou. The results indicated that pollution has been integrated into the school curriculum, and is infused in technology, natural science, geography, life science, life skills and life orientation subjects. However, educators reported that they had no knowledge of plastic pollution education. They reported that their curriculum content covers water pollution rather than plastic pollution. Due to the inadequacy of education about plastic, their learners were not taught to practise sorting, reusing, recycling and reducing plastic. These results do not correlate with recent results by Mashaba et al. (2022) with 80 primary school learners in Tshwane North. The study revealed that educators were offering adequate knowledge and awareness of plastic pollution. The study reported that they were using information of plastic pollution from life orientation, life sciences, geography and history textbooks. The results indicated that their plastic knowledge was supplemented by media outlets, and their learners were gaining knowledge of plastic pollution, sorting and recycling plastic by joining clean-up campaigns from charity organisations. In the results, educators reported that they were also arranging school clean-up days and awareness campaigns in the form of acting drama on issues about plastic pollution on the environment. In contrast, a study carried out in State University by Yuksel (2021) in Turkey with 130 pre-service educators reported inadequate EE education. The study revealed that educators had more theoretical knowledge about plastic recycling. Due to inadequate education about plastic recycling and shortage of dustbins, recycling was not practised in schools. Based on the results, Yuksel (2021) stated that educators need to collaborate with other educators who know how to teach them about zero waste and recycling. The drama acting campaign was found to be useful in raising awareness about plastic pollution. The stage drama can also encourage proper disposal and recycling of plastic (Mashaba et al., 2022).

Educators of environmental education should be well-equipped with knowledge of plastic pollution and its impact and provided with resources to carry out the task (Anokye et al., 2024). Some of the valuable resources that could enrich educators with skills and knowledge of plastic pollution and recycling are medias, websites and

libraries. The literature confirmed that sources of environmental knowledge are websites and the media (Basar et al., 2021; Mansor et al., 2021). Educators in rural schools do not have such resources. A study by Baloyi (2020) found that educators in rural schools have one type of textbook with less information about plastic pollution. Hence, littering in rural schools has escalated and poor knowledge of an educator serves as a barrier to EDS implementation. The results of this study showed that the source of environmental knowledge to learners was the educator. Studies disagreed that educators without equipment can impart knowledge about plastic pollution and recycling. A study by Sukma et al. (2020) found that media outlets such as TV, radio and websites are rich sources of environmental knowledge about education for sustainability and not educators without these tools. This is consistent with a study by Mashaba et al. (2022), who reported that learners were sensitised about environmental conservation by radio channels and books. They were able to apply practical knowledge of recycling plastic using books from the library and radio channels. The results also correlate with a study by Dziubaniuk et al. (2023) with university business students. The study reported that students were accessing environmental knowledge about sustainability via zoom meetings, videos and the internet. The results indicated that low socio-economic schools need to be connected to the internet for learners to access environmental issues. Dziubaniuk et al. (2023) recommended for the training of educators in information technology to access more environmental information from the internet. A study by Mzobea and Msezane (2024) revealed that libraries and a variety of books are required for proper education of plastic disposal. Mashaba et al. (2022) suggested the introduction of videos and TV in schools for learners to watch and learn about plastic pollution and its impact.

One way in which educators can encourage learners to save resources of the planet earth was through proper waste management practices. Most rural school learners mixed wastes and place them in a large skip bin. As more plastic waste is produced in schools, skips become full and overflow with wastes. The biggest challenge was that skips are not collected regularly by the local municipality to the landfill sites. Kanhai et al. (2021) reported that waste management in rural areas of developing countries was faced with the biggest challenge of uncollected waste. The backlog of uncollected waste by the municipality was caused by lack of infrastructure and treatment centres (GTM, 2022). When waste is not collected, rural schools burn them

in open spaces. The only way to prevent improper waste management is through sorting and recycling. However, in these research results, educators did not practice proper waste management. This factor becomes a barrier that led to poor implementation of ESD. This is consistent with a study by Ampofu (2020) in Ghana with 45 secondary school learners. The study revealed that learners were not familiar with proper waste management because they were disposing waste in open spaces. This resulted in wastes piling up and making the school filthy. The study showed that schools did not have dump sites. These results correlate with previous results by Hendrarso (2021) in Jarkata with 19 participants. The participants reported that they were not taught about dumping waste properly into the dustbins. The results indicated that waste accumulated in the campus and resulted in untidy open spaces. The study also indicated that dustbins for separating waste were available, but learners dumped waste on the ground. Therefore, it is the responsibility of educators to teach learners to dump waste correctly into the appropriate dustbins. In some cases, the teacher's negative attitude towards proper waste management is due to lack of awareness about detrimental effects of plastic. Ahmed et al. (2021) suggested that when educators are not aware of the damaging effect of plastic, their attitude towards proper waste management would be negative. Dumping waste like plastic into the dustbin is useful as it improves environmental conditions of the schools. Placing waste properly into the dustbins protect the environment and enhance the aesthetic beauty of the school (Viljoen et al., 2021). Therefore, the government should support schools by providing enough funding for schools to purchase enough dustbins for proper waste disposal.

Educators in rural schools had no knowledge of initiating environmental school committees to administer littering policy. That served as a barrier that led to poor implementation of esd in rural schools. Promoting three Rs policy, reuse, reduce and recycle is the key to achieve sustainable development goals in schools. It is educators' duty to assemble dustbins into categories of wastes and introduce rules to adhere to the 3Rs policy. In support, Hu et al. (2021) stated that providing correct waste disposal rules is a prerequisite for educators to redcuce littering in their schools. Therefore, when educators do not provide learners with correct waste separation policy littering would remain high. For this reason, this study results indicated that littering was high in rural schools because educators reported that they never heard about school environmental policy. Boonchieng et al. (2023) added that educators cannot control

littering behaviours of leaners when there is no school environmental policy. These results are not in line with a previous study by Hao et al. (2020) with 200 university students in China. The results showed that school environmental policy was available. It was reported that most students were willing to separate waste when they heard about penalty. The penalty was introduced as a school environmental policy to punish students who did not segregate waste. These results relate to recent research results by Uehara et al. (2022) with 295 college students in Japan. The results showed that school environmental policy was established. The results indicated that 86% of learners who were given school rules to sort plastic waste were able to sort other wastes. The study showed that policy and information about it strengthened students to participate in school recycling. Kadir et al. (2022) advised that supervision by the head of school encouraged learners to recycle and enhance the effectiveness of the policy. Uehara et al. (2022) advised that providing knowledge about sorting in densely populated areas such as train stations and taxi ranks will not be necessary. Mzobea and Msezane (2024) recommended the formation of educators' club to monitor cleanliness in schools and to enforce compliance with policy. According to Seblos et al. (2023), where there is policy, disciplinary measures could be taken against learners who do not comply with recycling. Plastic ban could also reduce consumption, but Dalu et al. (2020) stated in his study that educators reported that plastic ban would not be possible in their school. The educators reported that it is difficult to implement plastic ban because learners use it to carry books. Phan et al. (2023) agreed that the ban of plastic faces challenges even in countries that have adopted it to reduce disposable plastic. However, Phan et al. (2023) indicated that a school environmental policy can reduce and address plastic waste. Uche (2023) have analysed bans of plastic policies worldwide and found that plastic ban plays an important role in reducing plastic waste.

Educators in rural schools lacked knowledge of waste sorting and recycling plastic. For this reason, littering was pervasive in rural schools. This was supported by a study by Zhang et al. (2023), who stated that educators declared in his interview study that they lacked knowledge of waste sorting, and this led to littering in their school. Educators play a vital role in schools because they pass environmental knowledge and skills to the learners. Olsen et al. (2020) stated that educators are primary sources of skills and knowledge to sustain environmental resources. Therefore, they need training on the knowledge of waste separation. In these study educators confirmed

that they lacked training about waste separation to encourage learners to recycle. Lack of educator training in waste separation served as a barrier in the implementation of ESD. This is consistent with a recent study by Mzobe and Msezane (2024), who stated that educators were not trained in plastic recycling and lack knowledge of integrating plaastic management in their lessons. The study reported further that educators were using card boxes to recycle papers only because they lacked knowledge of plastic recycling. This correlated with a study by Dalu et al. (2020), who found that educators lacked knowledge about plastic pollution, and did not teach learners about proper disposal of plastic. Tertiary institutions are advised to train educators in microplastic pollution as it is difficult to teach in class without training (Ahmad-Kamil, 2022). Workshops about plastic pollution is required to educate educators about recycling plastic (Dalu et al., 2020). Zhang et al (2023) advised enducators to embark on field trip to incineration, landfill sites and local recycling centre to know more about sorting and recycling plastic. Zhang et al. (2023) stated that the trips would help learners to understand how much wastes are produced to encourage learners to sort and recycle plastic. Zhang et al. (2023) also advised schools to hire specialists in environmental education to teach and train educators about plastic pollution and recycling.

Educators in rural schools had no litter monitoring committees in their schools to monitor compliance with policy. Lack of litter monitoring resulted in poor implementation of ESD in rural schools. The Constitution of SA stated that humans have the right to stay in a healthy and clean environment. This human right mandated educators to educate learners to keep their surroundings clean. Besides, rural schools are densely populated institutions and generate much waste during the lunch time. Schools have vendors that sell more food covered in plastic. Therefore, constant litter monitoring and assessment is needed to keep schools clean from plastic waste. To respond to the call of the Constitution, educators should introduce a committee of learners in schools to supervise the use of dustbins and the need for more dustbins (Aziz et al., 2021). Aziz et al. (2021) stated further that through learner's supervision, learners can find the need for education about waste sorting and recycling to learners who do not comply with proper waste disposal. The existence of the committee ensures that learners comply with the policy about proper waste disposal (Boonchieng et al., 2023). However, in these research results, educators reported that their schools are dirty because they did not have knowledge of litter monitoring representatives.

These contradicted the results of a study by Dalu et al. (2020), who found that the schools were clean because of the availability of a litter monitoring policy. The study indicated that learners were monitored, caught and punished for not complying with the rules of proper waste disposal. This correlated with a study by Mzobe and Msezani (2022), who reported that educators introduced a group called Fighter to monitor littering in their schools. This correlated with a study by Aziz et al. (2021) with learners from Jambi (Indonesia). The results indicated that educators were able to maintain cleanliness of the school due to litter monitoring policy of a group of learners. Ahmad-Kamil (2022) advised that participation in citizen science helps learners to sort and recycle plastic and comply with litter monitoring policy. The World Bank (2022) also encourages citizen science participation in developing countries since they encounter financial problems regarding waste management. The World Bank has shown that the involvement of people in citizen science activities has gained strength in countries such as Philippines, Nepal and Thailand (Zhang et al., 2023). Aziz et al. (2023) advised schools to collaborate with Waste Banks. Through collaboration, learners are monitored picking up plastic and other other waste, sorting and recycling it. The sorted waste is then distributed to waste banks in exchange for money.

Educators in rural areas lacked knowledge of the importance of dustbins because their schools lacked enough dustbins. The existence of recycling bins in schools is important because it reduces the accumulation of waste on the grounds. Dustbin facilities enhance the separation of wastes and recycling. Studies have found that placing waste into separate dustbins depends on the visibility of the bins. Lee and Manfredi (2021) showed that learners are willing to throw waste in trash bins that are convenient and available at a short distance. Facilities that are positioned far away and are not easily accessible encourage littering. In addition, learners litter in schools because there are no dustbins in the school yards (Mir et al., 2021). Dustbins promote proper waste disposal and protect natural resources. However, educators in this study stated that they did not find dustbins in their school important. This idea led to the poor implementation of ESD in rural schools. This is consistent with a study by Dellorco et al. (2021), who reported that students did not find dustbins important. The study found that labels on the dustbins did not clearly indicate where different recyclables belong. These results correspond with the results by Harman and Yenikalayci (2022), who reported that students did not find existence of dustbin important. The results showed

that students were not valuing dustbins as important because they were not familiar with waste types, waste separation and how to place waste into matching bins. This did not correlate with a recent study by Boateng et al. (2023), who found that learners in urban schools knew the importance of dustbins because their schools have partnered with recycling companies that collect waste. Boateng et al. (2023) suggested that collaboration of school with companies offered schools dustbins and incentives and that made to view dust bins as important. The results indicated that the perception increased recycling behaviour of learners. Recycling education with qualified environmental education experts would change the behaviour of learners to value importance of dust bin and recycle waste (Harman & Yenikalayci, 2022). Zhang et al. (2023) suggested the introduction of fashionable trash bins for teenagers to be attracted to sort and recycle plastic waste and value importance of dust bin in the school yard.

Educators were entrusted with the duty to encourage reusing by introducing derived recyclable in schools. However, educators in rural schools did not encourage learners to use reusable plastic and other waste. Knowledge of reusing and its procedures motivates learners to recycle waste and reduces littering (Dalu et al., 2020; Kush et al, 2022). However, in these research results, educators stated that they have no knowledge of reusing derived recyclable wastes, which prevented the implementation of ESD in rural schools. These did not relate to the previous results by Situmorang et al. (2020), who found that students majoring in environmental science have more knowledge of reducing plastic bags than social science students. The study found that environmental science students carried their own reusable shopping bags when shopping than social science students. Situmerang et al. (2020) found that the students have knowledge of plastic pollution because they can use reusable plastic shopping bags and recycle them. These results relate to the recent results by Coco Chin et al. (2023), who also noted that students who majored in environmental education at university were able to use reusable shopping bags because they participate more in plastic pollution awareness than social sciences students. In the present study, learners lacked knowledge of plastic pollution and its impacts, hence they pointed that they lack knowledge of derived recyclables. Coco Chin et al. (2023) found that students and educators who do not recycle plastic should be encouraged to join plastic waste awareness campaigns. They also suggested that government

should provide schools with funds to purchase recycling facilities to reduce waste. Zhang et al. (2023) advised schools to hire specialists in environmental education to teach and train educators and learners about derived recyclables. Rural school educators need to engage learners in brainstorming activities to encourage reuse of materials (Assuah & Johansen (2023).

Educators lacked knowledge of litter picking-up programmes like the Good Green Deeds campaign to ensure that learners become aware of improper disposal and dispose of litter properly. Educators should initiate programmes to engage learners in picking up plastic litters and recycle them. Aziz et al. (2021) showed that in Indonesia, educators formulated school health programme competitions to support teaching and learning with cleanliness. Aziz et al. stated that in the programme, learners were awarded for being the most hygienic classroom. In addition, it was reported that before the competition started, educators had rules ready and were directing learners to pick up at least five pieces of waste daily. In this way, schools were kept clean, and learners became accustomed to sorting and recycling waste. However, in these research results, rural school educators stated that they had no knowledge of programmes that engage learners in picking up plastic litter and recycling plastic waste. The literature review of this study indicated that open spaces of some rural schools have piles of uncollected waste (Hendrarso, 2021). However, in the research results, learners indicated that their schools have no litter pick-up programmes, and that litter pick-up is used by educators to address late coming and misconduct such as failing to write homework. The litter pick -up roster is a barrier in rural schools that prevent ESD implementation. This does correlate with the previous study by Masemene and Msezane (2021) with eight rural primary schools from Ga-Sekhukhune. The results indicated that educators were only engaging certain groups of learners in picking up the litter to address late coming. This is not consistent with a study by Matsekoleng and Mapotse (2020), which was carried out with 14 secondary school learners. The results of the study indicated that educators and learners participated in litter rosters. A recent study by Assuah and Johansen (2023) with 20 primary school learners from Canada showed that on a weekly basis, educators and learners visit the community to pick up plastic bottles. The results showed that bottles were collected for their recycling in school. The introduction of mandatory recycling could help to encourage proper waste disposal. Zhang et al. (2023) claimed that a

citizen science project can influence learners to participate in the separation of waste at source, reduce and recycle. A community clean-up campaign could also help in recycling and sorting of waste (Assuah & Johansen, 2023). Harman and Yenikalayci (2022) found that recycling education could assist learners to sort and recycle waste in schools.

The hypothesis was approved as increasing knowledge of the educator enhances the attitudes of learners in adopting eco-friendly behaviours of recycling.

## 5.4 To evaluate the attitude of village school learners and educators towards proper waste management

Hypothesis 3- Developing attitudes in a pro-environmental behaviour leads to increase in environmental sustainability.

Awareness is necessary for sustainability because environmental resources will be protected. Learners hold positive environmental attitudes and awareness of plastic pollution, but they lack practical education of separating waste (Debra et al., 2021). Learners' attitude of consuming large amounts of plastic and disposing of plastic senselessly gives a clear indication that awareness is needed for sustainability. Debra et al. (2021) found that practical knowledge of proper waste disposal is lacking in developing schools. It was also found that educators did not provide learners with practical knowledge of correctly segregating waste into different trash bins (Debra et al., 2021). Song and Dai (2020) advised educators that waste segregation is the best measure known worldwide to reduce waste and needs to be practised highly. The attitude of an educator in raising awareness about proper disposal should be positive (Debra et al., 2021). However, attitudes of most educators in developing countries are negative because they do not practise segregation of waste. The learners' lack of knowledge of waste segregation is a factor that causes its improper disposal (Yusuf and Fajri, 2022). Hence, plastic waste is prevalent in open spaces of rural schools. Similarly, in these research results, learners responded that awareness is not necessary for sustainability. Therefore, lack of awareness of sustainability becomes a major obstacle when implementing ESD and increases littering in rural schools. This is in line with the results of a study by Debra et al. (2021) with secondary school learners and tertiary students in different countries. The results showed that learners

and students had positive environmental attitudes, and high awareness of environmental issues. The results showed that learners were not engaged in sorting and recycling activities. This corroborates with a recent study by Asri and Daud (2022) with 121 high school learners in Malaysia. The results indicated that students had high awareness and good attitude towards recycling. The results showed that students were not involved in recycling plastic. This is consistent with a recent study by Qu et al (2023) with 1213 college students in China. The results found that students were generally aware of the importance of waste separation but lacked practical knowledge. Coco Chin et al. (2023) stated that raising awareness about the effects of plastic waste on the environment can help to change negative littering attitudes. Recycling education is necessary for learners to develop positive attitudes to sort and recycle plastic (Harman & Yenikalayci, 2022). Aziz et al. (2021) suggested the invitation of environmental health experts to raise awareness and develop positive attitudes of learners towards segregating and separating waste.

Learners in rural schools consume, produce and dispose of large amounts of waste in schools. Research has found that waste is not collected in most schools. Virsta and Sandu (2020) suggested that educators need to assess how the waste produced assists in encouraging pro-environmental behaviour. To cultivate pro-environmental behaviours in learners, educators need to come up with a recycling programme. Boonchieng et al. (2023) confirmed that participating in recycling awareness programmes increases awareness of recycling, which relates to purchasing recyclable products and recycle them after use. Aziz et al. (2021) added that educators can enhance the participation of learners in recycling programmes by collaborating with waste banks to exchange waste for money. However, educators in rural schools have no recycling programme to change attitudes of the learner towards recycling. The findings of the present study indicated that learners were littering because schools had no recycling programmes, whose absence is the biggest barrier preventing the implementation of ESD in rural schools. This does not resonate with recent results by Banchohattakit et al. (2022), who studied collaborations between educators, learners, parents and environmental health science experts. The results revealed that participants were engaged in a 3Rs programme, where they were collecting plastic bottles. The results indicated that the intervention increased the recycling of plastic bags from 43, 2% to 60%. This does relate to a study by Shana and Abulibdeh (2020)

with 49 secondary school learners in the United Arab Emirates. The results showed that participating in practical work resulted in improved learners' attitude and content understanding. These results contradict those by Mkhondo and Mnguni (2021) with 145 rural primary school learners, which showed that participation in a rural school-based recycling project did not enhance Grade 7 Natural Sciences learners' attitude of recycling. In contrast, a study by Yusuf and Fajri (2022) conducted in Indonesia with 279 Social sciences and Sciences students revealed that participating in an environmental programme and understanding 3Rs policy assisted in sorting and recycling plastic. Debra et al. (2021) suggested that raising awareness and knowledge about environmental problems can change the attitude of learners. Classroom activities should engage learners in disputing arguments about collecting, sorting and processing waste (Rustamova, 2022). Educators need to introduce plastic waste recycling bank in schools (Banchohattakit et al., 2022). The collaboration between school and environmental health experts offers learners awareness about the impact of plastic pollution and recycling.

Enough trash bins are required to build a positive attitude in learners to segregate plastic waste into different categories. The positive attitude of educators in schools is highly needed. This will involve placing trash bins in a convenient location. Mazar et al. (2021) found that educators need to place trash bins at 4 metres apart. Different trash bins should be marked correctly to match the recyclable plastic material. This is because Dellorco et al. (2021) found that when a trash bin has confused labels, recyclables are not correctly recycled and that will result in littering. The availability of enough dustbins coupled with a convenience location to dump garbage increases the attitudes of recycling amongst the learners. The literature also found that sorting was hampered by incorrect marking of different types of dustbins (Mir et al., 2021). Attitudes of rural learners towards recycling was influenced by lack of properly marked dustbins that match the recyclable. This is because in the present research results, most learners stated that dustbins are not enough, but fewer stated that they are available. The obstacle to the implementation of ESD in rural schools is due to the unavailability of dustbins that can separate different types of waste. In this case, the learners would resort to dumping wastes inappropriately. In support, Limon and Vilarino (2020) have found that lack of garbage bins discouraged learners from practicing proper waste reduction. This is not consistent with a study by Nepah et al.

(2024) with school in Ghana, which revealed that learners agreed that dustbins are available, and indicated that some groups of learners were lazy to stand up and dump waste into the dustbin. The results indicated that the location of dustbins was arranged closer and that this improves the proper waste attitude disposal of learners. These results correlate with findings by Owojori et al. (2022) with 376 university students in Venda, which indicated that 93.6% of learners stated that dustbins are available, but 46,8% complained that they are few. That was an indication that the location and availability of dustbins is important for learners to dump waste. Boateng et al. (2023) suggested that schools should form environmental education clubs to educate learners about sorting and recycling waste to protect the environment. Phan et al. (2023) indicated that a school environmental policy can reduce and address plastic waste by increasing the availability of dustbins. Aziz et al. (2021) advised that schools need strong support from the government with funds to buy enough trash bins.

Educators with positive attitudes introduce recycling programmes in schools to change the littering attitudes of the learners**.** A recycling project with incentives creates positive attitudes in learners towards recycling. Andinar et al. (2023) found that learners who attended workshops of recycling plastic into eco-bricks earned an income and continued to recycle plastic waste. The adoption of positive attitudes towards recycling is encouraged by awareness of plastic pollution. A study by Uddin (2023) showed that students in India had knowledge about plastic pollution and positive attitudes about recycling and reusing it. They developed negative attitudes towards recycling because they lacked knowledge about plastic pollution and were never exposed to the waste separation activity. Kush et al. (2022) elaborated that the development of negative attitudes amongst learners is due to lack of knowledge and awareness in practising and sorting waste. Similarly, in this study, learners stated that they did not know that recycling is important for natural resource protection. Lack of knowledge about recycling is an important barrier in the implementation of ESD in rural schools. This statement does not correspond with previous results obtained by Altikolatsi et al (2021) with 402 primary school learners in Greece, which showed that 75% of learners were aware that recycling is important and can tackle environmental issues. The results showed that 89% of learners had positive attitudes, indicating that they were recycling frequently. This is in line with a recent of study by Seth and Daud (2022) with 40 primary school learners in Malaysia, which showed that 90% of learners were aware

that recycling is important and can save space in landfill sites. The results indicated that 85% participated in recycling every day. These results are supported by a study by Abdullar et al. (2023) with 308 university students in Malaysia. The results revealed that 98.7% of students had knowledge of plastic pollution, and that students were aware that plastic improperly disposed of into the water results in the death of aquatic animals. The World Bank (2022) indicated that joining citizen science could help learners to reduce, reuse and recycle. The project would encourage learners to use reusable bags during shopping. Plastic education awareness is also necessary to protect the environment. Andinar et al. (2023) suggested the introduction of incentives to encourage learners to develop positive attitudes towards recycling.

The hypothesis of the study was proven correct because the attitudes of the learners and educators towards proper waste disposal were changed by the increasing knowledge of plastic pollution and its impact.

### 5.5 To assess how increased learners' knowledge and practical skills can help them to commit to anti-littering

Hypothesis 3- Developing a commitment pledge in pro-environmental behaviour will lead to increased environmental sustainability.

The results of the study showed that rural schools consumed large amounts of plastic and dumped them carelessly in open spaces of the schools. The schools were dumping the waste in large skips provided by the municipality in a drop-off centre. The municipality collected plastic waste to the landfill sites irregularly. The accumulation of plastic waste attracted wild animals, birds, reptiles, flies, bees and rodents. Crow birds were the most affected species because they were pecking on the small plastic bags containing achar foodstuff every lunch time. To save the birds, the researcher introduced a presentation to educate learners and educators. The presentation was about plastic pollution and its detrimental effects on the environment. The researcher invited learners to write a commitment pledge to sort the plastic waste to save species of birds. Through this commitment pledge, plastic waste was reduced. These findings are consistent with a study by Jacobs et al. (2021) in Miami, which increased awareness and encouraged learners to separate and recycle plastic using commitment and goal setting.

The recent study by Lindemann-Mathies et al. (2021) conducted in Germany based on CBSM strategy with 38 teenagers used collective public commitments and workshops about different types of plastic to strengthen learners' willingness and ability to act. The findings showed that increased knowledge on the effects of plastic encouraged learners to recycle.

This study results showed that learners in School A wrote the public commitment after attending a presentation on the adverse effects of plastic on the environment to sort plastic. The presentation also raised awareness of learners in School B who also wrote a private commitment to sort plastic waste. The results of the observation showed that during four weeks of sorting waste, learners in public commitment sorted waste more than learners who took private commitment. The results in school B could be encouraged by the fact that learners were sorting waste when the others were not aware of their commitment to sort waste. The results of School A in terms of the public commitment intervention were influenced by the fact that learners in the whole school were aware of their commitment to sort waste. As a result, most learners in School A were encouraged to take part in sorting waste daily. Therefore, the commitment tool has proven to be the best tool for aligning attitudes with the behaviour of individuals in the long term. The hypothesis indicated that the development of knowledge in pro-environmental behaviour will lead to increased environmental sustainability. This hypothesis was proved correct because the commitment pledge has led to the sorting, reusing, reducing and recycling of plastic waste.

The success of the commitment pledge lies in the need for consistency (Isenberg & Brauer, 2021). When a person makes a commitment, it means that he binds himself to a new behaviour forever. In this case, learners made promises to sort, reuse, reduce and recycle plastic. The promise encouraged them to recycle daily for four weeks until schools closed. Lindemann- Matties et al (2021) stated that this is because people value more consistency between what they say and what they do. This is how the learners line up their self-concept with the committed behaviour (Isenberg & Brauer, 2021). The observation of the researcher captured learners going to shopping at school vendors with eco-friendly reusable containers. They will always tell other learners to pick up waste if they drop it. In this way, commitment can create a responsible person who values, cares and protects natural resources.

Commitment pledges shape the behaviour of people in the long term. The learners were observed continuing to recycle when schools reopened after 7 weeks. Ugwu et al. (2021) stated that when a person encounters dissonant attitudes and behaviour when they mistakenly break the promise of recycling and dump waste improperly, that person will become uncomfortable and restless when the attitude does not align with the new behaviour (Ugwu et al., 2021). Thus, people have an internal motivation to retain attitudes and behaviour to be in harmony with each other every day. Lindemann-Matties et al. (2021) stated that the commitment pledge encourages individuals to voluntarily take drastic steps to stop littering. Through the commitment pledge, individuals will not be told by someone to stop littering. Better recycling results are obtained when an individual takes a written public commitment pledge (Jacobs et al., 2021). This means that the public commitment is the one that makes individuals to sort waste successfully. Through public commitment, individuals feel that someone expects them to stay with sorting behaviour forever (Jacobs et al., 2021). For this reason, a public pledge is more successful than a written private commitment pledge. In a private commitment pledge, individuals have no pressure from people. Though he or she may perform an expected task, it would be minimal (Van der Werff et al., 2019). Lack of practising the commitment pledge served as a barrier in the implementation of ESD in rural schools. The government should consider integrating a public commitment pledge into the curriculum for learners to sort waste now and in the future. The hypothesis was proven correct as the commitment pledge led to the formation of attitudes towards environmental protection.

## 5.6 To assess current environmental practices among village school learners

Hypothesis 4- Developing practices in pro-environmental behaviour will lead to increased environmental sustainability.

Knowing about the environmental protection programme encourages learners to practise sorting and recycling wastes at school. Rural schools do not have a solid management programme to control littering. The 3Rs policy was not practised in rural schools, but it is a national policy. Based on the literature review, it was shown that the introduction of 3Rs policy could minimise littering (Banchonhattakit et al., 2022). However, learners in rural schools did not separate waste and recycling plastic waste.

Most learners stated in this study results that they did not know about solid waste management programmes. Lack of environmental protection programmes is a barrier affecting the implementation of ESD. The learners became familiar with the waste programme when educators introduced a project to recycle plastics at home. The qualitative research results showed that the learners avoided plastic by using reusable plates. They were also involved in a competition about the cleanest grade after the commitment pledge. This is in line with a study by Assuah and Johansen (2023), who reported that the school introduced recycling competition to limit the accumulation of plastic waste in the community. The educators offered toys as incentives to learners to learners who brought more recyclables at school. In this way, learners knew that there was a solid management programme at school. This is in line with a study by Fissi et al. (2021) in Italy with university students, which revealed that the university formulated a plastic recycling practice programme on the campus. The results indicated that many students were aware of the recycling program. They were seen recycling plastics on the campus and only small number students were not. The government should support waste reduction programmes in schools by providing funding for schools to buy dustbins. Boateng et al. (2023) stated that private schools have noticeboards in the school entrance to make people aware that littering is not allowed. Harman and Yenikalayci (2022) suggested that recycling education amongst learners would make them aware of the proper waste management program.

Environmental-related subjects can influence learners to recycle plastic wastes**.** The government has introduced environmental education in all grades, including grade R**.** The literature reviewed in this study showed that EE was infused in all subjects in schools, but the integration was ineffective (Sikhosana et al., 2020). The main aim of introducing EE in schools was to raise awareness about environmental problems of littering and measures of curbing littering. The insufficient provision of plastic knowledge causes poor practice of waste separation at source (Tinke & Adiola, 2020). This in turn causes high littering of plastic and no recycling of plastic is practiced in rural schools. The results of the present study indicate that most learners agreed that environmental-related subjects were essential, and positively affect the implementation of ESD. These results relate to those obtained by Coco Chin et al. (2023) in 2022 with 302 Malaysian and non-Malaysian residents, schools and university learners, which indicated that learners who took environment-related

subjects have a positive attitude and high knowledge of plastic pollution. These results correlate with the previous study results of Situmorang et al. (2020) with 98 students from National Chung Hsing University in Taiwan. The study found the differences between knowledge and behaviour about negative impact of plastic amongst students majoring in environmental science and social sciences subjects. The results indicated that students majoring in environmental sciences had higher knowledge of plastic impact than social sciences. In terms of behaviour, the results revealed that environmental science students were able to reduce plastic usage better than social science students. The behaviour of environmental science students was reported seen in purchasing of products with re-used plastic bags and using own meal box. These results correlate with the recent results of the study by Yusuf and Fajri (2022) with 279 science and social science students from Syiah Kuala University in Inddonesia. The study noticed the differences in knowledge, behaviour and engagement on waste management amongst students majoring in environmental science and social science subjects. The study reported that environmental science students were more engaged in free-waste movement implemented in Syiah Kuala University than social science students. Coco Chin et al. (2023) stated that raising awareness about the effects of plastic waste on the environment will help to change the littering behaviour of learners. Recycling education is necessary for learners to sort and recycle plastic (Harman & Yenikalayci, 2022). Classroom activities should engage them in disputing anti-environmental behaviour (Rustamova, 2023).

The collection of plastic waste into separate bins assists in the reduction of waste and sustain the environment. The literature review of this study showed that educating learners about sorting and recycling plastic enhances participation in an environmental protection programme (Hamalosmonglu et al., 2020). Participation in program that separate waste help learners to notice the importance of sustaining environmental resources. The results of the present study in turn revealed that learners disagree that collection of waste into separate dust bins sustain the environment. This could have served as a barrier to the implementation of ESD in rural schools. This does not relate to a recent study by Owojori et al. (2022), who showed that respondents knew that recycling protects the environment, and separating waste into different bins was important. The respondents agreed that the collection of waste into different bins was important as it protects the environment. This relates to a study by Taghdisi et al

(2021), who observed that participants viewed the collection of waste into separate bins as an important measure to tackle environmental issues. The results showed that learners had positive attitude and increased knowledge, showing that they were collecting waste into different bins. This is in line with a recent study by Seth and Daud (2022), which indicated that 90% of learners were aware that recycling saved space in landfill sites. The results indicated that 85% participated in a collection of waste into separate bins. Similarly, the recent study by Abdullar et al. (2023) with 308 university students in Malaysia. The results revealed that 98.7% of students had knowledge of plastic pollution and were collecting waste into separate bins. Zhang et al. (2023) stated that citizen science projects can influence learners to participate in the separation of waste at source, reduce consumption and recycle. Community clean-up campaigns could also help in the recycling and sorting of waste (Assuah & Johansen, 2023). Harman and Yenikalayci (2022) opined that recycling education could assist learners to sort and recycle waste in schools. Zhang et al. (2023) proposed that a public awareness campaign about waste reduction could encourage recycling. In addition, campaigns that are attended by celebrities, business owners and civic personal promote the separation of waste at source. Cultural programmes such as music festivals could be arranged at schools (Zhang et al., 2023) to increase the separation of waste. The World Bank (2022) suggested the introduction of proper waste disposal to provide learners with incentives for being environmental-friendly. Zhang et al. (2023) suggested that bins should be placed 50-60 metres apart and have clear labels for types of waste to recycle.

Long-lasting non-disposable plastics guarantee that littering is reduced because items are reused. The outcome of the literature review in this study has found that learners were littering because recycle, reuse and sorting of waste were not encouraged in rural schools (Banchonhattakit et al., 2022). The research results indicated that learners did not know about the use of long-lasting disposables, which create a barrier in the implementation of ESD. This is in line with a recent study by Coco Chin et al. (2023), who revealed that university learners were highly motivated to separate waste, recycle plastic and use reusable shopping bags. In this study, learners disagreed that they use long-lasting products more than disposable plastic products. Education about eco-friendly products would raise awareness of single-use plastics. The awareness about single-use plastic and its impact would reduce its consumption. Boateng et al.

(2023) suggested that schools should form environmental education clubs to educate learners about sorting and recycling waste to protect the environment. Phan et al. (2023) indicated that a school environmental policy should be introduced to reduce and address plastic waste. Zhang et al. (2023) believed that schools should organise field trips for learners to visit landfill sites, incineration and local recycling centres. This field trip is meant for learners to enhance their understanding of how much waste is produced daily. In this way, learners would realise the importance of separating waste and recycling waste. Zhang et al. also reported that learners can increase their knowledge of plastic pollution by searching the internet and watching plastic pollurion programmes on the television. Soares et al. (2021) suggested outreach programmes and financial incentives for learners to increase their recycling behaviour. Recycling education is also necessary for learners to sort and recycle plastic (Harman & Yenikalayci, 2022).

Socio-economic status also determines practices of proper waste management. The study by Liu et al. (2024) with college and university students in Beijin, found that the students' family income affected students' knowledge, attitude and practices of waste separation. Therefore, socio-economic status has served as barrier that prevented implementation of ESD in rural schools. In support, the literature review has shown that learners' failure to sort waste is commonly affected by occupation of the learners' parents (Kanhai et al., 2021). However, the results of the present study revealed that learners disagree that socio-economic status of their parents influenced their recycling attitudes. The learners denied, even though their parents work out of Limpopo province, and they did not teach them to separate and recycle waste. These results do not resonate with the results by Altikolatsi et al. (2021), who found a slight difference in the percentage of learners who recycle and who did not recycle waste. The study reported that the parents of this learners work in public and private sectors and fewer parents work as freelancers and farmers. Therefore, it was found that the occupation of parents does play a role in the recycling attitude of the learner. In contrast, the study of Olubela (2021) with Junior secondary school learners in Nigeria found that socio-economic status of parents does not influence learners' knowledge, attitude and practices towards waste disposal. In their study in Johannesburg, Schoeman and Rampedi (2021) also rejected their hypothesis that there is a positive relationship between recycling and higher income levels of parents. This does not resonate with

the recent study by Thakur et al. (2023) with 400 senior secondary school learners in India. The results found that 74% of the parents were employed in the farming and fewer in private and public sectors. It was reported in the results that learners who segregated and recycled of waste poorly due to lower income of their parents. Therefore, Thakur et al. (2023) suggested that introduction of mass media campaign that uses folk theatre and radio. Furthermore, Thakur et al. advise the government to target traditional structures such as women self-help groups and village councils to encourage participatory learning. Through these channels learners in rural areas with poor knowledge about sorting and recycling can be encouraged to participate in schools. The World Bank (2022) also suggested introduction of waste-wise programmes to offer learners incentives for behaving in environmental-friendly ways. This raises funds for the schools to purchase computers for learners in rural schools to increase their knowledge about sorting of waste.

Throwing plastic waste into the dustbins and recycling helps to protect natural resources from depletion. When learners have knowledge of plastic pollution and its impact, they will stick to recycling. Another way to encourage learners to sort waste in rural schools was to teach them to be responsible. Soares et al. (2021) stated that learners who have knowledge of plastic pollution and its impact are more likely to recycle waste. The literature review has shown that learners should be held accountable for their littering actions in schools (Hamalosmonglu et al., 2020). Aziz et al. (2021) stated that learners who have poor knowledge of plastic pollution do not recycle and must be told to be responsible and recycle. This study showed that schools do have programmes that monitor compliance to recycling. Therefore, all learners in this study confirmed that they would tell not those who throw the garbage on the ground to pick it up to save the environment. This factor led to poor implementation of ESD in rural schools. This is consistent with a study by Rustamova (2023), who argues that a sense of responsibility and accountability needs to be instilled in learners who do not sort waste and throw waste into the dustbin. Rustamova (2023) added that learners need to be shown the importance of sorting and recycling waste to prevent environmental degradation. This would induce a sense of global citizenship and empathy towards environmental resources. This is because ethical considerations are required in the development of ecological culture in schools. For this reason, Rustamova stated that learners should be assisted to adhere to environmentally

responsible decisions every day in schools. According to Rustamova (2023), ethical considerations involved realising the ethical consequences of their plastic usage patterns and its disposal practices in schools. Rustamova suggested the integration of ethical discussions into the school curriculum for educators to help learners in developing strong moral behaviour towards environmental issues. This is in line with a recent study by Seth and Daud (2022), which showed that learners were aware that recycling saved space in landfill sites. The results revealed that learners participated in sorting and placing waste into separate bins. These results are like a recent study by Abdullar et al. (2023), who showed that students had knowledge of plastic pollution and its impact. The study showed that students placed waste into separate bins to save the environment. Soares et al. (2021) suggested outreach programmes and financial incentives for learners to increase recycling behaviour. Recycling education is necessary for learners to sort and recycle plastic (Harman & Yenikalayci, 2022). Rustamova stated that stewardship would encourage learners to be involved in clean-up initiatives and to join organise awareness zero waste campaigns. Learners should be empowered to use social media platforms to raise their voices against improper waste disposal to the audience. By raising awareness about zero waste campaigns in the media, learners will develop a sense of agency against environmental challenges (Rustamova, 2023).

Confidence to talk about environmental activities helps to encourage learners to talk to one another about proper waste disposal**.** The literature review of this study revealed that a lack of political will affected the sorting of waste and recycling in schools (Hilder &, Collin 2022). Lack of participation in proper waste management encourages littering. Debra et al. (2021) showed that the learners' knowledge of separating waste and awareness is important for sustainability. This will in turn lead to a selection of some learners to monitor compliance with rules of recycling. In a healthy school programme, learners were assigned duties to supervise other learners if they comply with recycling (Aziz et al., 2023). Aziz et al. (2023) showed that when a team of supervision caught learners littering, the team talks to the learner to refrain from littering. In this study, schools had no programmes that allow learners to evaluate and encourage each other to recycle. This is confirmed by the research results, which show that learners were not confident to talk about environmental protection activities. This factor is a barrier that leads to the poor implementation of ESD. A study by

Rustamova (2023) advised that educators should encourage learners to become stewards for the protection of the environment. By developing stewardship and activism behaviour, learners would be encouraged to mobilise friends and the community to fight against improper waste disposal. This will, in turn, prepare them to be part of movements aimed at bringing a positive environmental change in schools and the community. In this way, Rustamova stated that stewardship would encourage learners to be involved in clean-up initiatives and to join organise awareness zero waste campaigns. They should be empowered to use social media platforms to raise their voices against improper waste disposal to the audience. By raising awareness about zero waste campaigns in the media, they will develop a sense of agency against environmental challenges (Rustamova, 2023). Coco Chin et al. (2023) stated that raising awareness about the effects of plastic waste on the environment will help to change the littering behaviour of learners.

## 5.7 To evaluate the interaction between teachers' knowledge, attitude and practice compared to the learners

Educators with a positive attitude promotes recycling to encourage learners to develop a positive attitude to practise proper waste disposal. For educators to effect change in knowledge and attitude of learners to sort waste properly, incentives are necessary. This is because coupling the sorting of waste with incentives encourages more reusing, reducing and recycling practices (Alpizar et al., 2020; Mir et al., 2021). Educators can influence the learners to recycle when there are enough dustbins to separate waste in schools. Boonchieng et al. (2023) stated that educators can reward attitude to recycle by introducing more dustbins to separate waste. However, educators' attitudes in rural schools do not effect change in the attitudes to separate waste due to lack of incentives. Rural schools do not have enough dustbins to recycle different types of waste. Therefore, in the present study, learners stated that the promotion of recycling waste is not necessary for sustainability. Promoting the recycling of waste is a barrier that prevented the implementation of ESD. This does not corroborate with findings by Owojori et al. (2022) in Venda, which showed that 41% of students agree that incentives promote recycling. Lee and Manfredi (2021)

conducted a study in Onondaga County, New York with 22 university students. The results indicated that students participated in New York States' bottles return project due to five cent cash reward. Lee and Manfredi (2021) revealed that out of 12 participants who were aware of the five-cent deposit, many did not participate. Their reason for not taking part in the programme was the inconvenience of traveling to the deposit return facilities. Lee and Manfredi (2021) suggested that if the scheme was implemented in a school-wide and convenient to use, more bottles would be recycled. The learners are aware that plastic must be recycled for natural resources to be protected. This corresponds with the study by Solekah and Jumriyah (2023) with 1911 secondary school learners from Malang Regency. The results showed that many learners participated into school recycling program that sorted and recycled plastic items. The learners recycled plastic waste into beautiful crafts such as flower bouquets, pencil holders and wall decorations which were sold to boost funds of their school. The study showed that the program increased learners' awareness and knowledge about proper waste management and strengthened their eco-friendly behaviours. Mir et al. (2021) proposed continuos public awareness about plastic pollution, its impacts and separation of waste through television, radio and advertisements. They also recommended monetary incentive for learners to sort and recycle plastic. Mir et al. (2021) suggested open sign board to discourage learners from littering. Soares et al. (2021) suggested an outreach programme and a financial incentive for learners to increase their recycling behaviour. The SA government should increase buy-back centres to rural areas for schools to exchange recyclables for cash.

Educators in rural schools did not involve parents because they thought that they were not sensitive to the protection of natural resources. Nxumalo et al. (2020) confirmed that parents are more sensitive as recycling activities are practiced more at home than in schools. Masykuroh (2022) added that parents who had knowledge of plastic pollution and its impact use reuseable products and encourage their children to recycle. However, in this study, learners reported that parents are not sensitive to the environmental protection. The sensitivity of parents towards the environment served as a barrier in the implementation of ESD. This does not relate to a study by Šorytė (2021) in Vilnius with 116 primary and 114 parents, which showed that learners were sorting waste influenced by environmental attitudes of their parents. This does correlate with a study by Katz-Gerro et al. (2020), who found that the behaviour of

learners related to the corresponding behaviour of their parents. The results showed that learners were applying practical knowledge on reduce, reuse and recycle, which they learned from parents. Therefore, recycling education of parents is necessary for learners to sort and recycle plastic (Harman & Yenikalayci, 2022). Zhang et al. (2023) argued that schools should organise field trips for learners to visit landfill sites, incineration and local recycling centres. Parents and learners can gain knowledge of sorting waste through informal education sources such as field trips, zoos, community centres and museums (Sihvonen et al, 2024). Sihvonen et al. added that field trips are necessary for increasing information of what learners learned in classrooms. In addition, field trips encourage active participation and social interaction between learners and educators. A field trip gives learners an opportunity to find new information through cooperative learning practices in group. Alternatively, Jerowsky (2024) suggested that schools could engage learners' virtual infield trips such as computer and web-based learning environments.

Educators in rural schools did not allow parents to participate in school recycling programmes. Research has proved that when parents are allowed to participate in workshops, their children will be encouraged to sort and recycle plastic. Collaborations between parents and educators build attitudes and behaviours to separate waste and recycle (Priatmoko & Sholihah, 2023). Priatmoko and Sholihah (2023) reported that environmental education requires collaborations between parents, educators and learners to change the attitude of learners to recycle. When parents and educators are trained about waste separation at source, they are more likely to engage learners. Suharti and Hapidin (2023) added that developing programmes that aimed at improving the performance of parents and educators promote recycling by learners. In rural schools, educators and parents do not collaborate to effect changes in the behaviour of learners to recycle. In these research results, learners stated that they did not think that the participation of parents could activate pro-environmental behaviour. The participation of parents is a barrier that prevents the implementation of ESD in rural schools. This is not consistent with a study by Taghdisi et al. (2021), which showed that educators and parents were taught about the importance of recycling. The results showed that knowledge and attitude about recycling in a learner increases after the training of parents and educators. This is in line with a study by Assuah and Johansen (2023), who reported that during world earth day, educators,

parents and learners attended presentations by environmentalists about plastic pollution and its effects. The results showed that learners demonstrated a positive attitude to recycle plastic. Zhang et al. (2023) believed that schools should organise field trips for learners to visit landfill sites, incineration and local recycling centres. These field trips are meant for learners to enhance their understanding of how much waste is produced daily. In this way, they will know the importance of recycling waste. Recycling education is necessary for learners to sort and recycle plastic (Harman & Yenikalayci, 2022).

Educators did not provide learners with stewardship positions to supervise other learners to ensure compliance with recycling. For this reason, rural schools were prone to littering. When learners are given a role to supervise others in schools, that role also reaches friends and relatives. Boonchieng et al. (2023) stated that when learners are provided with a supervision role, they are encouraged to engage in protest the municipalities to collect waste that is accumulating in their schools and in the communities. A study by Rustamova (2023) advised that educators should encourage learners to become stewards for the protection of the environment. This is because stewardship allows learners to act against the behaviour that does not comply with sorting and recycling. By developing stewardship and activism behaviour, learners will be encouraged to mobilise friends and the community to fight against improper waste disposal (Rustamova, 2023). Stewardship helps the learners to become leaders of campaigns aiming to raise awareness about the consequences of plastic pollution and the promotion of recycling. Rustamova (2023) prepares them to be part of movements aimed at bringing a positive environmental change in schools and the community. However, learners in rural schools were not given a role of stewardship against improper disposal. Therefore, in this study, they stated that they would ignore anyone throwing litter on the ground. When learners are unable to tell others not to litter, this serves as a barrier in the implementation of ESD. This does not resonate with a study by Kumar (2023), who indicated that youth are taking leadership role in social and environmental movements to seek solutions to combat marine plastic pollution. For example, Kumar indicated that there are youth-led campaigns that encourage youth to recycle plastic waste such as “Pacific Ocean Youth Project” in Fiji. Vierros et al. (2024) suggested that learners should be engaged in citizen science projects like

International Coastal Cleanup (Ocean Conservancy) to gain more knowledge of leading campaigns against littering.

# 6 Chapter 6: Conclusion

The previous chapter has uncovered barriers which prevented learners in rural schools to sort waste and recycle plastic. The barriers were uncovered using the pragmatic approach of CBSM. The improper disposal of waste in two schools was due to lack of knowledge and awareness about the impact of plastic on soil, air, water and plants. This is because educators were not trained about plastic littering and the negative effect of plastic on the environment. The commitment pledge and presentation about plastic helped to change the attitudes of educators and learners towards proper waste disposal. The other barrier to educators was the dustbin which the researcher helped in labelling and placing it conveniently. Both educators and learners were introduced to the sorting of waste into different categories and matching dustbins. The learners were educated about alternatives since the food they buy are packed in plastics.

The presentation raised feelings of empathy towards natural resources. The educators introduced a school environmental committee and policy. The policy introduced was 3Rs, thus reduce, reuse and recycle. To ensure that it is effective, learners came to school with their own containers. Since learners complained about the taste of food from the National School Nutrition Program, educators advised them to bring their own food. This was done to avoid dumping the food into dustbins. Educators were proactive and provided learners with projects that involved the collection of plastic shopping bags that were used mainly at their homes. Learners collected higher volumes and quantities of plastic shopping bag wastes from different homes in the community. With a large volume of shopping plastic bags, educators raised awareness about the reuse, recycling and consumption of plastic. Learners were asked to design an art project with all collected plastic shopping bags with their parents, who helped them to collect more plastics, and assisted in making plastic floor mats. The home projects made them to raise awareness about the plastic consumption and recycling. The project was successful because within four weeks, it was completed. Mats are used by old people for sitting and sleeping.

Other learners used stock sweet wrappers to make coffee mats. Science learners used 2 litre plastic bottles to make respiratory system experiments. Economics educators raised awareness of plastic tax. The vendors who sell food in the school yards were told to reduce plastic wrappers. The school environmental committee told

them to use reusable plates. The learners were charged 50$^{c}$ for collecting plate and were refunded when the plate was returned. The reusable plates with little tax helped to reduce Styrofoam plates and containers. The vendors who sold their food with plastic bags and Styrofoam were told to be responsible for cleaning waste if found littered. The committee told learners to purchase beverage plastic and glass bottles labelled returnable at the tuckshop. The returnable bottles and glasses were labelled R2.00 at the tuckshop. The tuckshop owner refunded R2.00 when bottles were returned by the learners. The returnable plastic bottles and glasses reduced the number of plastic and glass bottles in the school yard. In this way, educators succeeded in reducing and reusing plastic products.

To encourage proper waste disposal, the committee came up with litter monitoring. The monitoring learners were trained to tell other learners who litter to pick up the litter and place it safely into the dustbin. The learners reported those who refused to pick up litter. The sanction was imposed, and learners learnt to take responsibility for their own waste by disposing it properly into the bin. The educators also introduced competitions for the cleanest grade. The school environmental committee invited the buyback private recycling company after the event to collect waste. The recycling company came with a scale and measured the amount of waste and provided the school with money. The money was used to buy more dustbins, gloves and refuse bags.

Other proposed forms of raising awareness in this study were field trips to the landfill sites. The trip is known to encourage learners to reduce the disposal of waste by recycling. This journey to landfill sites would also enable them to experience odour coming from rotten waste and encourage them to stop littering but recycle waste. The methane gas, which is released by the waste, leads to the accumulation of heat in the atmosphere, which increases earth temperatures. The increase in temperatures of the earth causes global warming and climate change. The visit to a recycling facility is aimed at showing learners items that must be recycled. The trip would enable them to learn about new products that are produced. The trip to the beach monitoring or clean up would require educators to partner with citizen scientists. In this regard, learners would be involved in removing plastic for scientists

to analyse. This raises awareness of using eco-friendly products and for learners to understand that the plastic ban policy is required to protect the environment.

The study suggested the introduction of internet, computers and smartphones. The internet would equip learners with information about recycling and show images of the negative impact of plastic on the environment. The internet connection would also enable learners to communicate with peers, educators and experts. This would broaden their knowledge about environmental issues, and learners can communicate with peers from outside the country. In this way, rural learners would be able to make well informed decisions that protect the environment.

## 6.1 Contribution of the study

This study contributes to ongoing debates that plastic packaging covers food that people consume every day. But formal education about the dangers of plastic on the environment could reduce its consumption and disposal. The results of the survey and literature review showed that educators need training to engage learners in sorting and recycling plastic waste. This was revealed by the presentation about plastic pollution and the commitment pledge to sort and recycle plastic waste. The study calls upon the government to introduce workshops. The pledge enables the learners to guide themselves to complying with the policy of reduce, reuse and recycle.

The study showed that educators can alternatively learn about plastic pollution by contacting NGOs or experts via online learning. The study contributes towards informing the government to support educators to learn about plastic online with environmentalists. The government can invite schools to attend plastic pollution seminars or webinars online. The study contributes to highlighting to the government to support schools with internet access with which educators can search plastic pollution through websites. The educators can associate themselves with colleagues via Facebook or Wi-Fi calling to learn about plastic pollution. The educator may be absent from school but he or she can communicate with learners in class via Zoom or team viewer. With this argument, the study contributes towards informing the government to train educators about information communication technology. The Minister of Education once argued that we have approached the fourth industrial revolution. Schools need to be connected to the internet and have computer laboratories equipped with computers.

The study contributes towards informing the government to encourage the development of stewardship and activism behaviour in schools. This would encourage learners to mobilise friends and the community to fight against improper waste disposal and recycling. This would in turn prepare learners to be part of large movement campaigns aimed at bringing a positive environmental change in schools and the community.

The study also contributes towards awakening the government to provide learners with tablets or smartphones. This is because public schools rely on the government for funding of school equipment. The parents of learners would not afford the cost of smartphones and computers. With smartphones, learners can search more information on the websites about plastic sorting and recycling. The smartphones can allow learners to participate in online debates about waste reduction with other learners from abroad. The participation would enable them to become part of the global solution. Accessibility to the internet is also required for smartphones to perform such duty.

The study contributes to the formation of environmental education clubs in schools. Through the clubs, learners can share knowledge about the importance of throwing waste in the bins. The learners can tell those who do not dump waste to save natural resources. The learners in turn will understand plastic pollution when they are taught by fellow learners.

The study will assist the government to stress collaborations among schools through waste management centres. In that way, the centres would be able to provide schools with dustbins and educate learners about recycling and would help with the collection of recyclables and offer incentives or rewards to increase recycling.

The smartphone is required for educators to facilitate the sorting of waste by playing a game. The study contributes towards the introduction of new teaching strategies using games installed on smartphones and computers in the classrooms. This new teaching strategy would allow learners to play sorting recyclable games and recycling. The sorting is followed by designing an artwork using information from the game. The games usually offer procedures on how a particular waste is recycled. In that way, learners can start practising sorting and recycling of plastic waste in class. Later, the educators can introduce waste sorting outdoors.

The study contributes towards informing curriculum designers to include indigenous games in the school curriculum. Indigenous games such as morabaraba and Kgati would help learners in rural areas with shortage of technological equipment to play

games. The games use plastic bottle caps and plastic shopping bags. The learners would learn to reduce, reuse and recycle plastic and play funny games.

The study enables curriculum designers to include virtual field trips to accommodate learners from rural areas. This is because the learners cannot afford to pay money to visit museums, zoos, beaches and recycling centres. The virtual activity learning environment would provide learners with information about sorting, reducing, reusing and recycling waste. The trips also give learners an opportunity to interact with each other cooperatively. The virtual trip needs internet access as it uses web-based learning through computers.

The study also raises awareness of introducing school libraries and a variety of books about plastic pollution. Books contain photographs of the impact of plastic on animals, plants, soil, water and air. This is vital in raising awareness of plastic pollution and its negative impact. With various books in the library, educators can introduce photovoice, case studies, storytelling, discussions and arguments about plastic pollution. When learners raise their views about the impact of plastic on the environment, they would be encouraging other learners to recycle plastic wastes.

The study contributes to informing curriculum designers about collaborative projects on shared environmental challenges. This project would involve local and international learners from different countries. Through the project, learners would develop a sense of global citizenship and shared responsibility.

The study contributes to informing the government about the integration of ethical discussions into the school curriculum. This would assist educators to help learners in developing a strong moral behaviour towards the sorting and recycling of waste in schools.

The study has shown that research projects based on the analysis of stories from TV or Video about the negative impact of plastic cultivate empathy towards the environment. Therefore, the government needs to invest in teaching aids like TV and Video recorders in schools. This is because public schools are overcrowded with

learners in the classroom. Therefore, to revive a fully packed class with learners, TV or Video plays would encourage interest in the subject.

The study contributes towards the introduction of a School Environmental Policy as part of the school mission and vision of public schools. The reduce, reuse and recycle policy in schools would introduce the banning of plastic and mandatory recycling. The schools would use the plastic ban to encourage learners to come to school with refill bottles to collect water. The committee would instruct learners to use reusable containers when buying food from the local market. Those two plastic ban policies helped to instil responsibility of reducing, reusing and recycling waste in schools. The ban would encourage the reduction of plastic consumption and protect environmental resources by recycling. For this reason, the government must support schools with enough funds to purchase more dustbins.

The usage of PET beverage plastic bottles in rural schools is very high. The study is calling on the government to promote the introduction of deposit refund schemes in the school curriculum. The scheme has proven to reduce the disposal of PET plastic packaging in many developed countries like Finland and Germany. This would raise awareness to learners about the recycling of PET plastic packaging and enable parents and learners to recycle plastic bottles since job opportunities in rural areas are very scarce.

There is a high rate of consuming cheap plastic packaging in the local markets. These cheap plastics are improperly discarded in schools and villages. Therefore, the study calls upon the government to introduce extended producer responsibility awareness in the school curriculum. This would enable learners to raise awareness to the parents to stop using cheap plastic but use reusable products from the company that pays when reusable items are returned to the market.

The study contributes towards informing the government that South Africa is now a member of the United Nations. The government should introduce plastic ban in the school curriculum. As per agreement of the Paris Pledge, South Africa should divert waste in landfill sites. Schools should prevent plastic and other wastes from reaching landfill sites by recycling them. This is because the accumulation of waste in the landfill

sites produces greenhouse gases that contribute to global warming and climate change. In that way, schools would become part of mission of the government that should reduce greenhouse gas emission by 2030. The ban would enable learners to reduce and divert waste to landfill sites. This would also ensure that plastic and other waste are not disposed improperly on open spaces or burned in the school yard.

The study also contributes towards informing curriculum developers to include programmes that involve paying visits to recycling centres. The government in this regard is providing funds for learners to visit national parks through the subject Tourism. It is high time that environmental education curriculum designers introduce field trips as well in schools. In addition, the government must support environmental education learners with funds for field trips. Recycling centres provide knowledge to learners about the type of waste that must be recycled. Recycling centres help learners to know that resources are used efficiently, and that recycling boosts the economy. Recycling facilities reinforce knowledge that learners learn in class by providing experience about the recycling process.

The study contributes towards informing the government to invest in citizen science projects. The role of citizen science is to involve learners in separation of waste at source, reducing and recycling activities. For this reason, learners would be aware of the effects of plastic pollution and how to reduce its consumption. The plastic waste would motivate them to use environmental-friendly products.

The government should invest in supporting programmes that involve participation in community clean-ups. The schools need to be provided with gloves and refuse plastic bags. The days like 60-minute working for Nelson Mandela are valued by the community. The government should support schools and the community by inviting environmentalists on that day to address the community about plastic pollution and its dangers on the environment. This would raise awareness about the negative impact of illegal dumping of plastic and other wastes. When parents and learners are aware of the dangers of plastic, they would sort and recycle plastic waste. Like the Umuganda campaign in Gigali (Rwanda), campaigns would make villages and schools clean.

## 6.2 Recommendations

The study recommends that the Department of Education should support learners in rural areas in school libraries with different books. The study has shown that there are no school libraries in many schools. Therefore, educators and learners in the rural areas need more knowledge and awareness of environmental issues.

The dustbin infrastructure would be helpful in encouraging learners to dump waste properly. The government should consider pumping schools with enough funds to purchase dustbins. When dustbins are available, the implementation of mandatory recycling would become more effective because they improve the aesthetic value of the school and encourage newly admitted learners to maintain cleanliness at the school.

Collaborative projects where learners will discuss with international learners' environmental challenges should be introduced in schools. Through these projects, learners would develop a sense of global citizenship and shared responsibility.

The study recommends that the government should allow the development of stewardship and activism behaviour in schools. This would encourage learners to mobilise friends and the community to fight against improper waste disposal and recycling. This will in turn prepare learners to be part of large movement campaigns aimed at bringing a positive environmental change in schools and the community.

The study recommends that the government should integrate ethical discussions into the school curriculum. This would assist educators to help learners in developing strong moral behaviour towards the sorting and recycling of waste in schools.

A school environmental policy as part of the mission and vision of public schools needs to be introduced. With reduce, reuse and recycle policy, schools would ban plastic and mandatory recycling. The schools would use a plastic ban to encourage learners to come to school with refill bottles to collect water. The committee would instruct them to use reusable containers when buying food from the local market. Those two plastic ban policies helped to instil responsibility of reducing, reusing and recycling waste in

schools. The ban would encourage the reduction of plastic consumption and protect environmental resources by recycling. For this reason, the government must finance schools to purchase more dustbins.

The Public Commitment Pledge should be introduced in schools because it makes litter monitoring easier for learners and educators. When a learner has pledged, he or she commits herself to sorting, reducing, reusing and recycling. The learner also feels guilty when other learners are not practising pro-environmental behaviour. The learner always monitors others without being told by the educator to play such role. Commitment encourages stewardship in school and at home. With stewardship, learners are encouraged to teach parents to take responsibility.

The study recommends the formation of environmental education clubs in schools. Through the clubs, knowledgeable learners can share knowledge about the importance of throwing waste in bins. The learners can tell those who do not dump waste to throw them properly to save natural resources. Leaners understand plastic pollution when they are taught by fellow learners.

The study recommends that the government should stress the collaboration of schools with waste management centres. In this way, the centres will be able to provide schools with dustbins, educate learners about recycling, help with the collection of recyclables and offer incentives or rewards to increase recycling.

The study recommends that the government should fund field trips such as visits to recycling centres, which provide learners with experience of stages that a material takes to become a new raw material. The learners' awareness of the types of waste that are recyclable is enhanced. By observing the process of recycling, the learners become aware that recycling uses raw materials efficiently and that it boosts the economy. Recycling centres also develop the waste sorting and recycling behaviour of learners.

The study recommends that the government should introduce participation in citizen science projects by schools and join citizen scientist programmes. Participation in citizen science projects would involve learners in sorting waste at source, reducing

and recycling wastes. This activity allows them to become part of researchers about plastic pollution. Participation motivates learners to use environmental-friendly products, recycle and become aware of the proper disposal of plastic.

The study recommends the inclusion of indigenous games in the school curriculum by curriculum designers. Indigenous games such as morabaraba and Kgati will help learners in rural areas with shortage of technological equipment for play games. The games use plastic bottle caps and plastic shopping bags. The learners would learn to reduce, reuse and recycle plastic and play funny games.

Virtual field trips are recommended for learners who cannot afford to pay money to visit museums, zoos, beaches and recycling centres. The virtual activity learning environment provides them with information about sorting, reducing, reusing and recycling waste. The trips also give them an opportunity to interact with each other cooperatively. The virtual trip needs internet access as it uses web-based learning through a computer.

The study recommended that the government should fund field trips to recycling centres. This makes learners to gain more about recyclable items and the new product that they become. The learners in this regard can influence their friends and families to recycle waste.

The government should support schools in building computer laboratories and giving learners from poor household smartphones. The internet access should be a priority of the government to drive learners into the fourth industrial revolution. The internet will encourage learners and educators to communicate with their peers locally and internationally.

Workshops should be introduced in rural schools for experts to provide educators, parents and learners with plastic pollution education and its impact. The government must inform PETCO to partner with rural schools to introduce deposit refund schemes and to increase recycling. Training is necessary for educators to know that dustbins need to be labelled and placed conveniently for learners to dump waste properly.

The plastic pollution must be introduced fully in the textbooks that they are supplying to schools. The videos, TV and overhead projectors should serve as teaching aids to overcrowded classrooms.

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# 8.Appendices

## 8.1 Appendix1: Wits University: Ethical Clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

**HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)**
R14/49 Maunatlala

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER: H19/11/58** |
| **PROJECT TITLE** | Fostering commitment as a tool in Environmental Education to alleviate littering in rural schools |
| **INVESTIGATOR(S)** | Mrs P Maunatlala |
| **SCHOOL/DEPARTMENT** | Education/ |
| **DATE CONSIDERED** | 15 November 2019 |
| **DECISION OF THE COMMITTEE** | Approved<br>Risk Level: Medium |
| **EXPIRY DATE** | 17 June 2023 |
| **DATE** 18 June 2020 | **CHAIRPERSON** _____ (Professor J Knight) |

cc: Supervisor : Dr P Goldschagg and Dr D Long

**DECLARATION OF INVESTIGATOR(S)**

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to complete a six (6) month progress report.**

_____ **Signature**

_____/_____/_____ **Date**

**PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES**

## 8.2 Appendix 2: Head of the Department of Education in the Limpopo Province – Permit

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
**EDUCATION**

CONFIDENTIAL

Ref: 2/2/2 Enq: Mahoga NG Tel No: 015 290 6365 Email: [illegible]

Mauratlala PM
P O Box 3727
Tzaneen
0930

**RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH**

1. The above bears reference.

2 The Department wishes to inform you that your request to conduct research has been approved. Topic of the research proposal: **"FOSTERING COMMITMENT AS A TOOL IN ENVIRONMENTAL EDUCATION TO ALLEVIATE LITTERING IN RURAL SCHOOL "**

3. The following conditions should be considered:

3.1 The research should not have any financial implications for Limpopo Department of Education.

3.2 Arrangements should be made with the Circuit Office and the School concerned

3.3 The conduct of research should not in anyhow disrupt the academic programs at the schools.

3.4 The research should not be conducted during the time of Examinations especially the fourth term.

3.5 During the study, applicable research ethics should be adhered to; in particular the principle of voluntary participation (the people involved should be respected).

REQUEST FOR PERMISSION TO CONDUCT RESEARCH: MAUNATLALA PM

Cnr. 113 Biccard & 24 Excelsior Street, POLOKWANE, 0700, Private Bag X9489, POLOKWANE, 0700
Tel: 015 290 7600, Fax: 015 297 6920/4220/4494

## 8.3 Appendix 3: Ant-Litter Policy for School A

# ANTI-LITTER POLICY

School A High School acknowledges the need for and importance of maintaining a clean, healthy and safe environment that can be enjoyed by all staff members,, learners and visitors. Litter not only provides health risks in various forms, it also reduces the pleasantness of the school grounds, impacts negatively on the wider community and environment, and contributes to a “littering” culture within the school.

In order to maximise the enjoyment and learning opportunities for all staff members and learners of School A High School community, the following rules and expectations are to be followed by every learner at School A High School.

- Learners are to place all of their litter in the bins provided at all times.
- Learners are required to pick up litter at all times if directed to by a staff member or a senior leader student.
- Learners must not eat in the areas designated as ‘No Eating Areas’. These areas are outlined in the policy below.
- Learners are to take responsibility for the litter in their own eating area on a daily basis and keep their eating area clean.
- Teachers are required to give learners projects based on the rubbish produced at school, e.g sweets and snacks packages as well as plastic bottles and packages to promote recycling at school and at home.
- Teachers are required to demonstrate to learners the eco-friendly products to reduce plastic consumptions.

- Learners are required to treat garbage bins with the same respect as any other school property.
- Learners are required to bring their own containers to minimise the waste created by food wrappers.

**Designated 'No Eating' Areas**

The areas within the school grounds designated as No Eating Areas are as follows:

- The backgrounds of classrooms
- The Netball and Football Field
- In the Laboratory
- Inside any other school building unless given specific instructions by staff to do so
- Close to the decorating Trees
- All out of bounds areas

**Consequences**

Any learner found in breach of this Policy will be subject to one lunch time detention.

School Principal: Signature: …… Date ……..

Learner's signature: …… Date ……..

### 8.4 Appendix 4: Anti-Littering Policy for School B

# ANTI-LITTER POLICY

School B High School acknowledges the need for and importance of maintaining a clean, healthy and safe environment that can be enjoyed by all staff members, learners and visitors. Litter not only provides health risks in various forms, it also reduces the pleasantness of the school grounds, impacts negatively on the wider community and environment, and contributes to a “littering” culture within the school.

In order to maximise the enjoyment and learning opportunities for all staff members and learners of School B High School community, the following rules and expectations are to be followed by every learner at School B High School.

- Learners are to place all of their litter in the bins provided at all times.
- Learners are required to pick up litter at all times if directed to by a staff member or a senior leader student.
- Learners must not eat in the areas designated as ‘No Eating Areas’. These areas are outlined in the policy below.
- Learners are to take responsibility for the litter in their own eating area on a daily basis and keep their eating area clean.
- Learners are required to treat garbage bins with the same respect as any other school property.
- Learners are to bring their own containers to minimise the waste created by wrappers.
- Teachers are required to give learners projects based on the rubbish produced at school, e.g sweets and snacks packages as well as plastic bottles and packages to promote recycling at school and at home.

- Teachers are required to demonstrate to learners the eco-friendly products to reduce plastic consumptions.

**Designated 'No Eating' Areas**

The areas within the school grounds designated as No Eating Areas are as follows:

- The backgrounds of classrooms
- The Netball and Football Field
- In the Laboratory
- Inside any other school building unless given specific instructions by staff to do so
- Close to the decorating Trees
- All out of bounds areas

**Consequences**

Any learner found in breach of this Policy will be subject to one lunch time detention.

School Principal: Signature: …… Date ……..

Learner's signature: ……. Date ……..

### 8.5 Appendix 5: Questionnaire for the Educators

## Educators Survey Tool

Dear respondent,

The researcher, ……., is a postgraduate student (MSC) at the University of the Witwatersrand, Department of …….. undertaking a study on the ……..…… ……..… …….. The questions in this questionnaire are for research purpose only and the finding of this study will be treated with utmost confidentiality. Your assistance in answering the questions truthfully and accurately will be highly appreciated.

**BACKGROUND INFORMATION**

Name: ……Date ……..

School: ……

**1.** Gender:

1. Male [ ]
2. Female [ ]

**2.** Age

1. Below 30 years [ ]
2. 31-35 years [ ]
3. 36-40 years [ ]
4. 41-45 years []
5. Above 46 years [ ]

**3.** During your teacher training course, was environment education one of the main subjects?

1. Yes
2. No

## SCHOOL ENVIRONMENTAL POLICY

**4. Does your school have an environmental policy?**

1. Yes
2. No
3. I don't know

**5. If YES, in Question 1 above, please complete the statement below.**

The policy is _____ practised.

1. Fully
2. Partially
3. Never

**6. If NO to Question 1 above, please tell me the reasons why your school does not have one.**

……

……

……

……

……

## Litter monitoring at school

**7. How do your rate the cleanliness of your school?**

1. Very dirty
2. Dirty
3. Partially clean
4. Clean

**8. Does your school have a litter/waste pick-up roster?**

1. Yes
2. No

**9. If YES to Question 8 above, how many times do the litter picking happen at your school in a week?**

1. Once
2. Twice
3. Thrice
4. Four times
5. Five times (every day)

**10. If NO to Question 8 above, please tell me the reasons why your school does not have one.**

……

……

……

……

……

## LITTER MONITORING AT SCHOOL

**11. How do you rate the cleanliness of your school?**

1. Very dirty
2. Dirty
3. Partially clean
4. Clean

**12. Does your school have a litter/waste pick-up roster?**

1. Yes
2. No

**13. If YES to Question 4 above, how many times do the litter picking happen at your school in a week?**

1. Once
2. Twice
3. Thrice
4. Four times
5. Five times (every day)

**14. If No to Question 4 above, so who cleans the school grounds**

1. Parents

2. Groundsmen
3. Pupils that are on punishment
4. Community
5. Other (Specify)…….

## SCHOOL AND FAMILY

Questions concerning the role of school and family towards environmental motivation, as well as some conceptual questions about students' environmental sensitivity.

**15. How important is the existence of a Recycle Bin in your school?**

1. Not Important
2. Somewhat important
3. Important
4. Extremely important

**16. How important do you consider school's contribution to shaping environmental conscience?**

1. Not Important
2. Somewhat important
3. Important
4. Extremely important

**17. Do you think your school should participate in recycling programmes?**

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

**18. Do you think that participation in environmental education activities helps maximizing environmental awareness?**

1. Strongly disagree
2. Disagree

3. Neutral
4. Agree
5. Strongly Agree

**19. To what extent do you believe co-participation of children-parents will help in developing environment-protecting behaviour?**

1. Not Important
2. Somewhat important
3. Important
4. Extremely important

**20. To what extent do you think community/parents are sensitive to environmental protection?**

1. Not sensitive
2. Somewhat sensitive
3. Sensitive
4. Extremely sensitive

## KNOWLEDGE AND ATTITUDES

**21. In your opinion, what is Environmental Education?**

……
……
……
……
……

**22. How would you explain Environmental Education in your own words?"**

……
……
……
……
……
……

## MOTIVATORS, BARRIERS AND SUPPORT NEEDS

**23. Indicate if the school you are working at has a subject of Environmental Education taught to all students**

1. Yes
2. No

**24. If Yes, to Question 23 above and what are the main topics/issues**

……

……

……

……

……

**25. If NO, to Question 23 above, what could be the barriers to introducing Environmental education at your school?**

……

……

……

……

……

……

**26. Is there anything else that would be helpful to you in including more Environmental Education in your teaching? Select as many options as possible from the list below**

1. More time
2. Professional development
3. Increased funding
4. More flexible curriculum
5. Materials
6. Increased community connections
7. Administrative support

8. Resources
9. Collaboration with colleagues
10. Improved facilities

**27. To what degree/extent does the available curriculum and/or resources support teaching or engagement in Environmental Education?**

1. Not at all
2. Very little
3. Somewhat
4. To a great extent

**28.** Please indicate how you are agree with the following statements using a 5-point Likert Scale 1. Strongly disagree; **2.** Disagree; **3**. Neutral; **4.** Agree and **5.** Strongly Agree

| | **Statement** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| i. | To what extent do you believe that environmental participation would activate environmental protection behaviour? | | | | | |
| ii. | Do you believe that your family economic status plays a part in practicing environmental education behaviour? | | | | | |
| iii. | Do you think that young people should have a good environmental awareness for sustainable environment? | | | | | |
| iv. | Is it necessary for all learners to take subject related to environmental awareness? | | | | | |
| v. | I always show my best efforts to prevent pollution of the environment and show awareness | | | | | |
| vi. | Do you see that promotions of recycling waste/litter are necessary for sustainable environment? | | | | | |
| vii. | Is recycling of waste important for the protection of the environment and natural resources. | | | | | |
| viii. | Do you think that collection of waste in separate dustbins is important for a sustainable environment? | | | | | |
| ix. | Is there enough separate collection dustbins (plastic, metal, paper) in the buildings of your school? | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| x. | I prefer to use long lasting products (rechargeable batteries, cloth bags) for a sustainable environment instead of disposable products. | | | | | |
| xi. | I would avoid using plastic bags | | | | | |
| xii. | I try to protect the environment by using the least number of paper towels. | | | | | |
| xiii. | I throw the garbage into dustbins before leaving that place and not leaving any trash. | | | | | |
| xiv. | I throw the plastic, metal Plastic, metal and paper to separate recycling boxes | | | | | |

**29.** Please indicate how you are agree with the following statements using a 5-point Likert Scale 1. Strongly disagree; **2.** Disagree; **3**. Neutral; **4.** Agree and **5.** Strongly Agree

| | **Statement** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| | **ENVIRONMENTAL EDUCATION (VIEWS)** | | | | | |
| i. | Environmental education is a high status topic for me | | | | | |
| ii. | In classrooms teachers should advocate a particular stand with respect to environmental issues | | | | | |
| iii. | Environmental education should include a social justice perspective | | | | | |
| iv. | Environmental education should include an action component | | | | | |
| v. | Field trips and activities outside the classroom are essential to environmental education | | | | | |
| vi. | Visits to Outdoor Education Centres should be an essential component of environmental education | | | | | |
| vii. | Outdoor education should be about connecting children to the natural environment | | | | | |

| | **Statement** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| | **ENVIRONMENTAL EDUCATION (PRACTICE)** | | | | | |
| viii. | Environmental education is generally well implemented in my classroom | | | | | |
| ix. | I am successful in getting my students concerned about the GLOBAL environment | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| x. | I am successful in getting my students concerned about my LOCAL environment | | | | | |
| xi. | Field trips with my class are central to my environmental education goals | | | | | |
| xii. | I frequently use Outdoor Education Centre visits to promote environmental awareness | | | | | |
| xiii. | In my school, environmental education is mainly about raising student awareness | | | | | |
| xiv. | In my school environmental education is mainly about developing critical thinking skills to evaluate environmental issues | | | | | |

## 8.4 Appendix 6: Questionnaire for Learners

# Student Survey Tool

## SECTION A: DEMOGRAPHICS

Socio-demographics, such as place of race, grade attend by pupil parents' qualifications, and personal details

**Name of Respondent**: …… Date: ……

**Grade** ……..

## DEMOGRAPHIC INFORMATION

1. **Race** 1 = White 2 = Black 3 = Indian/Asian 4 = Coloured

2. **Sex** 1 = Male 2 = Female

3. **How old were you at your LAST birthday?**

   12 13 14 15 16 17 18 19 20 21

4. **Which grade are you currently in?**

   Grade 8 Grade 9 Grade 10 Grade 11 Grade 12

5. **What language do you speak at home most of the time?**

   Sepedi, Sotho, isiZulu, Xitsonga, English or Tshivenda

6. **What is the highest level of education of your mother?**

   1. Lower that Matric
   2. Certificate
   3. Diploma
   4. Degree (Honours Degree)
   5. Masters
   6. Doctorate

7. **What is the highest level of education pf your father?**

   1. Lower that Matric
   2. Certificate
   3. Diploma
   4. Degree (Honours Degree)
   5. Masters
   6. Doctorate

## SCHOOL ENVIRONMENTAL POLICY

8. **Does your school have an environmental policy?**

   1. Yes
   2. No
   3. I don't know

9. **If YES, in Question 1 above, please complete the statement below.**

   The policy is _____ practised.

   1. Fully
   2. Partially
   3. Never

## LITTER MONITORING AT SCHOOL

10. **How do you rate the cleanliness of your school?**

    1. Very dirty
    2. Dirty

3.Partially clean

4.Clean

**11. Does your school have a litter/waste pick-up roster?**

1.Yes

2.No

**12. If YES to Question 11 above, how many times do the litter picking happen at your school in a week?**

1.Once

2.Twice

3.Thrice

4.Four times

5.Five times (every day)

**13. If No to Question 11 above, so who cleans the school grounds**

1. Parents
2. Groundsmen
3. Pupils that are on punishment
4. Community
5. Other (Specify)…….

## KNOWLEDGE

**14.** Students' level of knowledge related to ecological awareness, information on ecological and environmental terms and student habits towards environment.

| | | Yes | No |
|---|---|---|---|
| i. | Are you familiar with Waste management? | | |
| ii. | Do you know the meaning of the word "Environment Education"? | | |
| iii. | Have you joined environmental programmes in your school? | | |
| iv. | Are you taking part in an environmental program now? | | |
| v. | Is there currently an environmental programme running at your school? | | |
| vi. | Have you used your smartphone for accessing environmental information? | | |
| vii. | Do you use the School Library for environmental information? | | |
| viii. | Do you know if there is a Public Library in your area? | | |

| | | | |
|---|---|---|---|
| ix. | Is there a recycle bin in your school? | | |
| x. | Do you use the recycle bin in your school? | | |
| xi. | Do you use school supplies derived from recycled materials? | | |

**15. Who tells you not to litter the most?**

a. Parents
b. Teachers
c. My conscience
d. Other (specify)

**16. Which of the following provides you with the best environmental knowledge?**

a. Books
b. Teachers
c. Parents
d. Others [Specify]

## SCHOOL AND FAMILY

Questions concerning the role of school and family towards environmental motivation, as well as some conceptual questions about students' environmental sensitivity.

**17. How important is the existence of a Recycle Bin in your school?**

1.Not Important
2.Somewhat important
3.Important
4.Extremely important

**18. How important do you consider school's contribution to shaping environmental conscience?**

1.Not Important
2.Somewhat important
3.Important
4.Extremely important

**19. Do you think your school should participate in recycling programmes?**

1.Strongly disagree

2.Disagree

3.Neutral

4.Agree

5.Strongly Agree

**20. Do you think that participation in environmental education activities helps maximizing environmental awareness?**

1.Strongly disagree

2.Disagree

3.Neutral

4.Agree

5.Strongly Agree

**21. To what extent do you believe co-participation of children-parents will help in developing environment-protecting behaviour?**

1.Not Important

2.Somewhat important

3.Important

4.Extremely important

**22. To what extent do you think community/parents are sensitive to environmental protection?**

1.Not sensitive

2.Somewhat sensitive

3.Sensitive

4.Extremely sensitive

## ENVIRONMENTAL AWARENESS

**2.3** These are self-evaluation questions concerning environmental knowledge, environmental education, and willingness to participate in environmental protection activities.

**24**.How would you rate your environmental knowledge level? Rate yourself from 1 to 5, with 1 being least important and 5 very important):

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

| | Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| i. | To what extent do you believe that environmental participation would activate environmental protection behaviour? | | | | | |
| ii. | Do you believe that your family economic status plays a part in practicing environmental education behaviour? | | | | | |
| iii. | Do you think that young people should have a good environmental awareness for sustainable environment? | | | | | |
| iv. | Is it necessary for all learners to take subject related to environmental awareness? | | | | | |
| v. | I always show my best efforts to prevent pollution of the environment and show awareness | | | | | |
| vi. | Do you see that promotions of recycling waste/litter are necessary for sustainable environment? | | | | | |
| vii. | Is recycling of waste important for the protection of the environment and natural resources. | | | | | |
| viii. | Do you think that collection of waste in separate dustbins is important for a sustainable environment? | | | | | |
| ix. | Is there enough separate collection dustbins (plastic, metal, paper) in the buildings of your school? | | | | | |
| x. | I prefer to use long lasting products (rechargeable batteries, cloth bags) for a sustainable environment instead of disposable products. | | | | | |
| xi. | I would avoid using plastic bags | | | | | |
| xii. | I try to protect the environment by using the least number of paper towels. | | | | | |
| xiii. | I throw the garbage into dustbins before leaving that place and not leaving any trash. | | | | | |
| xiv. | I throw the plastic, metal Plastic, metal and paper to separate recycling boxes | | | | | |

**25. Which institution do you think influences you the most to take action against littering?**

1. School
2. Home
3. Church
4.

**26. Do you think littering is an environmental problem?**

1. Yes
2. No
3. I don't know

**27. How would you rate the adequacy of environmental education you receive?**

1. Extremely inadequate
2. Inadequate
3. Neutral
4. Adequate
5. Extremely adequate

**28. Have you attended any project or seminar to acknowledge the environmental awareness?**

1. Yes
2. No

**29. If you were to see one pupil throwing litter on the ground, what will you do?**

1. I will tell them to pick it up
2. I will report them
3. Will ignore it
4. Will pick it up

**30. Which area do you think is littered the most?**

1. At school
2. At home
3. Other (specify)

**31. Do you litter the school environment?**

1. Yes
2. No

**32. Do you litter the home environment?**

1. Yes
2. No

## KNOWLEDGE AND PARTICIPATION IN ENVIRONMENT PROTECTION ACTIVITIES

**33. Do you know of any activities or programmes aimed at protecting the environment in your school?**

1 = Yes

2 = No

**34. If YES, can you describe these activities? (Open-ended response)**

……
……
……
……

**35. Have you participated in any activities or programmes aimed at preventing sexual violence?**

1 = Yes

2 = No

**36. Please give details of the activity or programme (Open-ended response)**

……
……
……
……

**37. Are you participating in the Environment Education provided by the School?**

1 = Yes

2 = No

**38. How confident would you say you are to speak out about environmental protection activities occurring in your school?**

1 = Not at all confident

2 = Fairly Confident

3 = Very confident

**39. How capable would you say you are you to play an active role in school to promote environmental protection?**

1 = Not at all confident

2 = Fairly Confident

3 = Very confident

### 8.7 Appendix 7: Learners Interview Guide

## *Fostering Commitment as a Tool in Environmental Education to Alleviate Littering in Rural Schools.*

## LEARNER'S INTERVIEW QUESTIONS

Gender …… Grade …….

Please answer the following questions honestly and to the best of your ability

1. What kind of food do you buy at school?
2. Does the food and drinks come in a packaging material?
3. If the answer to Question 2 is yes, then what type of packaging does it come in and how do you dispose of the packaging?
4. Do you think lessons you are learning in class about environmental issues help to prevent littering? Follow- on these questions: in which subject have you learned about environmental issues? What lessons do you think could be taught?
5. Are there enough dustbins inside and outside of classroom? Are they well situated? Follow- on question: Where do you think they should be situated?
6. What anti- littering messages have you seen or been told about?
7. Which anti-litter measures have proved to be effective, and which were not?
8. What other anti- littering measures do you think could be implemented?
9. What are the learners' responses when they see plastics, papers and other litter lying on the school grounds? Follow- up question: how do you think their responses could be improved upon to help reduce litter?
10. Does your school have teaching and learning programmes on management of wastes?
11. Are these effective?
12. How could their effectiveness be improved upon?

**Thank You for participating in the study**

## 8.8 Appendix 8: Educators Interview Guide

*Fostering Commitment as a Tool in Environmental Education to Alleviate Littering in Rural Schools.*

**TEACHER'S INTERVIEW QUESTIONS**

Gender ……..... Grade ……..

Please answer the following questions honestly and to the best of your ability

1. What kind of food do you buy at school?
2. Does the food and drinks come in a packaging material?
3. If the answer to Question 2 is yes, then what type of packaging does it come in and how do you dispose of the packaging?
4. Do you think lessons you are teaching in class about environmental issues help to prevent littering? Follow- on this questions: in which subject have you taught about environmental issues? What lessons do you think could be learned?
5. Are there enough dustbins inside and outside of classroom? Are they well situated? Follow- on question: where do you think they should be situated?
6. What anti- littering messages have you seen or been taught about?
7. Which anti-litter measures have proved to be effective and which were not?
8. What other anti- littering measures do you think could be implemented?
9. What are the learners' responses when they see plastics, papers and other litter lying on the school grounds? Follow- up question: how do you think their responses could be improved upon to help reduce litter?
10. Does your school have teaching and learning programmes on management of wastes?
11. Are these effective?
12. How could their effectiveness be improved upon?

**Thank You for participating in the study**