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The development of a sustainable intervention strategy for solid waste management in schools: A critical endeavor in promoting environmental sustainability within educational institutions

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Abstract

This paper aims to propose a sustainable intervention strategy for solid waste management through collaboration in schools. The study was motivated by the observation that schools were being affected by solid waste contamination, yet proper environmental considerations were not integrated into their daily operations. This lack of sustainable solid waste management solutions prompted the use of a qualitative, interpretive, multiple-case research methodology. The research was conducted in three primary schools with 24 participants, including school principals, members of the school governing body, teachers, learners, food handlers, and general workers. In three primary schools that were sampled purposefully. Data was gathered through a diary, and observations, and then analyzed using a typology approach. The results of the study were used to develop a comprehensive plan that can be used to manage waste generation effectively, involving both internal and external stakeholders. It is recommended that the sustainable intervention strategy for solid waste management through partnership be implemented in various circuits or districts, as insights from different settings could help refine the strategy.

Keywords: Developing, Education for Sustainable Development, Partnership, Solid Waste Management

Introduction

The global concern over solid waste management persists, despite opportunities for reform during times of crisis (Rosenberg, 2020; Abdel-Shafy & Mansour, 2018). Efforts to address this issue through waste legislation and public awareness have been met with limited success, as evidenced by the ongoing challenges highlighted by Sikhosana (2022). Although some Asian schools have shown success in waste management initiatives, the sustainability of these strategies remains uncertain (Tangwanichagapong et al., 2017). While South Africa has been a pioneer in waste management in Southern Africa, the country still lags 20-30 years behind developed nations in the waste management life cycle (Oelofse, 2019). President Ramaphosa's remarks in 2019 underscored the pervasive "throwaway generation" mentality, leading to improper waste disposal practices.

The prevalence of such practices points to a crisis in waste management in South Africa, demanding long-term solutions to mitigate its environmental impact and protect human health (United Nations Statistics Division [UNSD], 2017). Research on waste management in South Africa has primarily focused on domestic, industrial, and agricultural waste, neglecting commercial waste, and hindering the development of a comprehensive sustainable intervention strategy for waste management through partnerships (SISS-WMP). Efforts to regulate waste through waste management rules and public awareness have had a limited impact on South African schools (Sikhosana et al., 2020).

The purpose of this study is to discuss the evolution of the SISS-WMP in response to these challenges. Masange (2014) assessed waste management standards in local governments, emphasizing environmental governance's role in municipal waste management. Gumbi (2015) investigated waste reduction and management practices in local governments.

The Nkangala District Municipality (NDM, 2019) implemented an environmental program to prevent, minimize, or mitigate pollution and environmental damage, but these efforts have yet to yield significant results (Sikhosana, 2022). The establishment of the National Waste Management Strategy (NWMS) by the South African government, aimed at waste management regulation and public awareness, has not been fully effective in South African schools (Sikhosana et al., 2020).

In line with the Sustainable Development Goals (SDGs) outlined by the United Nations (UN, 2015), the SISS-WMP was developed to ensure effective solid waste management in schools, aligning with the 2030 Agenda for Sustainable Development. The goal of the SISS-WMP is to minimize the impact of waste on the environment and human health, fostering economic growth and enhancing quality of life (Leblanc, 2020).

The conceptual framework

The underlying framework is fundamentally social constructivist, as it is based on the belief that knowledge is shaped through social interaction. Solid waste encompasses items that lack intrinsic value and are typically discarded. This article aimed to examine the management of solid waste, including paper, glass, plastics, metal, tetra packs, polystyrene, and e-waste within school settings. Given the close relationship between solid waste and its management, my interest in the concept of solid waste management stemmed from observing how primary schools handle such waste.

Rasmeni and Madyira (2019) define solid waste management as the process of collecting, transporting, processing, disposing, and monitoring waste products. Solid waste management seeks to reduce waste through the development of strategies aimed at addressing challenges in waste management through environmental education and Education for Sustainable Development (ESD). Many development programs and studies are often executed with minimal consideration for grassroots needs (Ruthanam, 2021 & Abuiyada, 2018).

However, the concepts of solid waste and waste management have garnered significant attention at the grassroots level, informing the establishment and implementation of the SISS-WMP in three primary schools. Understanding the concept of development can be challenging due to its comprehensive nature, encompassing social, economic, political, and personal advancements (Diale, 2009). Development entails beneficial changes and improvements in social, physical, environmental, and demographic aspects. The concept of solid waste and its management were pivotal in creating the SISS-WMP. According to Fuller (2016), a strategy is a purposeful approach employed to achieve goals and objectives, guided by a vision and direction.

Method

The research utilized a qualitative interpretive multiple case study method to investigate the establishment of solid waste management practices in primary schools. The qualitative approach facilitated an in-depth understanding of the reasons behind the schools' waste management strategies and revealed the factors contributing to the development of the SISS-WMP. Data was gathered through semi-structured interviews, diary entries, and observations, focusing on three primary schools in the Nkangala district of South Africa's Mpumalanga province.

These primary schools were selected due to their distinct approaches to environmental challenges influenced by their geographical location. The establishment of the SISS-WMP was informed by research conducted at these schools. To ensure the robustness of the findings, various data collection methods such as observations, and diary entries were employed. The validity of data from semi-structured interviews and focus groups was corroborated by observations and a diary.

The study involved the observation of 24 stakeholders across three primary schools, including school principals, members of the school governing body (SGB), teachers, learners, food handlers, and general workers. The observations were conducted in their natural settings to confirm the consistency of their habits and behaviors. Additionally, a camera was used to document the solid waste generated during these observations, which contributed to the development of the SISS-WMP.

Data analysis was carried out using a typology technique, organizing the data according to the research objectives. The process involved immersing in the observation and photo data to comprehend the entire dataset before categorization. The data was then analyzed and interpreted as individual cases, using pseudonyms such as "Case 1: Mthombeni Primary School," "Case 2: Mahlangu Primary School," and "Case 3: Ndlovu Primary School" for classification purposes.

Findings

I focused on investigating the solid waste generated in the three primary schools that served as my case studies, categorizing them based on examples of solid waste, methods of solid waste management, and types of solid waste. This research informed the development of the SISS-WMP. Specifically, I examined solid waste such as

paper, cardboard, plastic, metals, tins, glass, and ceramics. The practices and opportunities influencing the SISS-WMP were summarized in Table 1, which covered the creation, disposal, and types of solid waste generated at Case 1: Mthombeni Primary School, Case 2: Mahlangu Primary School, and Case 3: Ndlovu Primary School.

Table 1: Primary schools’ practices and opportunities that shaped the SISS-WMP

| Numbering | Examples of solid waste | Ways in which solid waste was dealt with in three primary schools | Types of solid waste |
|-----------|-------------------------------|---|----------------------|
| 1 | Papers | Open burning | Recyclables |
| 2 | Old books | Storage | Recyclables |
| 3 | Plastics | Open burning | Recyclables |
| 4 | Plastic packaging | Open burning | Recyclables |
| 5 | Boxes | Open burning | Recyclables |
| 6 | Milk containers | Open burning | Recyclables |
| 7 | Surgical and cloth face masks | Open burning | Non-recyclables |
| 8 | Toilet papers/Tissues | Disposed | Non-recyclables |
| 9 | Tins | Collected | Recyclables |
| 10 | Containers of sanitizers | Storage | Recyclables |
| 11 | Food waste | Collected | Recyclables |
| 12 | Glasses (Alcohol bottles) | Disposed | Recyclables |
| 13 | Broken old plastic chairs | Disposed | Recyclables |
| 14 | Cattle horns | Disposed | Non-recyclables |
| 15 | Baby diapers | Disposed | Non-recyclables |
| 16 | Old stainless-steel plates | Disposed | Recyclables |
| 17 | Take away containers | Open burning | Recyclables |

Source: Author

In Figure 1, the management of solid waste generated by three primary schools is depicted. As shown in Table 1, out of the 17 types of solid waste, seven (41%) were handled through open burning, six (35%) were disposed of, two (12%) were retained, and the remaining two (12%) were collected by different community members, as demonstrated in Figure 1.

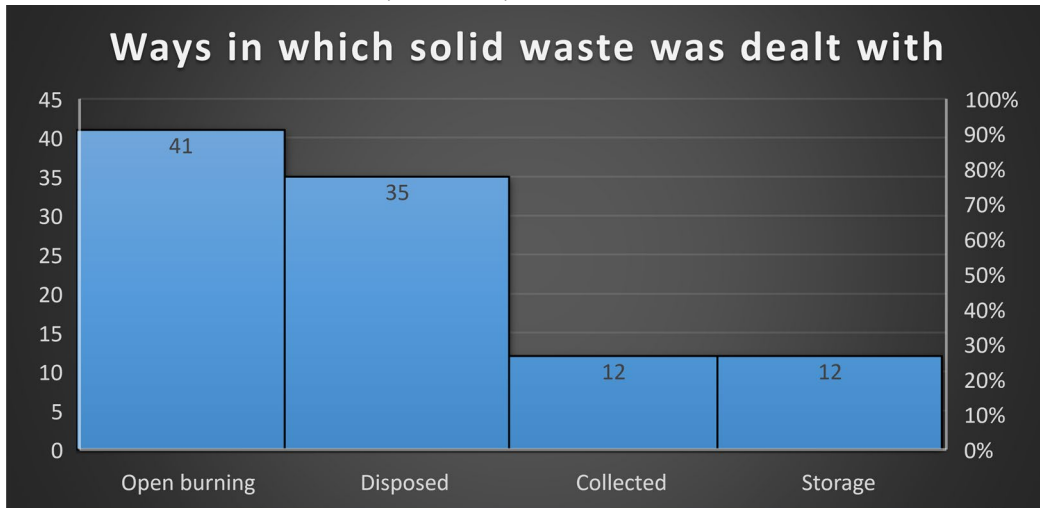


Figure 1: Solid waste management; *Source: Author*

According to Figure 2, the solid waste from three primary schools is divided into a recyclable portion of 76% and a non-recyclable portion of 24%.

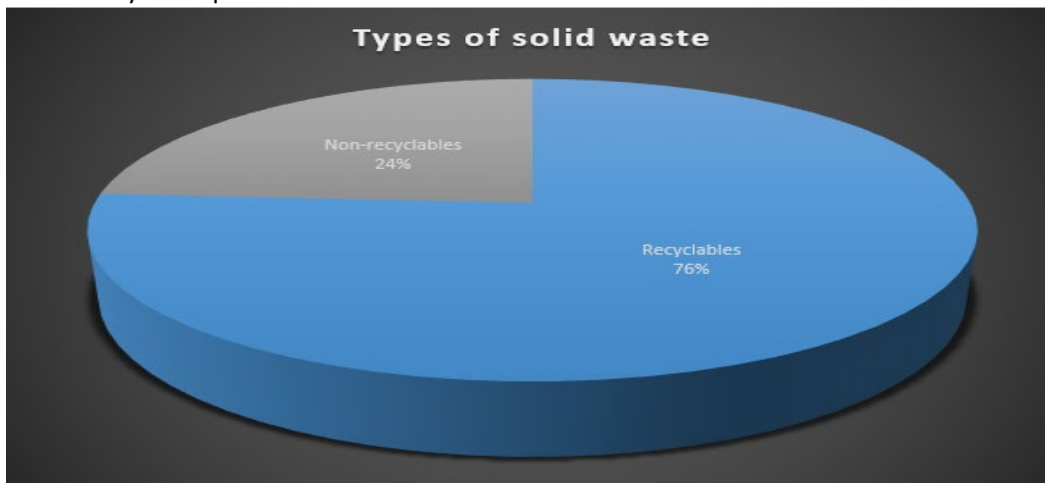
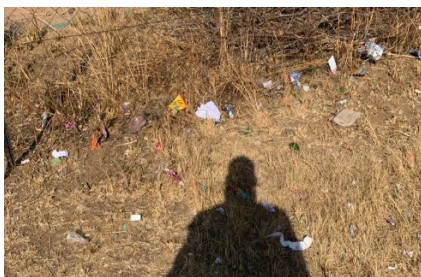


Figure 2: Types of solid waste; *Source: Author*

The pictures below present some examples of solid waste generated in these three primary schools:

Solid Waste generated at Case 1: Mthombeni Primary School



Solid Waste generated at Case 2: Mahlangu Primary School



Solid Waste at generated at Case 3: Ndlovu Primary School



Discussion

The findings presented above guided the development of the Sustainable Integrated Solid Waste Management Plan (SISS-WMP) by highlighting the specific types of solid waste that should be given priority for waste reduction, prevention, and the overall implementation of the SISS-WMP.

The Development of the SISS-WMP

Abdel-Shafy and Mansour (2018) emphasize the global significance of solid waste management with a motive of promoting environmental sustainability (Malatji, Kgarose, Setaise & Makhubela, 2023). The overarching aim of solid waste management is to minimize the adverse impact of waste materials on the environment and human health, thereby fostering economic growth and enhancing the quality of life for individuals (Leblanc, 2020).

It is within this context that the foundation for the development of the SISS-WMP was laid. The primary objective of the SISS-WMP was to ensure the cost-effective and efficient management of solid waste in primary

schools. This entailed maximizing the recycling, reduction, and reutilization (3Rs) of solid waste generated in primary schools while also promoting Education for Sustainable Development (ESD).

It is essential to acknowledge that waste management in South Africa is regulated by the Department of Environment, Forestry, and Fisheries (DEFF), as mandated by Section 24 (Environment) of the Constitution of the Republic of South Africa (Act 108 of 1996). This section outlines the right of every individual to:

- A. An environment that is not harmful to their health or well-being.
- B. Safeguard the environment for present and future generations through appropriate legislation and measures aimed at preventing pollution, promoting conservation, and sustainable development and utilization of natural resources.

In line with this commitment, the DEFF has enacted legislation, policies, programs, and strategies, including the National Environmental Management: Waste Act 59 of 2008 and the 2011 National Waste Management Strategy. However, the implementation of the National Waste Management Strategy has encountered challenges such as:

- A. Inadequate recycling infrastructure.
- B. Legislative and policy frameworks that do not adequately promote waste hierarchy in waste management.
- C. Population growth leads to increased waste generation (DEA, 2012a).

These challenges, along with the commitment to the United Nations' Sustainable Development Goals for 2030, inspired the development of the SISS-WMP.

The SISS-WMP

The SISS-WMP was designed to leverage opportunities within three primary schools, stemming from the existing challenges faced by stakeholders involved in solid waste management. Notably, there was a need to replace metal bins with plastic bins due to corrosion susceptibility, and the introduction of a skip bin for the collection of non-recyclable solid waste for disposal by the local government was essential. Additionally, exploring support from the Expanded Public Works Programme (EPWP) for solid waste management at schools was identified as an option, while proximity to a recycling facility would reduce transportation costs.

Furthermore, the establishment of a solid waste storage facility for recyclable solid waste within the school premises was deemed necessary. It was also crucial to enhance the environmental literacy of internal stakeholders, as their comprehension of environmental issues, solid waste, and its management was found to be lacking. Addressing the perception that solid waste disposal on school grounds was solely the responsibility of general staff also formed a key component of the plan. The involvement of both internal and external stakeholders was critical for the successful implementation of the SISS-WMP, encompassing:

- Representatives for solid waste management
- The division for social development services (SDS) in the local municipality
- Business enterprises
- Internal stakeholders

Functions of each stakeholder as per the SISS-WMP

a. Solid waste management representatives

It is imperative to establish a strong connection with local governments, waste management organizations, and representatives as they play a vital role in fostering the necessary knowledge and skills for individuals to adopt environmentally sustainable practices (Olsen et al., 2020). The stakeholders at the three primary schools showed a lack of understanding regarding environmental issues, which subsequently impacted their solid waste management practices. This is why the SISS-WMP was developed. It aimed to raise awareness and educate various stakeholders in these primary schools on solid waste management through environmental education, which is essential for enhancing public awareness.

Consequently, to bridge the knowledge gap on solid waste management among the public, environmental sustainability education needs to be integrated into schools at all levels (Debrah et al., 2021). In this context, it is crucial to involve representatives of solid waste management at both district and municipal levels. In the implementation of SISS-WMP, schools will be encouraged to invite district and/or local municipality representatives. Based on my observations, these leaders only promoted environmental awareness once a year, on World Environment Day.

This initiative was independent and voluntary, not in response to school invitations. Building a strong connection with these local authorities and waste management representatives can have a positive impact. Consequently, school stakeholders will understand the importance of environmental sustainability in solid waste management before World Environment Day. This proactive approach can result in awareness campaigns, outreach activities, and environmental benefits reaching a wider audience.

b. Division for SDS in the local municipal

The successful collaboration with the local municipality was a pivotal aspect of the SISS-WMP due to the statutory requirement for local governments to provide Sustainable Development Strategies (SDS) to the public. Chapter 7 of the Local Government Section 153 of the 1996 Constitution of the Republic of South Africa delineates the developmental responsibilities of municipalities. This includes the obligation of local governments to organize and administer their operations, budgets, and planning processes to prioritize the basic needs of the community and bolster its socio-economic development. Hence, sustainable growth and the equal distribution of economic activities in society lie within the local municipality (Mashabela & Thusi, 2023).

According to Section 152 of the Constitution of the Republic of South Africa, 1996, the objectives of local governments encompass ensuring democratic and accountable governance, perpetually providing community services, contributing to the social and economic progress of the country, maintaining a healthy and safe environment, and fostering community participation in local government affairs. The intervention by the local municipality involved providing skip bins to schools, enabling the disposal of previously non-recyclable solid waste. Once filled, the skip bins are collected by the local municipality.

This initiative aims to minimize solid waste by effectively managing and removing refuse from the school premises and promoting a zero-tolerance policy on the open burning of solid waste. To ensure the sustainability of the intervention, the local municipality is tasked with the regular collection of skip bins from schools, coupled with ongoing monitoring and maintenance to prevent cross-contamination. Additionally, the South African government has implemented the Expanded Public Works Programme (EPWP) on a national scale, encompassing an environment and culture sector, along with a waste management program supported by municipalities through their waste management units. This represents sustainable human resources for organizational leadership within the local municipality (Mutuleanu, 2023).

Local governments need to deploy EPWP members to schools to execute the environment and culture sector program, aligning with their waste management responsibilities. This deployment is contingent on the workload of general employees. Addressing the issue of solid waste generated by community members surrounding these schools, periodic deployment of EPWP members is expected to contribute to maintaining a clean school environment, mitigating hazards associated with solid waste generation, and fostering sustainable environmental practices.

c. Business enterprises

The utilization of various commercial enterprises' services within the context of the SISS-WMP was driven by the need to establish a sustainable recycling initiative at the primary school level. This involvement was justified by the observation that several environmental initiatives had been implemented in schools by various companies. However, it was found that these programs were not sustainable, as they were often introduced as one-time corporate social responsibility (CSR) endeavors.

For example, in 2018, a beverage company organized nationwide waste management programs in South African schools, yet this initiative only reached 866 schools, 12,000 teachers, and 700,000 students (Manyana, 2019). This illustrates that the National Waste Management Strategy's 2016 objective to ensure the participation of at least 80% of South African schools in waste management programs was not attained (DEA, 2012a). Additionally, the Amalgamated Beverages Industries (ABI) launched a recycling program in schools, but it only engaged 400,000 students from 404 schools across the nation (Independent Online, 2015).

This demonstrates the ongoing challenge of engaging schools in sustainable solid waste management projects. Notably, 76% of the solid waste generated at these three primary schools was found to be recyclable. However, if these schools continue to rely on intermittent initiatives by various companies for solid waste management programs, recyclable waste may continue to accumulate at disposal sites, leading to open burning and subsequent environmental and health implications.

Therefore, integrating the services offered by diverse corporate entities into the SISS-WMP could assist these schools in establishing sustainable waste management programs. This could involve providing recycling bins for the primary schools to facilitate their recycling programs, engaging the same companies for the collection of recyclable materials, and/or arranging for transportation to collect these materials.

Alternatively, if regular collection or transportation is not feasible, acquiring storage containers or materials for constructing a storage facility may prove beneficial, as they would allow for the accumulation of recyclable materials until a sufficient quantity is reached for recycling. Notably, 12% of the solid waste generated by these primary schools was found to be storable. This proportion could potentially increase if these institutions were provided with suitable storage containers. To ensure the long-term functionality of the storage containers, stakeholders would need to conduct regular inspections to uphold their maintenance and usability.

By providing recycling bins, facilitating the collection of recyclable materials, arranging transportation, supplying storage containers, and enabling the construction of storage facilities, schools can actively contribute to the recycling, reduction, and reuse of solid waste. However, this intervention needs to be sustainable, as it has the potential to instigate a shift in stakeholders' attitudes toward solid waste management, motivating them to explore additional strategies for reducing solid waste production in schools, now that they have the necessary resources to do so.

d. Internal stakeholders

It is crucial to form a solid waste management committee consisting of the School Governing Body (SGB), teachers, support staff, food handlers, and students representing the entire school community. This committee should be tasked with meeting the specific waste management needs of the three primary schools. The responsibilities of the solid waste management committee include:

- Crafting a solid waste management policy
- Promoting public awareness of the importance of environmental education
- Implementing solid waste management programs
- Ensuring a waste-free school environment
- Reporting to the school's management (school principal and SGB)

Establishing a solid waste management committee in schools can significantly contribute to the school's overall development. This committee has the potential to enhance stakeholders' environmental knowledge, skills, attitudes, engagement, and values. Additionally, it should foster a sense of shared responsibility and collaboration and development among stakeholders to protect and improve the environment through partnership (Braxton & Damoah, 2024).

Conclusions and recommendations

The SISS-WMP was developed with a focus on the potential presented by primary schools. This potential emerged from the challenges faced by stakeholders in managing solid waste. There is a need to replace metal bins with plastic bins due to corrosion, and a skip bin is necessary for non-recyclable solid waste that the local municipality will collect. Schools may also seek assistance from the EPWP with solid waste disposal and having a nearby recycling facility would reduce transportation expenses. It is crucial to have a dedicated solid waste storage area at the school for recyclable solid waste. Educating internal stakeholders about environmental issues is essential, as their behaviors showed a lack of awareness of environmental problems. It is important to address the perception that solid waste management on school grounds is solely the responsibility of general personnel. The SISS-WMP involves both internal and external stakeholders, including representatives of solid waste management from the district and local municipality, the local municipality's division for solid waste disposal, and various school personnel. It is suggested that the sustainable intervention strategy for solid waste management through partnership (SISS-WMP) be evaluated in multiple circuits or districts to refine the program based on the findings.

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Conflicts of Interest

No possible conflicts of interest exist with regards to the research, authorship, or publishing of this paper. This paper emanates from my doctoral research.

Declaration

The author confirms that the article has not been previously published.

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