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Exploring Teachers' Perceptions of Solid Waste Management in Umlazi District Schools, South Africa

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Abstract

This research aims to investigate the perceptions of teachers and learners regarding the handling of solid waste at secondary schools in the Umlazi District. This study used waste management theory and following a qualitative approach, adopted a case study design to explore the perception of teachers and learners on solid waste management in the Umlazi District, Kwa-Zulu Natal. By using focus group interviews, observation, face-to-face interviews, and photovoice, data were collected from three secondary schools three teachers, teaching Life Sciences, and 18 learners in Grade 10. The findings showed that the teachers and learners were aware of concerns with solid waste and waste management practices in their schools and local environment. It also appeared that schoolteachers and learners had an acute awareness that poor waste management would harm the school environment as well as them as individuals. Furthermore, the findings revealed that there was minimal awareness of effective solid waste management practices. Good waste solid waste management practices activities were minimal in both the schools and home environment. The critical recommendation of the study is that the Department of Basic Education needs to intensify the research on proper solid waste disposal to better understand the needs of teachers and learners regarding environmental matters such as solid waste management.

Keywords: Solid waste management, awareness, knowledge, understanding, practices

1. Introduction

This study aims to evaluate the perceptions of solid waste management in township secondary schools in KwaZulu-Natal. The research was carried out in three public secondary schools in Chesterville, in the Umlazi District of KwaZulu-Natal, South Africa. The schools were selected according to their different quintile rankings. All South African public ordinary schools, according to Heystek, and Minnaar (2015), are divided into five classes, known as quintiles, primarily to allocate financial resources. The "poorest" quintile is quintile 1, while the "least poor" quintile is quintile 5. There are no-fee schools in quintiles 1, 2, and 3, but there are fee-paying schools in quintiles 4 and 5. I selected

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Government Secondary School, which is in quintile 4, Sukuma Sakhe, Masiphe School, which is in quintile 3, and Bofela Secondary School, which is in quintile 5 (pseudonyms).

Increased awareness of environmental degradation on a global and local level has led to the need to aid people in changing their habits (Ackerman & Stanton, 2015). As a result, education is regarded as one of the most important tools for saving the environment through growing people's knowledge, skills, attitudes, and environmentally beneficial behaviour (Kaare, 2014). Since the 1970s, a series of international meetings and documents have stressed education for sustainable development (ESD) as a tool for dealing with the growing trend of environmental concerns. This prompted the Stockholm Conference on the Human Environment (UN, 1972), Belgrade Charter (UNESCO, 1976), Tbilisi Declaration (UNESCO, 1978), Brundtland Report (WCED, 1987), Rio Earth Summit (UN Conference on Environment and Development, 1992), and Johannesburg Summit (Dooley, 2002). At the United Nations Conference on Human Environment in Stockholm, for instance, the necessity of ESD was acknowledged and emphasised (UN, 1972). The government of South Africa's initiative to incorporate EE into school curricula is commendable (Zurbrügg et al., 2018). South Africa's economy is strongly reliant on the country's natural resources and environment (Joshua & Bekun, 2020).

Natural and man-made environmental problems, such as pollution, biodiversity loss, poor sanitation, a lack of clean and safe water, land degradation brought on by subpar agricultural methods, and unsustainable methods of resource extraction, like mining for minerals and overfishing, pose a threat to the environment's ability to support life (Ministry of Education and Vocational Training, New Zealand, 2016). These problems are exacerbated by population pressures, poor farming practices, and a high pace of urbanisation (Johnson-Pynn & Johnson, 2015; Stelmack et al., 2018). As a result, education is seen as critical for increasing awareness and finding solutions to these problems.

One of the most urgent problems in today's world is environmental degradation. Above all other factors, the desire to save our environment has taken primacy (Michael, 2015). As a result, solid waste is posing a threat to natural resources not only in developing nations but also in affluent nations. Indeed, the production of municipal solid waste (MSW) is one of the most important environmental challenges of the modern era (Pattnaik & Reddy, 2017). Domestic solid waste, or garbage produced by households, industrial and commercial solid waste, or building and demolition waste, and marine solid waste, or waste produced by coastal areas and the water, are all types of solid waste (Jin et al., 2016).

However, (SWM) is a massive task that falls primarily on the shoulders of local governments and necessitates organisational competence as well as collaboration between the commercial and public sectors (Michael, 2015). The need to manage this growing solid waste in a way that is environmentally friendly, commercially viable, and

socially acceptable manner is important (Kaufman et al., 2018). Even though environmental management is essential for public health, in most industrialised and emerging cities, particularly in African countries, SWM is inadequate (Michael, 2015). As a result, proper management, collection, and disposal of MSW are critical for maintaining a clean and healthy environment (Pattnaik & Reddy, 2017). Furthermore, as the world's population and urbanisation grow, so does the amount of waste produced annually (Hassan, 2016).

The types and amounts of solid waste produced do not merely accurately reflect the lives and living standards of the local populace. Urbanisation influences the overall rate of solid waste generation in several countries throughout the world. However, there are still problems with the collecting, dumping, and disposal of MSW (Hassan, 2016). Africa's issue with managing solid waste has gotten worse as a result (Hufane, 2015). The main causes of trash generation are population growth, consumerism, wealth, and technology (Kaufman et al., 2018). In Somalia, for instance, a country facing significant poverty, some people perceive waste as a potential source of income. However, wealthier nations recognise the need to address the waste issue to mitigate its consequences. Mere acknowledgment of the waste problem does not deter individuals from littering (Shahmoradi, 2016).

This study was undertaken to ensure teachers and learners are aware of the importance of having a safe and healthy environment around them. This research has the potential to help schools improve their SWM methods while also motivating teachers and learners to become involved. This research is valuable to a variety of stakeholders, including cleaners, learners, teachers, and garbage collectors, in gaining a better knowledge of the benefits of adopting best practices and cost-effective environmental solutions.

Undertaking a study on SWM at schools is crucial for several reasons. Firstly, schools serve as vital hubs of activity, generating substantial amounts of waste daily. By investigating and implementing effective waste management strategies within educational institutions, we can promote sustainable practices and instil environmental awareness among students, who are the future custodians of our planet. Additionally, addressing SWM at schools can have numerous benefits, such as reducing pollution, conserving resources, and creating a clean and healthy learning environment. By examining current waste management practices, identifying areas for improvement, and proposing innovative solutions, this study can contribute to the development of SWM frameworks that can be replicated in schools and educational settings worldwide. Ultimately, this research will foster a culture of environmental responsibility, empower students to become agents of change and contribute to the broader goal of building a greener and more sustainable future.

The research aims to investigate the perceptions of teachers and learners regarding the handling of solid waste at secondary schools in the Umlazi District.

2. Literature Review

2.1 Importance of Solid Waste Management in Schools

Environmental and human health protection, as well as resource conservation, are the goals of sustainable waste management (Kirama & Mayo, 2016). Other goals include avoiding trash-related problems in the future, such as using "clean" cycles and low-maintenance landfills (Brunner, 2013), as well as employing waste management methods that are acceptable to society (Wilson, 2007). One of the most important prerequisites is the availability of low-cost trash management services. To achieve these objectives, decisions must be incorporated into plans that include a variety of interconnected activities including collection, transportation, treatment, recycling, and disposal (Al Sabbagh, 2012). As a result, decision-makers expect cost-effective waste management that considers environmental, economic, technological, regulatory, and other societal considerations (Barton et al., 1996). Because the number of available waste treatment and recycling options is always growing, and because economic boundaries are always shifting, decision-makers are constantly faced with the following questions: Is the current waste management system the most cost-effective method for meeting waste management goals? Is there a better approach (Rogge & De Jaeger, 2012) to integrate more sophisticated operations to provide the same service at a lower cost?

Even though waste management is a crucial area of government service, several published assessment methodologies for waste management systems are fairly complex and sophisticated (Coelho, 2012). An integrated strategy is needed to achieve the challenging objective of ensuring sustainability as a balanced society, economy, and environment. As a result, all the processes involved must be examined when evaluating the multiple effects of waste management systems (Diaz & Warith, 2006). Within such a decision framework, an evaluation approach like the one presented in this study should be viewed as a cornerstone. The technique should be goal-oriented and objective, transparent and intelligible, and should offer an overview of the benefits and drawbacks of various alternatives. Solid waste management has become one of South Africa's most critical issues. Budgetary constraints, system complexity, and multidimensionality, as well as ineffective organisation, are the key difficulties that local municipal authorities encounter in solid waste management (Dlamini et al., 2019).

Local municipalities are the primary organisations in charge of processing solid garbage efficiently and effectively. To achieve recycling targets, local governments often promote a decrease in domestic solid waste production and encourage citizens to take responsibility for their trash rather than relying on municipal waste services (Dlamini,

2017). Despite South Africa's environmental laws and regulations, particularly about MSW management, garbage reduction through recycling and community engagement has received little attention (Dlamini et al., 2019). In South Africa, efficient management of MSW, as well as garbage minimisation, has proven to be a difficult task. This is contingent on environmental laws and regulations being enforced, institutional capacity being appropriate, local governments cooperating and collaborating, and greater community involvement among its members, as well as public awareness (Department of Environmental Affairs, 2012).

Community and school participation in solid waste management has become an important component of solid waste management through recycling in South African cities. Informal garbage pickers, for example, are increasingly important in recycling and solid waste management in Johannesburg (Dlamini, Simatele & Serge, 2019). Such participation of schools and communities benefits both the environment and the economy by fostering environmental sustainability and job creation (Gutberlet, 2010).

Politicians have not done much to include unofficial SWM systems in their plans and strategies, even though school and community participation in recycling promotes socioeconomic growth, environmental sustainability, and SWM in South Africa (Dhokhikah et al., 2015). Due to this circumstance, local administrations in South African cities have disregarded the value of community and school involvement in SWM.

Solid waste recycling employs thousands of people in low-income metropolitan areas, despite efforts by South African authorities to incorporate informal garbage pickers into SWM systems (Dias et al., 2012). In 2016, the Department of Environmental Affairs projected that between 18 000 and 100 000 garbage pickers worked in South African cities (Simatele 2019).

This demonstrates that, in comparison to the amount of solid waste created, schools and community members are capable. Decision-makers in South Africa must recognise community participation to improve SWM efficiency and achieve long-term waste reduction (Scheinberg, 2012).

2.2 Strategies Employed in Solid Waste Management

Worldwide

MSW management is a serious issue everywhere in the world because of the enormous amounts of trash that human living produces. The daily production of waste has been influenced by human development, economic growth, and population growth (Minghua et al., 2009). In 2022, solid waste generation amounted globally to about 2 billion tons a year (Matheson, 2022). The enormous amount of waste produced is a growing issue as a result of the ecological impact connected with improper waste management, which causes rubbish to deteriorate and harmful contaminants to develop (Karak, 2012). Despite the

difficulties both developed and developing nations face when it comes to managing MSW, first-world nations are setting the bar by implementing sustainable SWM policies and regulations (for example, waste-to-energy generation). In first-world countries, monitoring mechanisms have been set up to support MSW goals and encourage them (Nzeadibe, 2009). As a result, depending on the physical properties of the trash generated, enormous amounts of waste are managed in various ways.

The primary cause of this is the variety of physical traits present in the trash produced. For instance, the composition of garbage in developed nations is more likely to include recyclable elements (Chandrappa & Das, 2012). This is because people in wealthy nations favour purchasing goods that are already produced and packaged, whereas those in developing nations depend mostly on subsistence farming with little post-harvest food processing. Developing nations are more likely to import new and used goods and more raw resources, which results in a higher percentage of organic waste (Metin et al., 2003). Various solid waste management methods are used in numerous countries across the world. The most effective methods for disposing of waste include recycling, composting, waste-to-energy technologies, and sanitary landfilling, to name just a few (Guerrero, 2013).

On the other hand, cities without effective solid waste management practices have indiscriminate rubbish dumping; negative attitudes toward safe and secure disposal are escalating the issue (Johari, 2012). There are many reasons why there are so many people who have bad opinions of solid waste management. These include a lack of recycling and garbage disposal facilities, access to facilities for gathering, sorting, and separating trash, as well as a lack of regulations, incentives, and enforcement methods from the government. Residents of many industrialised nations, including Canada, Ireland, the United States of America, Japan, and Australia, often distrust local government officials (O'Connell, 2011). As a result, even countries with better waste management infrastructure and policies struggle with issues including the recycling of non-recyclable objects and a lack of solid waste sorting and recycling (Singh, 2014).

Africa and South Africa

Despite the City of Durban's success in managing MSW in Kwa-Zulu Natal, problems including how to manage an increase in the number of informal garbage pickers remain unaddressed. One of the causes of this issue is a lack of understanding of how to coordinate and incorporate formality and informality into urban development and planning plans. For instance, Chimuka and Ogola (2015) believe that the development of a sustainable MSW management strategy is frequently hampered by a shortage of skilled labour and administrative indifference, corruption, and misuse of municipal resources. Due to population expansion and rural-urban migration, MSW management in Durban has become more challenging (Glasser et al., 2008; Simelane & Mji, 2015). Some of the issues are evident when contrasting the current metropolitan MSW management system

with that of other Sub-Saharan African countries. For SWM in South Africa, it is not enough to just have strong rules and devote effort to researching appropriate technologies and practices. Additionally, it is important to consider other factors, such as how to effectively include waste pickers in the MSW management system. Communities' participation must be considered for these strategies to be successfully implemented (Dias et al., 2012).

An introduction to the issue and background information on informal waste recycling in Sub-Saharan African cities will help put the informal waste recycling system in South Africa into perspective. In this context, it is important to highlight South Africa's extensive and active domestic waste management system, which is primarily supported by the illegal dumping industry (Samson, 2008; Simelane & Mji, 2015). Numerous South African cities have thousands of rubbish pickers that rely on recycling informal waste for a living. These individuals are categorised as poor and disadvantaged urban dwellers (Dias et al., 2012; Gutberlet, 2010; Medina, 2007). For instance, it is estimated that there are between 18 000 and 100 000 waste pickers in South Africa (DEA, 2016).

The most effective municipal garbage management systems are therefore built on informal networks, regardless of where they exist around the world or inside cities, according to statistics from top municipalities in Egypt. They need to be accepted as an effective waste reduction and management technique (Scheinberg et al., 2010). Experts feel that informal garbage recycling might be successfully encouraged in African towns considering the aforementioned (Adams, 2012). They go on to say that recycling in the informal sector has far-reaching consequences for African urban lives and environmental sustainability. Reduced waste sent for disposal, cleaner cities, and environmental protections are some of the benefits stated by academics because of informal waste recycling, which drives entrepreneurship, employment, and revenue.

Climate change, the green economy and natural resource conservation are among the issues that informal waste recycling helps to combat. Recently, several international organisations have made compelling arguments in favour of garbage pickers and their integration into MSW management systems. Based on the foregoing finding, SWM has become a major challenge in Sub-Saharan African cities, failure of institutions, civil wars (Simatele & Etambakonga, 2015), and socioeconomic inequalities are also contributing factors (Serge Kubanza & Simatele, 2015) of SWM. Given the foregoing, it appears that most research on MSW management in the urban context has rarely examined and evaluated the value of including waste pickers in MSW management.

It has been noted that the MSW system is undervalued in urban policy planning and development plans in Sub-Saharan African nations in general and South Africa in particular. As a foundation for enhancing green employment generation and environmental sustainability, waste pickers should be included in urban development and planning strategies. While research in South Africa has concentrated on the legal

framework for waste management (Sentime, 2014), the solid waste collection system (Korfmacher, 1997), and MSW management (Ogola et al., 2011), no one seems to be aware of how to include the various informal structures so that we can have an efficient SWM system.

3. Theoretical Framework

A theoretical framework is required to aid the study in producing accurate and desirable results by serving as a lens through which the investigation is viewed. The waste management theory (WMT) was determined to be the best fit for this research. The WMT provides information about the subject, including conceptual waste assessments, waste activities, and a holistic view of waste management goals. The idea behind WMT is that it will prevent waste from hurting human health and the environment (Lagbas & Habito, 2015). It is founded on the concept that the way we characterise a goal dictate how we should behave to attain it, implying that the definition of sustainable waste management is crucial.

To design the most effective SWM system, the correct theoretical foundation must be established. The solid waste management theory (Popov, 2004) includes the following ideas:

- The purpose of solid waste management is to keep garbage out of people's homes and out of the environment.
- Resource conservation is the primary goal of solid waste management.
- To avoid manufacturing solid waste, we shall manufacture useful goods.
- Solid waste management's goal is to turn waste into non-waste.

Solid Waste Management's practical values are thus: (Popov et al. 2004)

- Providing conceptual answers by discussing waste and concepts.
- Providing a basis for selecting and integrating waste management alternatives, as well as how and when to do so.
- Foreseeing the results of solid waste management measures.
- Assisting legislators in prescribing waste-related activities.

This theory was used to provide an account of an in-depth examination of waste, waste activities, and a holistic perspective of SWM's functions and aims in this study.

4. Method

4.1. Research Design

The structure that informs data collecting and analysis decisions is known as research design (Anderson, 2013). This study used a case study design to elicit perceptions of teachers and learners on SWM in Umlazi. Case studies are methods of inquiry used in many areas, notably assessment, where the researcher conducts an in-depth investigation of the case; often, a programme, event, activity, procedure, and one or more participants (Creswell, 2014). The case for this research is township secondary school. By focusing on schools in a single district rather than being generic, the case study is regarded as an acceptable technique for establishing knowledge of the phenomena under study, that is, SWM. This study used three township secondary schools as case studies. As the researchers interact with numerous people, this technique aims to analyse the phenomenon of interest by gathering different perspectives (Maree, 2008). This method aids the researchers in gaining a better knowledge of the dynamics of SWM in these schools.

4.2. Data Collection Methods

In this study, the researchers want to find out how secondary school teachers and learners feel about including SWM initiatives in their classrooms. Research is not performed in a vacuum, according to the literature; research is viewed through a particular lens (Kivunja & Kuyini, 2017). It is carried out with a certain mindset and created with unique methods and procedures (Henning et al., 2004). One data collection method used in this study is the interview where, at each school, the researchers interviewed one teacher who was teaching Life Sciences. The researchers used a semi-structured interview guide where teachers were asked questions based on SWM in schools. Some of the questions that were asked are which general solid waste do you have more in the school? How do you get rid of solid waste in school? Observation was also used to collect data where the researchers observed one lesson for each school. During observation, the researchers noted how teachers integrated environmental content during the lesson, knowledge of the subject, involvement of learners during the lesson, teaching material, and assignment or activity that was given to the learners at the end of the lesson. Photovoice and focus groups were also used to collect data. During focus groups, we used photovoice as a tool to collect information that was said by learners, and questions were asked based on SWM in their school and how they perceived it.

4.3. Data Analysis and Interpretation

Observation, checklists, and interview guidelines are tools used to obtain qualitative data. Preparing, organising, minimising, condensing, and displaying data obtained during the study is what data analysis entails (Creswell & Poth, 2018). Data from qualitative research can be analysed in a variety of ways. One of the most common types of qualitative research analysis is thematic analysis. Its main goal is to find, analyse and interpret meaning patterns in qualitative data. Thematic analysis is used since it is versatile and easy to use (Clarke et al., 2015). It may be used in a variety of theoretical and epistemological contexts, including interpretivism, which is the paradigm that frames this research. Thematic analysis summarises the major aspects of a dataset and provides a detailed explanation of the data (Braun et al., 2017). To analyse data, thematic analysis in this research employed both inductive and deductive reasoning. Categories of meaning and connections between categories are formed from the facts in inductive 'bottom-up' reasoning (Saunders et al., 2015). The researcher's query and larger theoretical assumptions promote deductive 'top-down' reasoning analysis (Saunders et al., 2015).

4.4. Ethical Consideration

This paper has the approval certificate of the University, College of Education Research Ethics Committee. All ethical-related matters such as informed consent and assent, the anonymity of participants, and trustworthiness were considered during data collection and analysis.

5. Findings

The findings of this research were presented according to the three themes that emerged from the primary data of this study which aim to investigate the perceptions of teachers and learners regarding the handling of solid waste in selected secondary schools in the Umlazi District in the province of KwaZulu Natal in South Africa. The emerging themes were perceptions and role of teachers and learners on solid waste management, waste management challenges, and strategies for solid waste management used in schools.

Theme 1: Perceptions and role of teachers and learners of Solid Waste Management in schools

The state of the capacity for perceiving, feeling, or being cognisant of events, things, or sensory patterns is known as awareness (Oxford Dictionary, 2013). At this level of consciousness, an observer can verify sensory facts without necessarily assuming cognition (Oxford Dictionary, 2013). Any nation's waste management policy should

include education and awareness. This is also demonstrated by the 2010 Integrated Waste Management Strategy (IWMS) of the National Environmental Management Waste Act of South Africa (National Environmental Management: Waste Act 59, 2008). Considering this, one teacher was asked "Glass, metals, plastics, and paper waste can all be sold for money. Do you want to use this process to make money?"

"No, I do not think that selling waste will generate income for my school."

The above assertion showed that teachers were aware of the SWM concept, but he did not agree with the fact that the school could generate money through reusing, recycling, and reducing waste. Desa et al. (2011, p. 643) claim that "environment awareness can be broken down into two categories: perception and behaviour, or the perception of environmental issues and the propensity to act in ways that promote environmental protection". People's subjective knowledge, perceptions, and environmental reality all play a role in how environmental problems are perceived. According to some studies, EE/ESD is crucial to increasing learners' environmental consciousness (Zelezny & Schulz; 2015). Learners should also be educated in a way that will increase their knowledge and increase their awareness of the environment so that they may make wise decisions as adults (Zelezny & Schulz; 2015). Learners in school A were asked, "Do you learn about caring for nature and the environment in your school?"

"No, because we are not taught about taking care of the environment although in Life Science some topics do involve the environment. But we are not taught deeply about the importance of environment and we also feel that learners that are not doing Life Science they are not even aware of the importance of the environment."

They are not aware of the importance of the environment, and they feel that there is a need for their school to enlighten them on the importance of waste management. Strong evidence from global waste management reveals that the human race's attempts to address the current waste management issues depend on its understanding of garbage generation and management, as well as its attitudes toward it. Studies from South Africa show that learners' environmental awareness is not very high (Zelezny & Schulz, 2015). Learners do not appear to have a sufficient fundamental understanding of the environment, according to the limited educational research done by researchers such as Schulze et al. (2015). According to the study by Schulze et al. (2015), which is like this study, the school curriculum should pay more attention to environmental developments like ecology, population growth, pollution, and the depletion of natural resources. Peden (2008) draws attention to a variety of problems with South Africa's current education system. He suggests that a review of the environmental curriculum in schools is necessary to guarantee that learners receive top-notch environmentally sustainable development that will expand their knowledge and awareness in terms of solid waste disposal initiatives. All participants in these investigated schools showed low levels of awareness and knowledge of SWM importance and its impact on the environment.

Theme 2: Waste Management Challenges

Even though South Africa has made great strides in developing a legal framework to support SWM, as can be seen in the section above, much more needs to be done to enforce these laws, improve waste services, and increase resource recovery given that landfilling is still the most popular waste solution (Godfrey, 2019). A few of the challenges the country faces with SWM include planning, financial management, understanding the country's current SWM rules, and providing trash services (DEA, 2016). Financial, institutional, labour, and equipment management are the four primary areas under which these problems fall (Oelofse, 2018). A complicated issue, SWM considers societal, institutional, legal, economic, and technological factors. It is tough and challenging to connect these aspects within a system that functions properly while simultaneously involving all relevant players in South Africa because no perfect methods have been provided to assess the current and future demands of the sector at all governing levels. According to Gutberlet (2018), the baseline data and decision-making tools that would enable municipalities responsible for providing waste services to make well-informed decisions about SWM are lacking. One teacher was asked how they felt about the air, water, and ground pollution in South Africa. She stated:

> *"I think there is a lot of pollution in South Africa; most especially in our townships. They are quite polluted".*

Despite its insufficient management of local governments, which face financial constraints due to expanding populations and rising waste quantities, the national government asserts that providing waste services is a right (Tsheleza, 2019). Rural areas frequently lack adequate waste disposal facilities, so locals resort to illegal dumping and burning, both of which have detrimental environmental effects. Furthermore, these shortcomings have led to unappealing and unhealthy settings. The complex waste flow caused by a surge in middle-class residents and informal settlements, which put strain on local authorities with increased generation, makes waste services difficult to provide even in urban places like the city of Johannesburg (Dlamini et al., 2019). This problem highlights the government's inability to effectively plan and use affordable methods to close the SWM deficit (Simelane-Mnisi & Mji, 2016). Improved governance and planning including all stakeholders, including informal waste pickers, is crucial to addressing these waste services and cost recovery concerns (Godfrey, 2019). One teacher was asked what she thought about illegal dumping and pollution in the school and its surroundings. She responded.

> *"It a shame we are not doing well in the township there is a lot of littering in the suburbs littering is minimal, but I have noticed that people in the suburbs take their waste and litter it around in the township because the is no fine in townships and they fear the fines in their area. In rural areas there is no management of waste at all it depends on each household to burn the waste".*

Some of the strategies that the school could use to minimise challenges that school was facing in terms of lack of support from stakeholders were suggested by another teacher:

> "*Create waste-free campaigns in the school and also invite the municipality team to come in the school and encourage learners about the importance of keeping the environment clean."*

She further stated that there was a need to:

"make sure all staff is educated about staff environment and they are aware of the importance of integrating nature during their lessons with the learners".

The participant also stated that during her free period in the morning sometimes she makes learners that come late to school to pick up the papers around the school premises. She further states that this strategy also helps the school to reduce latecomers.

The researchers are fully agreeing with teachers in this study that educating teachers and learners is the key to eradicate improper solid waste disposal in the schools. Providing education to all school staff members would enhance the school's support for waste minimisation within its premises.

Theme 3: Strategies of Solid Waste Management found in some Schools.

When interviewed about strategies that the schools used to curb improper solid waste disposal, one teacher mentioned that a club for SWM had been started at the school. She claimed that they were able to start a group named "Fighter" that oversaw maintaining the cleanliness of the school. She continued that the existing club was completely operational. Mawela (2018) suggested that SGB members, teachers, and school administrators need to create policies for ESD to be implemented during classroom activities. Teachers also stated that they also made sure to remind learners to use the accessible dustbins every morning during assembly to prevent littering. As a result of the teachers' awareness of the damaging effects that solid waste has on the environment, there has been a positive shift in attitude and behaviour toward littering (Ahmed et al., 2020).

When interviewing teachers, they highlighted that the schools need to purchase more bins and place bins in each class. Bins are essential, as Gayanthika (2019) noted, citing them as the best alternative for waste management. Dustbins, according to Viljoen et al. (2021), not only assisted in reducing solid waste and benefiting the environment, but they also enhanced aesthetics by giving people a convenient place to dispose of their solid trash. This was similar to what teachers mentioned that their technique of recycling plastic had resulted in improvements to school cleanliness.

Teachers added that the open burning of solid garbage was a smart idea because it was one of their solutions for when the municipality did not show up to collect waste. This

was comparable to Nathanson's (2020) claim that open burning of solid trash, despite causing greenhouse gas emissions, is one of the most effective ways to reduce the amount of solid waste. Teachers also stated that a different method of managing solid waste involved digging a hole and dumping solid garbage inside of it.

As researchers we, therefore, believe that if the schools can implement these goals in their strategic plan of reducing waste in the school by recycling, excess waste can be minimized. The school should continue to encourage learners to join the environmental Eco-groups that aim to enhance environmentally friendly society.

6.Discussion and Concluions

Theme 1: Perceptions and role of teachers and learners of Solid Waste Management in schools

This study findings revealed that the teacher's role in waste management in schools is to educate the learners about the importance of waste management and teach learners about the 3Rs, namely, recycling, reuse, and reduction, for learners to get an understanding of waste management. The findings of this study also indicated that the learners' role is to apply what they have been taught by the teacher in school and they can even apply it at home. For example, during the interviews, some teachers stated that most of the time when they were learning topics based on waste disposal, they instructed learners to practice what they had learnt in terms of recycling paper.

In contrast some of the teachers indicated that they played a minimal role in ensuring that learners were exposed to proper SWM ways. The study found that in some schools it was revealed that for their school to manage their solid waste, learners needed to respond to the negative impact posed by littering on the environment. Learners were not aware of the importance of recycling and separating solid waste into separate packages like glass, paper, plastics, and garden waste. Teachers believed that learners need to be taught about the importance of nature. The schools needed to have campaigns about waste management where they would teach learners about the importance of taking care of the environment. There was no campaign now in some schools as one of the teachers thought that learners were not aware of the importance of managing waste since nothing was done by the school. Only the caretakers were responsible for waste removal at the school and keeping the environment clean inside the classroom and around the school premises.

One teacher mentioned that she had implemented a strategy for late-coming learners at the school. However, there was a lack of emphasis on teaching them about the importance of nature and how to ensure their safety. She expressed a desire for the school to provide more education on the significance of the environment and waste management. In her lessons, she incorporated environmental topics, such as species

classification. One activity involved going outside to count the number of species on the school grounds. During this observation, some learners mistakenly plucked leaves from the plants without permission, causing damage. She promptly corrected them, highlighting the importance of not harming nature. The learners at some of the Schools exhibited good practices in waste management, including reducing, reusing, and engaging in fair recycling and proper disposal. The school also established an Eco-Club to educate learners about the 3Rs and organized recycling campaigns as seen in section 5.0. In the past, one of the schools received an Eco flag, indicating support from various stakeholders.

Theme 2: Waste Management Challenges

The study's participants appeared concerned about a lack of resources since they saw this as a hindrance to teaching and learning. The participants also brought up the limitations of the overcrowded classrooms, and the lack of textbooks as the only teaching resources in the classroom appears to be an obstacle to learning on SWM. Teachers believed that if learners are exposed to more outdoor education it might give them a chance to engage with the natural world and understand the importance of SWM in schools.

The municipality's improper disposal of solid and liquid hazardous waste within the township has led to the emergence of new environmental concerns (Simon et al., 2017). One teacher stated that: the municipality *only collects waste in the school once a week and he also stated that he wishes that the municipality could collect waste twice a week".* He further stated that *"Sometimes the municipality transport does not come to collect school waste and the waste is left outside the school gate for days."* This relates to Rasmeni and Madyira (2023) as they described SWM as a process of collecting, transporting, processing, monitoring, and appropriately disposing of solid waste material.

Other challenges that schools are facing it a lack of support from stakeholders' principals, School Governing Bodies, and other school staff are not doing anything to encourage solid waste minimisation in schools. *"Plastic is generated the most in school because tuck-shop sell packets of chips which most learners throw on the bin or around the school premises also selling bottled drinks made of plastics".* Hence, there are several issues with waste disposal in public places, especially schools, including the scattering of food scraps and other abandoned items. As a result, rats may start invading and become carriers of diseases (Sridhar, 2019). These rats increase the spread of disease or otherwise endanger the health of learners, teachers, school administrators, and staff members. It can also contaminate the surrounding area by allowing toxic materials and pathogenic organisms to leak into an open waste dump, endangering the water supply of the area around the school, and generating unpleasant odours. The researcher also asked one of the school caretakers what was happening with the black bags packed outside the school gate. He explained that the municipality did not come for waste collection on that date. This relates to Rasmeni and Madyira (2023) as they described SWM as a process of collecting,

transporting, processing, monitoring, and appropriately disposing of solid waste material. Teachers also maintained that they do not have enough bins in schools; even in their classrooms, they use cardboard boxes for waste. Teachers also stated that the schools never had any campaigns where they talked about the importance of waste management and there was a need to enlighten learners about the environment and how to keep the environment free from waste. Rural areas frequently lack adequate waste disposal facilities, so locals resorted to illegal dumping and burning, both of which have detrimental environmental effects.

However, SWM is very challenging in schools since most teachers are not well-educated about waste management. The researchers believe that in the future the government needs to integrate topics based on SWM into the curriculum or even in the policy documents. One of the challenges experienced by teachers was waste collection from schools due to delays from the municipal waste collector. Teachers are of the view that the Department of Basic Education need to implement some interventions to help the schools solve this problem. Another challenge was that of teachers lacking knowledge of how to integrate SWM into their lessons.

Theme 3: Strategies of Solid Waste Management found in some Schools.

The study found that the teachers used question-and-answer methods during the lesson that were based on the environment. For example, one teacher indicated that teaching learners about ecology and defined ecology as the "interaction between plants, animals, and their environments". However, there was only one strategy that the school used for waste management in school. That strategy was the recycling of papers only. The reason for having one strategy was the lack of knowledge/awareness about SWM in school. However, another teacher revealed that in their classrooms they used cardboard boxes for learners to discard their solid waste. The waste that was generated in classrooms was mixed up in one box. The Life Science teacher also states that she was trying to educate learners about recycling papers. Thus, in this school, they had only one strategy for waste management which is the recycling of paper. Teachers further stated that in their school they had created an Eco-Club. The Eco-Club picked up waste around the school premises. However, in some schools some strategies such as recycling papers and plastics and was using compost made from waste in the garden.

The study found that most of the investigated schools used similar strategies to minimise waste generated in schools. Strategies such as recycling paper and plastics were used in schools. These were similar to the strategies that were found by O'Connell (2011) who stated that there were insufficient recycling and waste disposal facilities, a lack of access to facilities for collecting, sorting, and separating trash, and a lack of government rules, incentives, and enforcement mechanisms. Citizens in most industrialised countries such as Canada, Ireland, the United States of America, Japan, and Australia, had a general distrust of local government officials. As a result, even nations with improved waste

management policies and infrastructure had problems, such as the recycling of non-recyclable items and insufficient solid waste sorting and recycling (Singh et al., 2014). The findings in this study align with Singh et al. (2014) that in most instances, waste collection was an issue most schools faced and that recycling was still an issue in schools due to a lack of awareness of how to do recycling in schools. Different SWM techniques exist in many nations across the world such as composting, recycling, waste-to-energy technologies, and sanitary landfilling are only a few of the best practices for waste disposal (Guerrero, 2013). The findings of this study showed that these schools should adopt these model technologies of SWM.

Teachers also suggested that each classroom must have monitors to check learners on how they disposed of their waste. These monitors also need to be trained in waste management. Large posters should be displayed with warning signs about illegal dumping and actions that would be taken if the rules were broken. The researchers therefore agree with the learners' views that it is important to educate learners about the environment.

This study into the perceptions of teachers and learners regarding solid waste disposal in the Umlazi Districts was a success because the researcher was able to meet its objectives and aim. The conclusions showed that the teaching and learning in most schools did not successfully incorporate SWM. Although there was potential for incorporating proper solid waste disposal, it was clear that both teachers who did so and those who did not face difficulties. The findings demonstrated that, when considering the instructional methodologies that teachers used, their inadequate knowledge of EE had a significant impact on how they incorporated SWM in their lessons. This study showed that for participants to incorporate proper SWM strategies, they need to play a leading role in the schools. The leading roles can be fully supported by the participants being aware, and knowledgeable and practicing proper SWM strategies that would ensure that the school environment and the surroundings are kept environmentally friendly.

7. Limitations

- The study involved three teachers who taught Life Sciences to Grade 10 learners. The study did not consider other subjects and grades in the schooling system.
- The study was a case study; thus, its conclusions cannot be applied to all teachers, but they can provide researchers with an idea of how to approach future research on how to incorporate solid waste in their lessons.

8. Recommendations

Arising from the findings of this study, the following recommendations are proposed:

Waste Generation

It is best to avoid using plastic bags, particularly those used by stores and supermarkets. One illustration is the practice of putting a loaf of bread in two plastic bags at once. It is time to start using recyclable paper bags in place of standard plastic bags. Less waste production may result from the use of natural products like sorghum plastic.

Waste Separation

Schools ought to make the separation of garbage at the source clear. Waste separation at the school level could be accomplished with the use of colored bags or bins. The danger to waste collectors of broken bottles in plastic bags should be made clear to learners, and they should be urged to segregate other waste.

Illegal Dumping of Waste

To make it harder for learners to dispose of waste outdoors, trees should be planted in open areas on the school grounds that can be turned into parks. Those who report the unauthorised disposal of waste in schools need to receive compensation. To ensure that this behaviour does not persist indefinitely, it is important to comprehend and address the causes behind learners' illicit waste disposal.

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