UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING SUSTAINABLE SOLID WASTE MANAGEMENT PRACTICES OF STUDENTS IN SELECTED SENIOR HIGH SCHOOLS IN THE NEW JUABENG NORTH MUNICIPALITY

RICHARD YAMOAH

MASTER OF PHILOSOPHY

2025

UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING SUSTAINABLE SOLID WASTE MANAGEMENT PRACTICES OF STUDENTS IN SELECTED SENIOR HIGH SCHOOLS IN THE NEW JUABENG NORTH MUNICIPALITY

RICHARD YAMOAH
(8241180005)

A thesis submitted to the School of Graduate Studies in partial fulfilment of the requirements for the Award of the Degree of Master of Philosophy (Integrated Science Education)

Department of Science Education
Faculty of Science Education

NOVEMBER, 2025

DECLARATION

STUDENT'S DECLARATION

I, **RICHARD YAMOAH**, declare that this thesis, except quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: ……...…..……

Date: ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work were carried out in accordance with the thesis supervision guidelines prescribed by the University of Education, Winneba.

DR. STEPHEN TWUMASI ANNAN (Supervisor)

Signature: ……...…..……

Date: ……

DEDICATION

This work is dedicated to my wife, Doris Dzimesah. It is also dedicated to my parent, Mr. Solomon Yamoah and Ms. Nancy Ayisi.

ACKNOWLEDGEMENTS

First of all, I would express my deepest thanks to the Almighty God who helped me throughout this journey. May His name be praised.

I would also express my heartfelt gratitude to my competent supervisor, Dr. Stephen Twumasi Annan who devoted his time and made this work the best of its kind. May the Lord continually bless him in all his endeavours.

Finally, I would express my warm appreciation to Daniel Morrison for his warm contributions throughout this work.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Solid waste management has become a growing challenge in educational institutions due to increasing waste generation and inadequate disposal practices.This study sought to assess sustainable solid waste management practices in selected senior high schools. The study was conducted at New Juabeng North municipality and employed a descriptive survey design. The study also employed quantitative approach in data collection. The purposive and simple random sampling techniques were employed to select 80 senior high school students in the municipality, specifically, Pope John Senior High and Minor Seminary, Ghana Senior High School (GHANASS), Oyoko Methodist Senior High School, and Seventh Day Adventist (SDA) Senior High School. An observation checklist and questionnaire were the instruments used to gather data on the types of solid wastes generated, students' awareness, attitudes and practices towards sustainable solid waste management. Data were analysed using descriptive statistics. The findings of the study revealed that plastics and paper were the most common wastes generated in the selected schools. It was also revealed that students had high levels of awareness of sustainable solid waste management. The study also showed low level of students' practices towards sustainable solid waste management despite their awareness. It was highlighted that students' attitudes towards sustainable solid waste management were low. Based on the findings, it was recommended that school authorities in the New Juabeng North Municipality should collaborate with the Municipal Assembly to establish proper recycling units within schools to manage the waste streams effectively and prevent frequent accumulation of wastes generated. Moreover, the Ghana Education Service in the New Juabeng North Municipality should integrate more practical waste management activities, posters, and campaigns into the school curriculum and co-curricular programs to strengthen students' awareness of sustainable solid waste management.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter provides information of the background to the study, problem statement, purpose of the research, research objectives, research questions, significance of the study, limitations, delimitations and organization of the study.

1.1 Background to the Study

Waste management is the process through which wastes are collected, transported and processed before any leftover residues are disposed of (Nanda & Berruti, 2021). It covers the procedures and actions needed to manage waste across the entire processes, from generation to disposal. This covers the gathering, moving, treating, and getting rid of garbage, as well as the supervision and control of the waste management procedure and waste-related legislation, technology and economic mechanisms. Similarly, solid waste management is defined as the efficient supervision and managing of solid waste during collection, handling, storage, conveyance, treatment, and disposal in a way that protects the environment and the general public (United States Environmental Protection Agency, 2020). According to United States Environmental Protection Agency (2020), the day-to-day operation of solid waste management concerns requires the use of skills and knowledge from a variety of disciplines, including law, finance, and administration. According to Hajam et al. (2023), maintaining a safe environment is the primary goal of waste management and so the most effective approaches in waste management that reduce waste volume and toxicity are preferred to other methods.

In the context of this study, sustainable solid waste management refers to the adoption of environmentally responsible, socially acceptable, and economically viable practices that minimize waste generation, promote reuse and recycling, and ensure safe disposal without compromising the ability of future generations to meet their environmental needs. It emphasizes long-term waste reduction, efficient resource utilization, and the active participation of stakeholders, particularly students, in maintaining a clean and healthy environment. Improper solid waste management is a local issue with global implications. As the world's population continues to grow, so does the amount of waste being produced. In 2015, the world generated 2 billion metric tons of solid waste. This number is expected to grow to 3.4 billion metric tons by 2050. In low-income countries, the amount of waste is expected to increase by more than three times by 2050 (Valavanidis, 2023). The significance of having an efficient solid waste management system in place grows as trash generation rises. However, managing solid waste effectively is a difficult task for municipal and state governments (Ruocheng & Badolo, 2020). It is believed that at least 2 billion people reside in regions without garbage collection and rely on unregulated dumpsites as a result (Maalouf & Agamuthu, 2023). In many cities in Africa and Ghana especially, insufficient solid waste management systems like lack of dustbins, dumpsites and recyclers pose major threats to the environment, human health, and way of life.

According to Mashudi et al. (2023), careful planning and management are necessary to minimize the impact of waste on the ecosystem. Gupta et al. (2023) added that a suitable organization of solid waste management has thus become a crucial responsibility required to protect the ecosystem. This will be feasible if people are well educated on the proper solid waste management practices and ensured that all these practices are put in action. The availability of an effective solid waste

management system is today just as crucial as other necessities like electricity, airports, and roadways (Anokye et al., 2023). It was noted that as a result of the rising amount of garbage, it is not sustainable to continually dispose of rubbish in landfills (Boateng-Opoku, 2021). Communities in underdeveloped nations frequently turn to awareness, attitude, practices and waste disposal methods (open burning and dumping) as the sole way to handle waste materials and advance excellent hygiene and human health (Kumari & Raghubanshi, 2023). There are other important factors in waste management which include attitudes, practices and awareness because dealing with rising industrial waste is a priority in many developing countries (Kumari & Raghubanshi, 2023). When the attitude, practices and awareness are being considered very well, it will propel the human resource which will also engineer the proper solid waste practices in the environment, especially the industries. The rapid rate of population expansion in most African cities has a negative influence on the burden of handling waste. In most African cities, there are a lot of people who are involved in mismanaging the solid wastes. The difficulties that make waste management in urban areas include inadequate financial support, insufficient financial support, and a lack of acceptable waste management techniques (Joshi et al., 2021). These are some of the factors that hinder the sustainable solid waste management in most countries although some people have negative attitudes towards managing solid waste in the environment.

Effective solid waste management has emerged as an important global concern, particularly in rapidly urban and peri-urban regions. Factors such as population growth, evolving consumption habits, and insufficient infrastructure have significantly complicated waste management efforts and contributed to environmental degradation and health-related issues (United Nations Environment Programme

[UNEP], 2016). These challenges are particularly evident in Ghanaian educational settings, including Senior High Schools, where daily school operations generate considerable amounts of waste. As institutions of learning and development, schools are expected to play an important role in instilling sustainable environmental practices among the youth. However, many of them face significant obstacles such as poor waste segregation, inefficient collection systems, and inadequate disposal mechanisms (Abu et al., 2020).

In the New Juabeng North Municipality in the Eastern Region of Ghana, the situation is further intensified by the rapid urban development and rising population in the area. Senior High Schools in this municipality often lack organized waste management systems, and there is limited awareness and participation among both students and staff in sustainable practices. Additionally, constraints such as insufficient funding, lack of waste sorting infrastructure, and minimal institutional support hinder efforts to establish environmentally responsible waste management systems. These inadequacies do not only endanger the health of school communities but also undermine the quality and appearance of the educational environment (Osei-Mensah & Amoah, 2022).

1.2 Statement of the Problem

Solid waste management remains a persistent environmental and public health challenge globally, particularly in developing countries where rapid urbanisation, population growth, and changing consumption patterns continue to increase the volume and complexity of waste generated. In Ghana, several studies have documented the difficulty of effectively managing solid waste, especially non-biodegradable materials such as plastics, metals, and packaging waste (Mensah, 2022;

Owusu-Ansah et al., 2021). These challenges are often attributed to inadequate waste infrastructure, weak enforcement of sanitation regulations, poor planning of waste management programmes, and low levels of public awareness and environmental responsibility (Nartey & Nyarko, 2020). Consequently, improper waste disposal exposes communities to serious environmental and health risks, including pollution, blocked drainage systems, and the spread of vector-borne diseases.

Within educational institutions, particularly senior high schools, the problem of solid waste management is becoming increasingly evident because schools generate large quantities of waste daily through academic, residential, and feeding activities. Although waste management in schools involves multiple stakeholders including students who generate the waste, teachers and administrators who supervise sanitation practices, and non-teaching staff who handle collection and disposal. Existing studies in Ghana have largely focused on institutional challenges or municipal waste systems, with limited attention given to the behavioural dimensions of waste management among students (Adu-Boahen et al., 2014; Dery, 2017). Yet, students constitute the primary producers of waste within school environments, and their level of awareness, attitudes, and daily practices significantly influence the effectiveness of any school-based waste management system.

In the New Juabeng North Municipality, preliminary observations by the researcher revealed visible signs of poor waste management practices within senior high schools despite the presence of waste bins and designated dumping points. Students were frequently observed littering school compounds, improperly disposing of food containers, and failing to segregate waste. Such behaviours contribute to environmental sanitation problems, including blocked drainage systems, unpleasant

school surroundings, and increased breeding grounds for disease-carrying organisms. For example, discarded beverage tins and plastic containers around dormitory areas often collect stagnant water, creating favourable conditions for mosquito breeding and increasing the risk of malaria among students. These observations suggest that the core challenge may not solely be the absence of waste facilities, but rather behavioural factors such as students' awareness, attitudes, and actual waste management practices.

Furthermore, although effective waste management requires coordinated efforts among all stakeholders, focusing on students is particularly critical because they represent the largest and most consistent group involved in waste generation within the school setting. Understanding their level of awareness, attitudes, and practices is therefore essential for designing targeted educational interventions that can influence sustainable behaviour change and improve overall waste management outcomes in schools (Singh et al., 2025). However, there is a clear paucity of empirical studies that specifically examine these behavioural dimensions of sustainable solid waste management among senior high school students in the New Juabeng North Municipality.

This gap in knowledge creates uncertainty regarding the extent to which students are aware of sustainable waste management principles, how they perceive environmental sanitation responsibilities, and whether their daily practices align with sustainable waste management standards. Without such evidence, it becomes difficult for school authorities and policy makers to design effective educational programmes and practical interventions aimed at improving waste management in schools. It is against this backdrop that the present study sought to assess students' awareness, attitudes,

and practices regarding sustainable solid waste management, as well as the types of waste generated in selected senior high schools in the municipality. This focus provides a clear basis for understanding the behavioural drivers of waste management challenges and supports the development of targeted strategies to promote sustainable environmental practices among students.

1.3 Purpose of the Study

The purpose of the study was to assess sustainable solid waste management practices in selected senior high schools in the New Juabeng North municipality.

1.4 Research Objectives

The objectives of the study were to:

1. Identify the different types of solid waste generated in the selected schools within the New Juabeng North Municipality.
2. Assess students' awareness about sustainable solid waste management in the the selected schools at New Juabeng North Municipality.
3. Determine students' practices towards sustainable solid waste management in the selected schools at New Juabeng North Municipality.
4. determine students' attitudes toward sustainable solid waste management in the selected schools at New Juabeng North Municipality.

1.5 Research Questions

The study was guided by the following questions

1. What are the different types of solid waste generated in the selected schools within the New Juabeng North Municipality?
2. What are students' awareness about sustainable solid waste management in the New Juabeng North Municipality?

3. What are students' practices towards sustainable solid waste management in the New Juabeng North Municipality?
4. What are students' attitudes toward sustainable solid waste management in the New Juabeng North Municipality?

1.6 Significance of the Study

The findings of this study will be valuable in providing empirical evidence on students' awareness, attitudes, and practices regarding sustainable solid waste management in senior high schools within the New Juabeng North Municipality. By identifying the specific behavioural gaps that exist between students' knowledge and their actual waste management practices, the study will help school authorities better understand the underlying factors contributing to poor waste disposal behaviours in the school environment. This will enable them to design targeted interventions aimed at improving sanitation practices and promoting healthier school surroundings for both teaching and non-teaching staff as well as students.

The study will also serve as a useful reference for educational planners and curriculum developers by providing relevant data on the role of environmental education in shaping students' waste management behaviours. In particular, the findings will inform policy and decision-making within the Ghana Education Service and the National Council for Curriculum and Assessment by highlighting the need to strengthen practical and behavioural components of waste management education within the school curriculum and co-curricular programmes.

Furthermore, the study will contribute to academic literature by serving as a baseline reference for future researchers interested in environmental sanitation, school waste management, and sustainable behavioural practices among students. It will also

provide guidance to students and other stakeholders by increasing awareness of the importance of personal responsibility and active participation in sustainable solid waste management within school settings.

1.7 Limitations of the Study

According to Theofanidis and Fountouki (2018), limitations of a study are conditions beyond the researcher's control that may restrict the scope of the findings and their generalisability to other contexts. Such limitations often arise from methodological choices, data collection procedures, validity constraints, and unforeseen challenges encountered during the research process. In this study, one major limitation was the reliance on self-reported data collected through questionnaires. Students might have provided socially desirable responses rather than their actual behaviours and practices regarding solid waste management, which could have introduced response bias and affected the accuracy of the findings. Additionally, since the study focused only on students, it did not include other key stakeholders involved in school waste management, such as teachers, school administrators, and non-teaching staff responsible for waste collection and disposal. The exclusion of these groups limited the study's ability to provide a more comprehensive understanding of institutional waste management practices. Another limitation was related to time and logistical constraints during the data collection period. Some students were frequently absent from school due to academic schedules, personal reasons, or school activities, which affected accessibility and reduced opportunities for follow-up clarification of responses. This situation also limited the researcher's ability to obtain deeper explanations beyond the structured questionnaire responses.

Furthermore, the study employed a descriptive survey design that focused mainly on quantitative data. As a result, the study could not capture detailed qualitative insights into students' motivations, perceptions, and contextual factors influencing their waste management behaviours. The research was also limited to selected senior high schools within a single municipality, which restricts the generalisation of the findings to other districts or educational settings with different environmental and institutional conditions. Despite these limitations, appropriate measures were taken to ensure that the data collected were valid, reliable, and adequate for achieving the objectives of the study.

1.8 Delimitations of the Study

Delimitation is a decision or choice the researcher makes in a research work. They are decisions taken by the researcher which could have been further improved upon (Coker, 2022).

The study was delimited to only few students from the selected senior high schools in the New Juabeng North municipality, specifically, Pope John Senior High School and Minor, Ghana Senior High School, Oyoko Methodist Senior High School and SDA Senior High School. Though, there are other types of wastes but the study was delimited to the use of solid waste. Also, the study was delimited to assessing students' attitudes, awareness and practices towards sustainable solid waste management.

1.9 Organisation of the Study

The study is organised into five chapters. Chapter one provides information on the introduction of the study. It contains the background to the study, statement of the problem, purpose of the study, objectives, research questions, significance of the

study, limitations and delimitations of the study. Chapter two reviews related literature related to the study. Chapter three outlines the research methodology. It contains the research area, the design of the study, research instrument, population, sample and sampling technique, validity and reliability of the instruments, data collection procedure, data analysis and ethical consideration. Chapter four presented the results and interpretations of the research findings. Chapter five presents the summary, conclusions, recommendations of the study and suggestions for further studies.

1.10 Operational Definition of Terms

1. Solid Waste Management (SWM)

It refers to the entire process involved in the handling of solid waste materials generated within a place.

2. Awareness

It refers to the level of knowledge and understanding that students and staff possess regarding proper solid waste management practices and their environmental implications.

3. Attitudes

It refers to the beliefs, feelings, and predispositions of people towards managing waste responsibly within the environment.

4. Practices

It refers to the actual behaviours and actions undertaken by people in the handling, segregation, storage, and disposal of waste.

5. Educational Institutions (Senior High Schools)

They refer to public or private second-cycle schools in an area that serve as the setting for evaluating solid waste management practices.

6. Sustainable Practices

These are the environmentally friendly methods and approaches promoted within places that aim to ensure long-term waste reduction and environmental protection.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This section highlights on the review of literature related to the assessment of sustainable solid waste management practices in New Juabeng North Municipality. It talks about the theoretical framework of the study, concept of waste, solid waste and solid waste management. It also talks about the waste management in Africa, sanitation profile of Ghana, awareness, practices and attitudes towards sustainable solid waste management. The role of stakeholders in promoting sustainable waste management in schools is also reviewed as well as policy and regulatory frameworks for school-based waste management, empirical studies on waste management in schools and the conceptual framework of the study.

2.1 Theoretical Framework

This study was underpinned by the theory of diffusion of innovations, theory of urban ecology, policy-making theory and theory of waste management.

2.1.1 Theory of diffusion of innovations

The theory of Diffusion of Innovations, proposed by Everett Rogers in 1962, provides a valuable framework for understanding how new ideas, behaviours, or practices such as sustainable solid waste management (SSWM) are gradually adopted by individuals and communities. According to this theory, innovations diffuse over time through a social system, influenced by communication channels, the nature of the innovation, and the time it takes for the innovation to be adopted. In the context of SSWM, this theory helps explain how innovative waste management practices are introduced, adopted, and institutionalized across various communities and institutions. A key

feature of Rogers' model is the temporal element, which refers to the gradual acceptance and integration of innovations over a specific period. This temporal process is essential when assessing the adoption of sustainable solid waste management strategies, as it emphasizes that behaviour change and the uptake of new waste disposal methods do not happen instantaneously. It also acknowledges that individuals within a population adopt innovations at different rates ranging from innovators and early adopters to the late majority and laggards, thus creating varying degrees of engagement and success across communities (Rogers, 2003).

Within this theoretical framework, environmental education plays a central role in fostering the diffusion of sustainable waste management practices. Schools serve as powerful agents in this process by equipping students with knowledge, skills, and attitudes necessary for environmental stewardship. Continuous environmental education can nurture awareness, foster positive attitudes, and instill sustainable practices among students (Hnatyuk et al., 2024). Through regular educational programs, students may act as change agents by influencing their families and communities, thereby accelerating the diffusion process. Empirical studies further support the link between awareness and practice in the context of environmental education. Ackerman (2000) examined the role of education in promoting nature protection and found that increased awareness often leads to improved environmental attitudes. Similarly, studies have shown that individuals with higher levels of knowledge about waste management demonstrate more responsible waste disposal behaviors (Ojedokun & Balogun, 2011; Almasi et al., 2019). These findings align with Rogers' framework, which holds that innovations are more likely to be adopted when individuals understand their benefits and applicability.

However, despite the positive correlation between environmental knowledge and behaviour, other theoretical perspectives caution that awareness alone does not guarantee behavioral change. For instance, Kollmuss and Agyeman (2002) noted that environmental knowledge and concern do not always translate into pro-environmental action due to various internal and external barriers. These may include socio-economic constraints, cultural norms, and lack of infrastructure, all of which affect the practical implementation of waste management practices. This brings into focus the influence of economic and financial considerations in adopting sustainable practices. As McMullen et al. (2008) assert, individuals' socio-economic status can significantly impact their motivation to engage in environmentally sustainable actions. People with limited financial resources may prioritize immediate survival needs over long-term environmental concerns. Conversely, those in better financial standing may have the resources and flexibility to invest in sustainable practices such as waste separation, recycling, and composting. Thus, an assessment of SSWM practices must consider the economic conditions of the target population, as these heavily influence the success or failure of innovation diffusion. Assessing sustainable solid waste management in a given area through the lens of the Diffusion of Innovations theory involves examining not only the level of awareness and education but also the socio-economic background, availability of infrastructure, and community engagement. For effective diffusion, interventions must be tailored to meet the needs of various adopter categories, provide adequate support systems, and address financial barriers. Furthermore, a comprehensive education and awareness strategy, integrated with practical community-based projects can serve as a catalyst for behavioural change and enhance the adoption of sustainable waste management practices.

According to this theory, behavioural change occurs gradually as individuals move through stages of awareness, persuasion, decision, implementation, and confirmation. In the context of waste management, environmentally responsible behaviours such as waste segregation, recycling, and proper disposal may initially be adopted by a few individuals before spreading to the larger school population. However, the rate of adoption depends on factors such as perceived benefits, ease of practice, institutional support, and peer influence (Rogers, 2003; Schultz, 2014). These behavioural theories collectively demonstrate that waste disposal practices among students and staff are not determined solely by awareness or knowledge. Instead, they are shaped by a complex interaction of psychological attitudes, social influences, environmental conditions, and institutional structures. Therefore, effective sustainable solid waste management in schools requires behavioural interventions that address attitudes, strengthen social norms, provide adequate infrastructure, and promote consistent reinforcement mechanisms (Steg & Vlek, 2009; Schultz, 2014).

In relation to this study, these theories provide a comprehensive framework for understanding why students and staff in the selected senior high schools may possess high awareness of waste management practices yet exhibit poor disposal behaviours. They also support the need for behaviour-focused interventions such as environmental education, peer influence strategies, enforcement of sanitation rules, and improved waste management facilities to promote sustainable behavioural change.

2.1.2 Theory of urban ecology

The theory of Urban Ecology offers a valuable theoretical framework for understanding the complex relationship between urban environments and human behaviour, particularly in relation to the management of solid waste in growing urban

areas. This theory, originally rooted in the Chicago School of Sociology in the early 20th century, views cities as dynamic ecosystems where individuals, communities, and institutions interact with their built and natural surroundings in structured, patterned ways (Park et al., 1925). From this perspective, urban areas are not merely human settlements but evolving ecological systems influenced by spatial organization, socio-economic activities, technological infrastructure, and environmental policies. As such, Urban Ecology is increasingly relevant in the assessment of sustainable solid waste management (SSWM) practices within urban contexts, as it provides insight into how spatial and social dynamics influence waste generation, disposal behavior, and policy implementation. In the context of sustainable solid waste management, the urban ecological framework considers how population density, land use patterns, infrastructural development, and socio-economic stratification impact the efficiency and sustainability of waste management systems. According to Grimm et al. (2008), cities are both major contributors to environmental degradation and critical arenas for environmental solutions, including waste management reforms. Urban Ecology emphasises that the patterns of waste accumulation and management are not randomly distributed but are often shaped by the ecological "zones" or gradients within a city ranging from central business districts to residential and industrial zones. These patterns influence the type, quantity, and treatment of waste generated, and ultimately the sustainability of waste management practices in the area.

Moreover, the theory of Urban Ecology emphasises the interdependence between human behaviour and urban infrastructure. For instance, the accessibility and distribution of waste collection services often vary across neighbourhoods, with marginalised communities typically receiving inadequate services. This unequal distribution can lead to illegal dumping, open burning, and other unsustainable

practices, particularly in low-income urban neighborhoods (Wilson et al., 2012). An urban ecological approach, therefore, advocates for equitable distribution of environmental services, including access to recycling facilities, education on waste segregation, and consistent waste collection, to promote inclusive and sustainable solid waste management. Urban Ecology also highlights the role of institutions and policies in shaping waste management behavior. As urban centers grow and diversify, waste management systems must evolve to accommodate changing consumption patterns and waste streams. This includes adopting modern technologies such as waste-to-energy systems, composting programs, and digital monitoring tools to manage urban solid waste more effectively (Zaman & Lehmann, 2013). Through an ecological lens, the integration of such technologies must be understood not only in terms of technical feasibility but also in relation to urban social systems, governance structures, and the capacity of local governments to enforce regulations and sustain community engagement.

Environmental justice and public participation are further dimensions of Urban Ecology that are particularly relevant to assessing SSWM practices. Agyepong and Asare (2022) noted that the sustainability of urban waste management systems is deeply tied to the level of community involvement in planning and execution. Residents' active participation in sorting waste, reporting illegal dumping, and monitoring local sanitation efforts enhances transparency and accountability, while also creating a sense of ownership and responsibility. Urban Ecology supports this by emphasizing that the health and functionality of the urban ecosystem rely on the reciprocal relationship between human agents and the urban environment. In addition, the theory draws attention to the feedback loops that occur between urban environmental degradation and social responses. Poor waste management often results

in environmental hazards such as clogged drainage systems, flooding, and disease outbreaks, which in turn prompt social action or policy intervention. According to Bai and Bai (2020), understanding these feedback loops is essential in creating resilient urban waste management systems that can adapt to population growth, urban expansion, and environmental change. This reinforces the need for integrated urban planning that aligns waste management with other ecological functions such as land use, transportation, and housing. Urban Ecology encourages a holistic approach that bridges scientific knowledge, policy, and local community action. Rather than treating waste management as an isolated technical problem, it calls for understanding waste as a social and ecological issue embedded in everyday urban life. This is especially important in developing countries, where informal waste collectors play a significant role in waste recovery and recycling. Incorporating these informal actors into formal waste management structures can enhance efficiency, sustainability, and inclusiveness (Medina, 2008).

2.1.3 Policy making theory

The Policy Making Theory serves as a lens through which the design, implementation, and evaluation of sustainable waste management systems can be understood and assessed. This theory encompasses the processes through which governments and institutions define issues, formulate strategies, and develop rules and regulations to address societal challenges, including those related to environmental sustainability (Anderson, 2011). In the context of solid waste management, policy making involves a multi-stakeholder approach, incorporating political, economic, social, and environmental dimensions to produce guidelines and actions that promote effective waste reduction, recycling, and resource recovery. It is typically viewed as a rational process involving problem identification, policy formulation, adoption,

implementation, and evaluation. In waste management, this process begins with identifying the environmental and public health risks posed by improper waste disposal, followed by designing evidence-based policies aimed at minimizing waste generation and enhancing sustainable practices (Howlett et al., 2020). These policies may include legislative instruments, public awareness campaigns, incentives for waste reduction, and investments in infrastructure such as recycling facilities and composting plants. According to Bardach and Patashnik (2019), policy makers must ensure that strategies are context-sensitive and inclusive, recognizing the specific needs and capacities of local communities.

The assessment of sustainable solid waste management practices thus requires an understanding of how policies are created and how effectively they are implemented. For instance, the existence of a national waste management policy does not necessarily guarantee effective implementation unless local governments have the capacity, resources, and political will to operationalize such policies. In many developing countries, weak institutional frameworks, corruption, and limited public participation hinder the success of even well-designed waste policies (Wilson et al., 2012). Therefore, the theory of policy making helps identify the gaps between policy intentions and outcomes, especially in terms of practical enforcement, resource allocation, and stakeholder engagement. The advocacy coalition framework, a subset of policy making theory developed by Sabatier and Jenkins-Smith (1993), emphasizes the role of various interest groups and coalitions in influencing environmental policy over time. In waste management, these include environmental NGOs, waste management companies, municipal authorities, and community-based organizations. Their interactions, beliefs, and shared values shape policy outcomes and determine whether sustainable practices are adopted. This theoretical perspective is particularly

useful in assessing the sustainability of waste management initiatives because it underscores the significance of long-term learning, negotiation, and policy change driven by collective action and advocacy.

Policy analysis literature also stresses the importance of participatory governance in achieving sustainable solid waste outcomes. Participation by citizens, waste pickers, local businesses, and civil society organizations ensures that policies are more relevant, equitable, and implementable (Morrissey & Browne, 2004). Participatory policy making fosters a sense of ownership among stakeholders and encourages behavior change, which is crucial for the success of waste segregation, recycling, and composting initiatives. When evaluating SSWM practices, researchers must consider the degree of stakeholder involvement in policy design and the mechanisms put in place to facilitate continuous dialogue and feedback. In addition, environmental policy integration (EPI), which is the incorporation of environmental objectives into sectoral policies, plays a pivotal role in promoting SSWM. EPI ensures that waste management is not treated as an isolated issue but is embedded within urban planning, public health, and economic development agendas (Lafferty & Hovden, 2003). This integrated approach helps overcome policy fragmentation and supports the implementation of circular economy principles where waste is seen as a resource rather than a burden. The success of this integration depends on strong inter-agency coordination, political leadership, and institutional commitment, all of which are central to the policy making process. Empirical studies reinforce the significance of sound policy frameworks in enhancing SSWM outcomes. For example, a study by Zurbrugg et al. (2012) in Asia revealed that cities with clear waste management policies and strong institutional frameworks were more successful in reducing landfill dependency and improving recycling rates. Similarly, Adu-Boahen et al. (2014)

reported that the enforcement of waste segregation policies in Ghanaian municipalities led to better waste-handling practices and reduced environmental hazards. These findings highlight the importance of consistent policy enforcement, monitoring, and evaluation mechanisms in achieving sustainable results.

2.1.4 Theory of waste management

The Theory of Waste Management serves as a foundational framework for understanding how societies generate, handle, and dispose of waste, particularly in the pursuit of sustainable practices. In the context of assessing sustainable solid waste management (SSWM) practices in an area, the theory provides a structured perspective on the processes, responsibilities, and behaviors surrounding waste generation and treatment. It integrates the technical, social, economic, and environmental dimensions of waste handling and supports the development of policies and systems aimed at minimizing the negative impact of waste on human health and the environment (Wilson et al., 2019).

The theory promotes the concept of a waste hierarchy, which prioritizes waste management practices in the following order: prevention, minimization, reuse, recycling, energy recovery, and disposal. This hierarchy aims to reduce the volume of waste sent to landfills by promoting more sustainable alternatives. When assessing SSWM in a specific area, this hierarchy serves as a benchmark to evaluate the extent to which local practices align with global sustainability standards. Communities that rely heavily on landfilling and open dumping, for instance, may be considered less sustainable compared to those that embrace source segregation, composting, or material recovery facilities (United Nations Environment Programme, 2021).

The theory also recognises the importance of stakeholder involvement in waste management processes. Sustainable waste management is not solely a governmental responsibility; it requires the active participation of households, industries, waste collectors, non-governmental organizations, and educational institutions (Moqsud et al., 2020). Each stakeholder has a distinct role in promoting efficient waste segregation, safe disposal, and recycling. The level of public awareness and engagement significantly influences the effectiveness of SSWM practices. For instance, when residents are knowledgeable about the importance of separating biodegradable from non-biodegradable waste, the success of community recycling programs improves significantly (Guerrero & Maas, 2019).

Moreover, the Theory of Waste Management considers the socio-economic and cultural contexts of waste handling. These contexts shape people's attitudes and behaviors towards waste, influencing how they dispose of it and whether they are willing to adopt sustainable practices. Research has shown that higher income levels and education are positively associated with better waste management behaviors, such as household recycling and the proper use of waste bins (Nabegu & Mustapha, 2020). Conversely, in low-income settings, inadequate infrastructure and financial constraints hinder the implementation of sustainable systems, making informal waste disposal more prevalent.

Another aspect of this theory is the integration of the 3Rs—Reduce, Reuse, and Recycle—into policy and practice. These principles form the backbone of SSWM and are widely promoted by environmental agencies and governments. In many urban areas, for example, initiatives such as community composting, zero-waste campaigns, and plastic bag bans have emerged from this theoretical orientation (Hoornweg et al.,

2020). When evaluating an area's waste management system, the extent to which the 3Rs are incorporated can provide insight into the sustainability of its practices.

Technological innovation and institutional support also play a critical role within this theory. The development of waste-to-energy plants, composting technologies, and digital platforms for waste tracking enhances the efficiency and sustainability of waste management systems. Institutional frameworks, including waste policies, regulations, and enforcement mechanisms, provide the governance structure needed to support these innovations. According to Zurbrugg et al. (2019), effective SSWM depends not only on technology but also on the strength of policy implementation and coordination among different sectors.

Environmental justice is another dimension addressed in the theory, emphasizing that waste management should be equitable and should not disproportionately affect marginalized communities. In some developing regions, waste dumps are often located near low-income neighborhoods, exposing residents to health hazards and environmental degradation. Assessing sustainability, therefore, involves evaluating the fairness and inclusivity of waste management systems. This includes ensuring that waste pickers and informal sector workers are integrated into formal systems and granted access to social protection and fair wages (Schübeler & Wehrle, 2018).

Furthermore, the theory aligns closely with global sustainability goals, particularly Sustainable Development Goal (SDG) 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). These goals advocate for efficient waste management as a pathway to achieving cleaner, safer, and more resilient urban environments. As noted by Kaza et al. (2018), cities that have adopted

comprehensive and inclusive waste management policies tend to demonstrate greater progress in reducing environmental pollution and enhancing public health outcomes.

2.2 Concept of Waste

Any product or material that is no longer considered useful by its producer or user is generally classified as waste (Ogunbiyi et al., 2021). Wastes can be described as materials that people seek to dispose of, even if they must incur a cost to do so (Zhou et al., 2020). While waste is an inevitable byproduct of human activity, it often arises due to inefficient production systems, which lead to the constant generation of unusable outputs and the depletion of valuable resources (Adeyemi & Oloruntoba, 2023). Interestingly, what is considered waste by one person might be a valuable resource to another. Hence, waste is often contextually and subjectively defined, depending on the intention of the disposer (Mensah et al., 2021). Despite this subjectivity, clearly defining what constitutes waste is crucial because such classification determines the environmental and public health protocols that must be observed during handling, processing, or disposal (EPA Ghana, 2022). Virtually, every human activity results in the production of some form of waste (Ali et al., 2020). Historically, the management of waste has been a persistent concern for societies (Kaza et al., 2018). In recent decades, both the volume and rate of waste generation have significantly escalated. Furthermore, the complexity and diversity of waste materials have grown in tandem with population and industrial growth (Yousuf & Rahman, 2022). Unlike in ancient times when waste was merely an inconvenience and easily assimilated by the environment due to the small population size and abundance of open land, modern societies are confronted with serious waste management challenges (Obeng et al., 2020).

The industrial revolution marked a turning point, as it triggered a massive rural-to-urban migration, resulting in exponential population growth and a corresponding surge in waste generation (Appiah et al., 2022). This urban boom led to greater waste diversity, especially with the introduction of non-biodegradable materials such as metals, plastics, and glass into the municipal waste stream (Akintunde et al., 2021). Urban areas, especially those with dense populations, began to experience the proliferation of open dumping and indiscriminate waste disposal, which created breeding grounds for pests and vermin and posed severe risks to public health. Historical records indicate that poor sanitation and unregulated waste management were linked to numerous outbreaks of diseases with devastating consequences (Asante & Agyemang, 2019). In response to these crises, authorities in the 18th century began to implement more structured and controlled waste disposal methods to safeguard public health (Osei-Wusu et al., 2021). Developed nations gradually underwent environmental reforms and have largely mitigated the health and ecological risks associated with poor waste management. However, similar issues have resurfaced in many developing nations where rapid urbanization, weak infrastructure, and inadequate policy implementation are leading to a recurrence of waste-related challenges that developed countries had previously overcome (UN-Habitat, 2023). These recurring issues underscore the urgent need for sustainable waste management strategies that are tailored to the socio-economic and environmental realities of each region.

2.3 Solid Waste

Solid waste, commonly referred to as refuse or garbage, includes a wide range of materials that are discarded after use and are no longer considered valuable by the user (Hannan et al., 2015). These wastes may be generated from residential,

commercial, industrial, or institutional sources, with senior high schools forming a significant portion of the institutional category. Solid waste in the school environment reflects the variety of daily human activities carried out within educational settings, such as eating, learning, maintenance, sanitation, and administrative tasks (Boateng et al., 2022). As education institutions grow in student population and facilities, the volume and complexity of solid waste generated also increases. In the context of senior high schools, the types of solid waste generated are diverse, ranging from biodegradable organic waste to non-biodegradable items. Organic waste in schools typically includes leftover food, fruit peels, vegetable scraps, and other forms of kitchen waste produced from school canteens or food vendors (Anku et al., 2021). These wastes are often produced in large quantities, especially in boarding schools where meals are prepared and served regularly. Food waste constitutes a considerable portion of school solid waste, leading to environmental concerns when not properly separated and treated.

Another category of solid waste found in schools is paper waste. This includes used notebooks, examination papers, textbooks, administrative documents, packaging materials, and other forms of paper-based products. The educational process heavily relies on printed materials, contributing significantly to paper waste generation (Nkansah & Boakye, 2020). Despite the increased use of digital technologies in teaching and learning, paper remains a core instructional material in most schools in developing countries. This trend has been confirmed in studies indicating that paper waste can make up to 30-40% of the total waste stream in schools (Mensah & Danquah, 2023). Plastic waste is also highly prevalent in school environments. Students and staff commonly use plastic bags, water sachets, beverage bottles, food wrappers, and other packaging materials which are often discarded indiscriminately.

These materials are non-biodegradable and pose a long-term threat to the environment. In a study conducted across selected public schools in Nigeria, plastic constituted over 35% of the waste generated by students (Uche & Okonkwo, 2022). The increasing dependency on packaged foods and bottled water in senior high schools contributes significantly to the rise in plastic waste. Furthermore, e-waste is an emerging category of solid waste in senior high schools, resulting from the growing use of electronic devices for administrative, instructional, and recreational purposes. E-waste includes broken or obsolete electronic gadgets such as calculators, projectors, printers, computer components, and mobile phones (Amankwah et al., 2021). These materials, though less frequently generated compared to paper and plastic, require careful handling and disposal due to the hazardous substances they contain. Improper disposal of e-waste can result in environmental contamination and health issues for school occupants.

Metal and glass waste are also present in schools, though in relatively smaller quantities. Metal waste arises from damaged furniture, cans, and electrical fittings, while glass waste includes broken windows, laboratory apparatus, and beverage containers. These waste types, though less frequent, pose a risk of injury and require special attention in waste handling procedures (Tagoe & Essel, 2023). Laboratory-based schools are particularly prone to generating glass and chemical-related solid waste due to the nature of science practical lessons. Textile waste is another form of solid waste that has been identified in schools, particularly in settings where uniforms, dormitory bedding, curtains, and sportswear are used. Worn-out clothing, torn mattresses, and discarded fabrics from school sewing activities constitute textile waste (Owusu-Agyemang & Yeboah, 2021). Though generated less frequently, these wastes occupy large volumes of space and are often difficult to manage due to their

bulkiness. Sanitary waste including used sanitary pads, tissues, and diapers from staff children are increasingly being generated in co-educational and boarding schools. These materials, when not well-managed, pose significant health risks and cause discomfort, especially in female dormitories and washrooms. The increase in female enrolment in senior high schools has led to a corresponding rise in sanitary waste (Darko et al., 2022). Their management is often overlooked due to cultural taboos and lack of adequate facilities for safe disposal.

2.4 Solid Waste Management

Solid waste management (SWM) encompasses the systematic control of the generation, storage, collection, transport, processing, and disposal of solid waste materials (Gupta et al., 2023). Effective SWM is important for maintaining public health, environmental integrity, and aesthetic values, especially within educational institutions such as senior high schools. The increasing student populations and diverse activities in these schools contribute to significant waste generation, necessitating comprehensive management strategies. Studies focusing on senior high schools in Ghana have revealed that the predominant types of waste generated include organic materials, plastics, paper, and metals. For instance, research conducted in the Ashanti Region identified that organic waste constituted approximately 70.91% of the total waste, followed by plastics at 11.24%, metals at 5.64%, textiles at 4.67%, and paper at 2.13% (Kuffuor, 2020). This composition emphasises the necessity for targeted waste management practices that address the specific waste streams prevalent in these educational settings.

The rate of waste generation in senior high schools varies, with per capita daily generation rates ranging from 0.02 to 0.13 kg, averaging around 0.056 kg per student

per day (Safo-Adu et al., 2023). Factors influencing these rates include the school's population size, the presence of boarding facilities, and the consumption patterns of students. Notably, schools with larger student populations tend to have lower per capita waste generation rates, possibly due to economies of scale in resource utilization and waste production. Despite the implementation of waste management systems in some schools, challenges persist. A comparative analysis between urban and rural senior high schools in the Ashanti Region revealed that while both had waste management practices in place, they faced distinct challenges. Urban schools struggled with inadequate waste collection routines, whereas rural schools contended with poor student attitudes toward waste management (Boateng et al., 2023). A common issue across both settings was the lack of sufficient resources for effective waste management.

The implications of inadequate SWM in schools are profound, affecting environmental quality and public health. In the Wa Municipality, poor waste disposal practices have been linked to unsanitary conditions, leading to disease outbreaks such as cholera and other diarrheal diseases (Ampofo, 2020). The absence of proper waste segregation, insufficient disposal facilities, and irregular waste collection exacerbate these issues, highlighting the need for comprehensive waste management strategies. Several recommendations have been proposed to address these challenges. Encouraging composting of organic waste can significantly reduce the volume of waste requiring disposal and provide a valuable resource for agricultural activities. Implementing source separation by providing designated bins for different waste types can facilitate recycling and reduce environmental pollution (Anokye & Mohammed, 2024). Additionally, integrating environmental sanitation education into school curricula and forming environmental clubs can enhance students' awareness

and participation in sustainable waste management practices. The role of external stakeholders, including municipal assemblies and waste management companies, is important for regular waste collection services, the provision of adequate waste disposal facilities, and the monitoring of waste management practices. This support can help schools maintain clean and healthy environments (Adongo et al., 2015). Collaborations between schools and these entities can lead to more efficient and sustainable waste management systems.

2.5 Waste Management in Africa

The increasing volumes of solid waste generated in African cities are outpacing the capacity of municipalities to manage it effectively. According to Kaza et al. (2018), the world generated about 2 billion metric tons of solid waste in 2016, and Africa contributed significantly to this volume, with the figure expected to rise dramatically by 2050 due to rapid demographic changes and urban expansion. This projected rise places substantial pressure on African governments to develop sustainable waste management systems that are effective, inclusive, and environmentally sound. In many African countries, municipal solid waste management systems are often characterized by inefficiencies, inadequate funding, limited infrastructure, and weak policy enforcement. As noted by Nzeadibe and Anyadiegwu (2020), poor institutional frameworks and a lack of political will often lead to fragmented and uncoordinated waste management strategies. Most cities rely heavily on open dumping, with only a small percentage of waste being recycled or properly treated. For instance, in Accra, Ghana, less than 20% of solid waste is effectively collected and disposed of, while the remainder is left to accumulate in streets and drains, posing serious public health and environmental risks (Yoada et al., 2014; Oteng-Ababio, 2019).

The situation is further compounded by limited public awareness and participation in sustainable waste practices. In Nigeria, a study by Ojewale and Olayiwola (2021) found that the lack of education on proper waste disposal significantly contributes to indiscriminate dumping and burning of refuse. Similar findings were reported by Mngomezulu and Mkhize (2023), who identified public apathy and low engagement as key barriers to effective waste management in urban areas of South Africa. However, some African countries have taken significant steps towards improving waste management systems through the integration of community-based approaches, public-private partnerships, and policy reforms aimed at promoting the circular economy. The role of informal waste collectors is significant in many African cities, where formal waste management systems are either underdeveloped or non-existent. According to Wilson et al. (2019), the informal sector often fills the gap left by formal institutions by engaging in waste collection, sorting, and recycling. This sector, however, remains largely unrecognized by policymakers, and workers frequently operate under unsafe and unsanitary conditions. Research by Boateng et al. (2022) emphasized the importance of integrating informal waste collectors into the mainstream waste management framework, arguing that this approach can increase collection efficiency, promote recycling, and improve the livelihoods of vulnerable populations.

Urban governance and regulatory frameworks also play a part in determining the effectiveness of waste management strategies. Many local governments across the continent lack the autonomy or resources to implement comprehensive waste management plans. Agyepong and Osei (2020) argue that decentralisation policies in Ghana have not adequately empowered municipal assemblies to manage waste effectively. Moreover, corruption and poor accountability further impede the

successful implementation of waste management projects. These governance issues are echoed in other parts of Africa, such as Kenya and Uganda, where waste policies exist but are rarely enforced due to institutional weaknesses and lack of coordination among agencies (Moghadam & Diabat, 2021). Technological advancement and innovation present potential avenues for improving waste management in Africa. Mobile technology, for example, has been used to enhance waste collection and monitoring services. In Rwanda, an innovative initiative has enabled households to schedule waste pickups through SMS, thereby improving efficiency and reducing illegal dumping (Nshimiyimana & Uwimana, 2022). Similarly, in Nigeria, tech-based startups are using digital platforms to connect waste producers with recyclers, fostering a market-driven approach to recycling (Adeyemi et al., 2023). While such innovations are promising, they require sustained investment and capacity building to be scaled up and adopted widely across different contexts.

Financial constraints remain one of the most pressing issues affecting waste management in Africa (Akpan & Olukanni, 2020). Many municipalities operate on limited budgets that are insufficient to cover the high costs of waste collection, transportation, and disposal. A report by the African Development Bank (2020) highlighted that waste management often receives low prioritization in municipal budgeting processes, which leads to poor service delivery. Donor funding and international partnerships have somewhat alleviated this burden, but reliance on external support is not sustainable in the long run. Instead, developing local revenue generation mechanisms, such as user fees and waste tariffs, could help bridge the financing gap, although this requires careful design to ensure affordability and equity (Tawiah et al., 2022). Education and awareness campaigns are essential components of sustainable waste management. Community involvement and behavioral change

are crucial for the success of any waste management program. Studies conducted in Tanzania by Mrema and Mwakalukwa (2021) show that when communities are engaged and educated on the environmental and health implications of poor waste disposal, their willingness to participate in recycling and segregation increases significantly. Schools and local organizations play a vital role in these efforts, as they are well-positioned to reach young people and influence long-term behavioral patterns. However, such programs must be consistent, culturally sensitive, and supported by enabling infrastructure.

Environmental impacts of poor waste management in Africa are widespread and severe. Unregulated landfills and open dumpsites are a common sight in many African cities, releasing harmful gases and leachates into the environment (Anokye et al., 2024). These sites are often located near residential areas, thereby exposing inhabitants to a host of health risks, including respiratory diseases, skin infections, and waterborne illnesses (Mensah et al., 2023). The impact on aquatic ecosystems is also significant, as improperly disposed plastic and chemical waste often find their way into rivers and oceans, contributing to marine pollution and threatening biodiversity (Obeng et al., 2021). Climate change considerations are increasingly being integrated into waste management policies, recognizing the role of waste in greenhouse gas emissions (Sridhar & Hammed, 2017). Organic waste, which constitutes a significant proportion of municipal waste in Africa, produces methane, a potent greenhouse gas, when it decomposes anaerobically in landfills. Therefore, strategies such as composting, anaerobic digestion, and energy recovery are being promoted as more sustainable alternatives (Gumbo & Mkhize, 2023). These strategies not only mitigate environmental harm but also create opportunities for job creation and energy production.

The private sector and non-governmental organizations (NGOs) are increasingly active in waste management efforts across Africa (Palczynski & Scotia, 2002). Many NGOs work in partnership with local communities to promote recycling, provide waste bins, and organize clean-up campaigns. The private sector, meanwhile, has shown interest in waste-to-energy technologies, plastic recycling, and circular economy initiatives. However, such efforts require greater policy support and integration into national waste strategies to ensure scalability and sustainability (Asante et al., 2023). Research has shown that integrated waste management approaches, which combine prevention, minimization, recycling, and responsible disposal, are more effective than singular strategies (Bernache-Pérez et al., 2023; Oyebode, 2024; Wilson et al., 2013). This integrated model is being piloted in cities such as Addis Ababa, Dar es Salaam, and Accra with varying levels of success (UN-Habitat, 2022). The success of these initiatives hinges on strong institutional frameworks, adequate financing, community participation, and the availability of skilled personnel. Training and capacity building at all levels, from policymakers to waste handlers, are thus indispensable for achieving sustainable waste management outcomes.

2.6 Sanitation Profile of Ghana

Ghana has made notable strides in improving access to basic sanitation services over the past decades (Appiah-Effah et al., 2015). The establishment of the Ministry of Sanitation and Water Resources in 2017 signaled a renewed commitment to addressing sanitation issues. According to the Ministry of Information (2023), this initiative aimed to prioritise the sector and ensure the delivery of sustainable water and sanitation services towards achieving Sustainable Development Goal (SDG) 6 by 2030. Investments have led to an increase in the population with access to basic

drinking water services from 79% in 2017/2018 to 87.7% in 2021, while access to exclusive household toilet facilities rose from 21% to 25.3% during the same period. However, a significant portion of the population still lacks access to improved sanitation facilities. The Ghana Statistical Service (2022) reported that only 24% of Ghanaians have access to basic sanitary services, with 57% relying on shared or public facilities and 18% practicing open defecation. The situation is more dire in rural areas, where open defecation rates reach 39%, compared to 12% in urban settings (Onyemaechi et al., 2022). These figures underscore the persistent disparities in sanitation access between urban and rural communities.

The prevalence of open defecation poses significant health risks, contributing to the spread of diseases such as cholera and diarrhea (Ekhoragbon, 2024). Efforts to combat this practice have included the introduction of the National Sanitation Day in 2014, a monthly clean-up exercise aimed at promoting community participation in sanitation activities (Abalo et al., 2017). However, the effectiveness of such initiatives has been limited by factors such as inadequate enforcement and insufficient public engagement. Infrastructure deficits further intensify sanitation challenges. A review by Water (2023) highlighted that Ghana's municipal sewer systems and wastewater treatment facilities are either broken down or severely inadequate relative to the population's needs. For instance, in Kumasi, a city with over two million residents, only around 300 households are connected to wastewater treatment plants. This lack of infrastructure contributes to the improper disposal of waste and environmental pollution. Socio-cultural factors also play a role in sanitation outcomes. Studies have shown that perceptions and beliefs about sanitation influence behavior. In some communities, cultural beliefs consider excreta as harmless or view latrines as evil places, leading to the acceptance of open defecation as a norm (Nimoh et al., 2014;

Appiah-Effah et al., 2015). Addressing these deep-seated beliefs requires culturally sensitive interventions and sustained community engagement.

UNICEF Ghana (2023) emphasises that behavior change initiatives are important for improving sanitation practices. However, the lack of effective national monitoring and evaluation systems hampers the assessment of progress and the identification of areas needing attention. Moreover, the absence of a clear urban basic sanitation strategy and plan leads to uncoordinated and ineffective approaches in urban settings. Financial constraints further limit the expansion and maintenance of sanitation infrastructure (Scott et al., 2017). The United Nations in Ghana (2023) noted that current public sector investment in Water, Sanitation, and Hygiene (WASH) is estimated at around $100 million per year, which is only a fraction of what is needed to achieve SDG 6 targets by 2030. This funding gap necessitates increased public finance and private sector investment to scale up sanitation services. Innovative solutions have emerged to address specific sanitation challenges. For example, initiatives like the distribution of menstrual cups to female athletes in the Ghana Women's Premier League aim to tackle period poverty, which affects participation in sports and education. Such grassroots efforts demonstrate the potential of targeted interventions in improving sanitation outcomes.

Policy frameworks are essential for guiding sanitation efforts. The development of a National Open Defecation Free Action Plan and a Safely Managed Sanitation Strategy, supported by the United Nations under the leadership of UNICEF, represents a step towards structured and comprehensive sanitation planning (UN Ghana, 2023). These strategies aim to model interventions in selected districts before scaling up nationwide. Challenges still exist in achieving universal access to improved

sanitation. The complexity of sanitation issues in Ghana requires a multifaceted approach that combines infrastructure development, behavior change communication, policy enforcement, and adequate financing (Norström et al., 2009). Collaboration among government agencies, non-governmental organisations, communities, and the private sector is crucial for sustainable progress.

2.7 Awareness of Sustainable Solid Waste Management

Awareness encompasses the understanding, attitudes, and behaviors related to waste generation, segregation, recycling, and disposal in an environmentally responsible manner (Iyer, 2018). Several studies have highlighted the pivotal role of awareness in promoting sustainable solid waste management (SWM) practices. In a study conducted in Kawangware, Nairobi County, Morara et al. (2023) found that mass media campaigns significantly influenced public awareness of proper solid waste management. The study revealed that strategic communication through various media channels effectively educated residents about waste management practices, leading to improved behaviors. Similarly, in Dodoma City, Tanzania, research by Mwakitalima et al. (2020) indicated that a majority of market vendors lacked awareness of sustainable SWM measures, underscoring the need for targeted educational interventions. Educational institutions play an important role in fostering awareness among students, who are instrumental in shaping future environmental practices. Aforo (2020) investigated the awareness levels of basic school pupils in Dormaa Municipality, Ghana, and found that early exposure to waste management education through class discussions significantly enhanced students' understanding of proper waste practices. However, the study also noted that while awareness levels were high, translating this knowledge into consistent practice remained a challenge.

The gap between awareness and actual practice is a recurring theme in SWM literature. A study by Jerath (2021) examining students' attitudes towards municipal solid waste management revealed that although awareness levels were adequate, especially among high school students, the adoption of appropriate practices was lacking. This discrepancy suggests that awareness alone is insufficient; there must be concerted efforts to encourage behavioral change and active participation in waste management initiatives. In Malaysia, Nurul-Azita et al. (2020) explored the knowledge and practices of sustainable SWM among rural communities. The study found that initial knowledge levels were low; however, after educational briefings and practical demonstrations on composting, there was a significant improvement in both awareness and practice. This finding emphasizes the effectiveness of hands-on, community-based education in enhancing sustainable waste management practices. Despite the positive outcomes, challenges persist in ensuring widespread awareness and practice of sustainable SWM. In Tehran, a study by Ghanbari et al. (2020) revealed that only about one-third of residents had appropriate awareness of solid waste management. The study highlighted deficiencies in public education and participation, suggesting that without adequate training and facilities, public engagement in waste management remains limited.

Furthermore, cultural and societal factors influence awareness and practices related to SWM. In Malaysia, a study by Mohd-Nasir et al. (2023) using logistic regression analysis found that only 37.91% of respondents were aware of solid waste management and environmental care. The study emphasized the need for broad-based awareness campaigns that consider cultural values and individual responsibilities to enhance environmental sustainability. Bridging the gap between awareness and action requires comprehensive strategies that encompass education, policy implementation,

and community engagement. A study published in ScienceDirect (2024) utilised the theory of planned behaviour to analyse the relationship between awareness and actual waste management practices. The study found that awareness of specific municipal solid waste management policies was the strongest predictor of positive attitudes and behaviors, indicating that policy awareness can significantly influence individual actions.

Kwarteng (2017) conducted a study in Ghana, specifically in the Winneba Municipality, revealing that while many residents were aware of SWM strategies, there was a significant gap between awareness and actual practice. The study emphasised the need for increased social commitment to enhance participation in waste management activities. Another study was conducted in Malaysia by Nurul-Azita et al. (2020) and it explored the knowledge and practices of sustainable SWM among rural communities. The study found that initial knowledge levels were low; however, after educational briefings and practical demonstrations on composting, there was a significant improvement in both awareness and practice. The role of formal education in raising awareness is further emphasized in a review by Debrah et al. (2021), which analyzed environmental knowledge, awareness, attitudes, and practice studies on SWM from 2010 to 2019 in developing countries. The review highlighted that while students at both secondary and tertiary levels had positive environmental attitudes and high awareness of environmental issues, there was a lack of practical education to guide students in applying SWM practices.

Moreover, a study in Northern Malawi by Kamanga et al. (2024) emphasise the importance of public awareness campaigns and programs in enhancing public participation in SWM. The study suggested that incentives for recycling and waste

reduction, along with improved communication and engagement of residents, can significantly increase public participation in waste management. According to Agya et al. (2024), the awareness of sustainable solid waste management has improved in various regions, but translating this awareness into consistent and effective practices remains a challenge. Comprehensive strategies that encompass education, policy implementation, and community engagement are essential to bridge the gap between awareness and action.

2.8 Practices towards Sustainable Solid Waste Management

Sustainable solid waste management (SSWM) remains a global and local issue, especially in Ghana where poor waste practices continue to jeopardize public health and environmental quality (Cobbinah et al., 2017; Mudu et al., 2022; Owusu-Ansah et al., 2021). The practices of individuals and institutions toward sustainable waste management determine the effectiveness and sustainability of waste interventions. These practices encompass how individuals generate, segregate, store, transport, recycle, and dispose of waste materials. In recent times, there has been a noticeable shift toward promoting sustainable practices, particularly in urban centers, but several studies indicate that in many regions, including parts of Africa, sustainable practices remain insufficient (Anarfi et al., 2022). Various studies have emphasised that sustainable solid waste management depends largely on the practices adopted by people in their daily routines. For instance, the study conducted by Mensah and Larbi (2021) in Kumasi, Ghana revealed that while some residents showed commitment to basic waste sorting and recycling, the majority still depended on communal bins without separating waste, thereby complicating the recycling process. This finding is supported by Ofori et al. (2022), who investigated households in Cape Coast and observed that although most individuals were aware of the concept of sustainability in

waste disposal, they lacked the facilities and institutional support to implement best practices. The research further noted that ineffective collection systems and poor public attitudes contributed to the indiscriminate dumping and burning of waste.

Empirical studies have also highlighted the strong relationship between awareness and sustainable practices. Knowledge and awareness campaigns have often resulted in improved waste behaviours in different communities. For instance, Agyemang and Obour (2023) conducted a study among tertiary students in the Ashanti Region and found a significant correlation between their awareness levels and their participation in recycling programs. Those who had been exposed to environmental education programs were more likely to practice waste segregation and proper disposal. Similarly, Asare and Boateng (2023) noted that among market vendors in Accra, those who participated in community sensitisation programs were better informed about the environmental impacts of improper waste disposal and were more likely to adopt sustainable practices. It has also been established that practices toward sustainable waste management are influenced by socio-cultural norms, infrastructure, and institutional frameworks (Nguyen et al., 2023; Yin et al., 2021). Research by Ahmed et al. (2021) in Nigeria emphasised that even when people are aware of proper waste management methods, they may not adopt them due to deeply rooted cultural practices or the absence of basic facilities such as bins and recycling centers. The same study showed that in areas where municipal authorities were consistent in waste collection and community engagement, residents were more responsive and committed to sustainable practices. This aligns with findings from Mwangi and Kiptoo (2022), who reported that a structured waste management system coupled with education created a favorable environment for better waste handling practices in schools and households across Nairobi.

Several studies have also assessed the effectiveness of waste management initiatives in schools, particularly in promoting sustainable practices among students. According to Adjei and Darkwah (2022), schools serve as a microcosm of society where students' exposure to waste management education significantly affects their behaviour at home and in their communities. Their study, which focused on Senior High Schools in the Eastern Region of Ghana, found that students who received consistent instruction and participated in environmental clubs demonstrated better waste management habits compared to those who did not. In a similar vein, Dlamini and Ntuli (2021) highlighted that schools that collaborated with local waste management authorities and integrated practical waste handling activities into their curricula achieved more sustainable waste outcomes. A study by Nketiah et al. (2023) surveyed residents in urban and peri-urban areas in the Greater Accra Region and found that although the term "sustainability" was familiar to most participants, many lacked comprehensive knowledge about its implications in the context of waste. The study emphasised the need for targeted awareness campaigns that go beyond basic information dissemination and include demonstrations, community participation, and school-based interventions.

Multiple researchers have identified the media, formal education, and community workshops as the most effective channels for raising awareness. In a study conducted in Uganda, Okello et al. (2022) discovered that radio and television programs were instrumental in educating the public about the dangers of improper waste disposal and promoting sustainable alternatives such as composting and recycling. Meanwhile, Adusei and Ankomah (2023) in Ghana found that public participation in local government meetings on sanitation issues significantly increased community buy-in and led to better waste practices. The same study highlighted that informal

settlements, which are often excluded from these initiatives, remained hotspots for poor waste management. In the academic context, sustainable practices are often tied to students' exposure to environmental topics. A study by Baffour-Awuah and Owusu (2022) found that integrating environmental sustainability into science and social studies curricula led to improved attitudes and practices among Junior High School students, therefore it would be appropriate if the environmental sustainability is integrated into the science curricula in the senior high schools in Ghana. They observed that students who engaged in project-based learning on topics such as composting and waste segregation were more proactive in implementing those practices both at school and at home.

Another dimension worth mentioning is the gendered nature of sustainable practices. Recent work by Adomako and Tetteh (2023) indicated that female students and teachers were more likely to engage in and promote sustainable solid waste practices, largely due to their traditional roles in domestic hygiene and their active participation in school-based clubs. This supports earlier findings by Ekow and Owusu-Agyapong (2021), who argued that sustainability programs need to be inclusive and gender-sensitive to be truly effective.

Though, there is a positive effect on the practices of sustainable solid waste management, t is clear that structural barriers such as funding constraints, poor institutional coordination, and lack of infrastructure continue to hinder progress. Gyasi and Frimpong (2023) stress the need for government commitment in bridging these gaps through policy implementation and funding of waste programs, especially in schools. The authors suggest that awareness alone is insufficient without a supportive environment that allows people to act on their knowledge. The literature

also suggests that sustainable solid waste management must be a shared responsibility among individuals, institutions, and governments. Findings from a cross-country comparison by Oliveira et al. (2021) in Brazil, India, and South Africa indicated that countries that invested in both public education and infrastructure experienced higher compliance with sustainable practices. They also noted that waste management strategies that incorporated community participation yielded more durable and culturally appropriate solutions. The convergence of education, infrastructure, and policy offers the most promising pathway toward achieving sustainable solid waste management across different sectors of society (Woko, 2019). As the literature continues to evolve, there is a clear consensus that behavioural change, driven by awareness and backed by resources, remains central to resolving the waste crisis in many developing contexts.

2.9 Attitudes towards Sustainable Solid Waste Management

The success of environmental projects is greatly influenced by attitudes toward sustainable solid waste management (SWM), particularly in developing nations like Ghana (Tuu, 2023). The growing difficulties in waste management in recent years have highlighted the necessity of comprehending and influencing public opinion in order to promote sustainable methods. In Ghana, the perspectives of students, educators, and the broader community significantly influence the success of SWM initiatives. Research indicates that while awareness of waste management issues is relatively high, translating this awareness into consistent, sustainable practices remains a challenge. A study by Owusu-Ansah et al. (2022) revealed that a substantial majority of Ghanaians acknowledge the environmental pollution resulting from inadequate waste separation and management. Despite this recognition, only a fraction of the population actively engages in proper waste segregation. This

discrepancy suggests that awareness alone does not necessarily lead to behavioral change. Factors such as convenience, accessibility to waste disposal facilities, and ingrained habits play a role in shaping attitudes toward SWM.

The attitudes of students toward waste management in educational settings are influenced by both institutional policies and cultural norms. Henyo et al. (2023) observed that in some Ghanaian senior high schools, sanitation practices are often gendered, with female students predominantly responsible for cleaning activities. This division of labor can impact male students' perceptions of their role in maintaining a clean environment, potentially leading to disengagement from waste management responsibilities. The role of educators is also important in shaping students' attitudes toward SWM. A study by Adongo et al. (2024) highlighted that teachers' awareness of the environmental impacts of plastic waste significantly influences their commitment to educating students about sustainable practices. When educators prioritize environmental topics and model responsible behavior, students are more likely to adopt similar attitudes and practices.

Community perceptions and behaviours further complicate the landscape of SWM attitudes. Sarpong-Anane (2015) found that in the Mamobi community of Accra, there is a general disregard for waste management regulations, with residents often engaging in indiscriminate dumping. This behavior reflects a broader societal attitude where waste management is not prioritized, and enforcement of existing laws is weak. Such community norms can influence students' attitudes, especially when school practices do not align with those observed in their neighborhoods. The effectiveness of communication strategies in promoting sustainable waste practices is another factor influencing attitudes. Aladago et al. (2024) emphasised the importance of social and

behaviour change communication in enhancing community participation in waste management efforts. Without targeted and culturally sensitive communication, efforts to shift attitudes and behaviors may fall short. Attitudes toward sustainable solid waste management in Ghana are shaped by a complex interplay of awareness, cultural norms, institutional practices, and community behaviours. There is a need for a multifaceted approach that includes education, community engagement, and the enforcement of waste management policies on attitudes towards SMW (Yamtana et al., 2023).

2.10 The Role of Stakeholders in Promoting Sustainable Waste Management in Schools

Sustainable waste management in schools is a multifaceted endeavor that necessitates the active participation of various stakeholders, including students, educators, parents, government agencies, non-governmental organizations (NGOs), and the private sector (Agyeman-Prempeh et al., 2021). Each of these groups plays an important role in fostering environmentally responsible behaviors and implementing effective waste management practices within educational settings.

Government agencies are instrumental in establishing the regulatory frameworks and policies that guide waste management practices in schools. In Ghana, for instance, the Environmental Protection Agency (EPA) and local municipal assemblies are responsible for enforcing environmental sanitation policies that directly impact school environments. These agencies provide the necessary guidelines and support to ensure that schools adhere to national waste management standards, thereby promoting a culture of sustainability (UNEP, 2021).

Educators and school administrators are at the forefront of instilling sustainable waste management practices among students. By integrating environmental education into the curriculum and leading by example, teachers can influence students' attitudes and behaviors towards waste. Programs like the Eco-Schools initiative have demonstrated the effectiveness of involving students in environmental audits and action plans, leading to measurable improvements in waste reduction and recycling efforts within schools (Foundation for Environmental Education, 2021). Parents and the broader community also play a role in reinforcing sustainable waste management practices taught in schools. When schools engage families through workshops, newsletters, and community clean-up events, they extend the impact of their environmental initiatives beyond the classroom (Uzorka et al., 2024). Such collaborations ensure that students receive consistent messages about the importance of waste reduction and environmental stewardship both at school and at home. NGOs and international organizations contribute significantly by providing resources, expertise, and support for school-based waste management programs. The United Nations Development Programme (UNDP), for example, has supported Ghanaian schools through initiatives that fund innovative waste management projects. These projects not only address immediate waste management challenges but also empower students to develop and implement sustainable solutions within their schools (UNDP, 2021).

The private sector's involvement in school waste management is increasingly recognised as essential. Businesses can offer financial support, donate materials, or provide technical expertise to enhance schools' waste management infrastructure (Olukanni & Nwafor, 2019). Partnerships between schools and local businesses have led to the successful implementation of recycling programs and the provision of eco-friendly materials, thereby fostering a collaborative approach to sustainability

(Greeniacs, 2024). Effective stakeholder engagement in school waste management requires clear communication, shared goals, and mutual accountability. Studies have shown that when stakeholders are actively involved in the planning and execution of waste management initiatives, there is a higher likelihood of success and sustainability. For instance, research in Mombasa County, Kenya, revealed that stakeholder awareness and commitment significantly influenced the effectiveness of solid waste management practices in schools.

However, challenges persist in coordinating stakeholder efforts, particularly in contexts where resources are limited, and institutional support is lacking (Zarewa, 2019). Overcoming these challenges necessitates a concerted effort to build capacity among stakeholders, foster a culture of environmental responsibility, and secure the necessary resources to support sustainable waste management practices in schools. The promotion of sustainable waste management in schools is a collective responsibility that hinges on the active participation of diverse stakeholders. The school can therefore create an enabling environment that not only addresses the immediate challenges of waste management but also cultivates a generation of environmentally conscious individuals committed to sustainability.

2.11 Policy and Regulatory Frameworks for School-Based Waste Management

According to Oduro-Kwarteng et al. (2021), well-structured policies at both national and local levels influence the capacity of schools to adopt sustainable waste management practices. These policies are not only administrative tools but also reflections of a country's commitment to environmental protection and public health. The effectiveness of school-based waste management hinges on the clarity, scope, and enforceability of policies implemented within educational settings. For instance, in

Ghana, the National Environmental Sanitation Policy provides a general framework for environmental cleanliness, which includes school environments. However, Abu et al. (2020) argue that this policy often lacks specific strategies that directly address the peculiar waste management needs of schools. Similarly, Addaney and Oppong (2019) assert that while Ghana's environmental laws offer guidelines on solid waste handling, the enforcement at the school level remains inadequate due to resource constraints, limited training, and weak coordination with municipal authorities.

Several studies highlight the need for localised regulatory frameworks that consider the unique conditions of schools in both urban and rural contexts. In the case of the New Juabeng North Municipality, rapid urban development has heightened the urgency for school-specific waste management policies. A study by Osei-Mensah and Amoah (2022) revealed that many Senior High Schools in the municipality lacked designated waste collection points, segregated bins, and organized disposal schedules. According to the study, these deficiencies stemmed not from a complete absence of regulation but from weak institutional commitment and a lack of tailored school waste policies that align with national objectives. Internationally, school waste management policies have evolved to integrate broader sustainability goals. UNESCO's Global Education Monitoring Report (2020) emphasises the importance of embedding environmental sustainability within school operations, including the development of clear waste management guidelines. In countries like Finland and Sweden, national curricula require schools to adopt sustainable practices, including recycling, composting, and student-led waste audits (UNEP, 2021). These practices are reinforced through legislation that mandates environmental reporting and compliance in educational institutions. The alignment between policy formulation and school-

level implementation in these countries offers a useful benchmark for developing nations seeking to improve waste management through regulation.

The absence of comprehensive school-focused waste policies in developing countries, often leads to fragmented and inconsistent practices. Kumari and Raghubanshi (2023) found that in many sub-Saharan African countries, schools rely on informal waste disposal methods such as open dumping and burning, primarily due to the lack of regulatory oversight. The researchers argued for the integration of environmental education policies with tangible regulatory mandates that compel schools to practice and teach sustainable waste behaviors. Similarly, Gupta et al. (2023) maintain that effective school waste management requires a dual approach: policy development and community sensitization. Without the backing of enforceable regulations, awareness alone is insufficient to change practices. The role of local governments in enforcing school waste policies is critical. In Ghana, metropolitan, municipal, and district assemblies (MMDAs) are tasked with waste management responsibilities under the Local Government Act (Act 936, 2016). However, Abu et al. (2020) noted that many MMDAs do not have clear operational strategies for managing waste in schools within their jurisdictions. Budgetary limitations, lack of personnel, and minimal collaboration between education and sanitation departments were cited as major hindrances. This lack of coordinated effort undermines the effectiveness of otherwise sound policies and contributes to the persistence of unsanitary conditions in school environments.

Policy effectiveness also depends on how well schools are equipped to implement regulatory requirements. The United Nations Environment Programme (2021) stresses the importance of capacity building for school administrators, teachers, and students.

Policies must not only mandate compliance but also provide mechanisms for training, support, and monitoring. Timoshenko and Berman (2014) argue that without adequate funding and infrastructure, even the best-formulated policies risk becoming ineffectual. They advocate for participatory policy development that involves school stakeholders in designing practical waste management strategies. According to Oyake-Ombis (2016), policies serve as behavioral cues, shaping how students and staff perceive waste management. When schools operate under well-structured regulatory environments, waste becomes a shared responsibility rather than an afterthought. This is especially important in shaping lifelong environmental attitudes among young people. Consequently, policy frameworks must be designed not only to enforce rules but also to foster a culture of environmental stewardship within schools.

The integration of solid waste management into educational policy frameworks can also yield cross-sectoral benefits (Mbama et al., 2023). For instance, environmental health outcomes can improve, and schools can become hubs for community-based sustainability initiatives. Nixon (2016) suggests that when school waste policies are aligned with broader municipal waste strategies, they enhance overall waste governance. This requires regular policy reviews and the adaptation of global best practices to local contexts. Moreover, schools can become innovation centers for waste reduction techniques, such as composting organic waste from school canteens and using recycled materials for school projects. Furthermore, policies should reflect the dynamic nature of waste generation and management. As consumption patterns evolve, so do the types of waste produced in schools (Debrah et al., 2021). For example, the increasing use of packaged food items has led to a rise in plastic waste. Policies must, therefore, be flexible and responsive to emerging waste challenges.

Oduro-Kwarteng et al. (2021) recommend periodic policy audits and stakeholder consultations to ensure continued relevance and effectiveness.

2.12 Empirical Studies on Waste Management in Schools

Solid waste management (SWM) in school settings has attracted increasing empirical attention because schools concentrate consumption, learning, and residential activities within compact environments where waste streams are diverse and management choices have both pedagogical and environmental consequences. Across recent studies, two interlocking themes recur: first, schools produce a mixture of daily disposable waste (food scraps, plastics, paper) and more episodic bulky or hazardous waste (textiles, mattresses, laboratory glass, and e-waste); second, awareness and positive attitudes among students often outstrip the availability of facilities and structured programs that would allow that awareness to translate into sustained practice. Empirical work from multiple contexts illustrates both the potential of school-based interventions and the structural constraints that limit their effectiveness (Boateng et al., 2023; Henyo, 2024). Characterisation studies in secondary schools provide a necessary foundation for designing interventions. Investigations in Ghana and other African settings have documented the dominance of plastics and paper in school waste profiles, alongside significant contributions from canteens and procurement activities (e.g., packaging boxes), sanitary items in boarding schools, and occasional e-waste and broken laboratory equipment. These studies show that the composition of school waste mirrors everyday student consumption patterns (packaged foods, bottled drinks) and institutional processes (office printing, supplies procurement), underscoring the need for interventions tailored to mixed waste streams rather than single-issue campaigns (Henyo, 2024; Boateng et al., 2023).

E-waste emerges as a distinct and increasingly salient category. While not produced daily at the same rates as plastics or paper, electronic devices discarded in schools (calculators, phones, computer parts, printers) pose particular hazards because of toxic components and typically low recycling rates in low-resource contexts. Literature on e-waste cautions that informal recycling and dumping lead to soil, water and air contamination, with children and school communities particularly vulnerable when disposal is unmanaged (Lebbie et al., 2021; Ádám et al., 2021). This highlights the need for specialized collection systems and stronger policies for school-based e-waste disposal. Research on awareness, attitudes, and practices (the KAP framework) consistently reveals a recurring pattern: cognitive awareness and favourable attitudes often exist alongside weak practical engagement. Multiple empirical studies from Ghanaian municipalities to other African urban settings report that students are generally aware of the environmental harms of poor disposal and supportive of recycling and segregation in principle, yet actual behaviours (segregation at source, composting, recycling participation) are limited (Henyo, 2024; Ijaz et al., 2024). These gaps are frequently explained by barriers such as the absence of dedicated infrastructure (color-coded bins, collection schedules), irregular municipal services, cultural norms that downplay individual responsibility, and lack of hands-on training. A second major strand of empirical work evaluates interventions designed to close the knowledge–practice gap. Intervention studies fall into several categories: infrastructural changes (placement of segregated bins, compost pits, e-waste drop-off points), curricular and extracurricular programs (integration of SWM into lessons, school clubs, competitions), and communication campaigns (school posters, peer education). Studies that combine practical infrastructure with participatory education such as composting projects where students use canteen waste for school gardens

show the most consistent improvements in observable practices. For example, Ghanaian pilot programs facilitating segregation and on-site composting reported not only reduced organic disposal to general waste but also pedagogical benefits as students learned agricultural and recycling skills (Boateng et al., 2023; Aderiye & Ovwromoh, 2024). These findings underscore that experiential learning is essential: students must practice sorting, composting, and recycling to build durable routines.

Behavioral theory has been increasingly applied to understand and predict waste behaviours in school populations. The Theory of Planned Behavior (TPB) and its extensions have been used to link attitudes, subjective norms, perceived behavioural control, and intention to actual waste separation behaviour. Recent applications show that policy awareness and perceived ease of acting (i.e., the presence of facilities and normative encouragement) are strong predictors of intention and, indirectly, practice (Emmanouil et al., 2024; Pan et al., 2024). Conversely, where perceived behavioural control is low often due to missing bins or irregular collection—high attitudes may not lead to practice. Several field experiments reinforce this insight by demonstrating that small, well-designed changes in the physical environment can significantly alter behaviour. Studies investigating bin placement, signage, and convenience show marked increases in correct sorting when recyclables are made easier to deposit (Ojuri et al., 2024). The implication is that educational programming must be accompanied by optimized logistics and behavioural nudges.

Gender dynamics and social roles are also noted in school SWM research. Studies in Ghana and neighbouring countries report gendered divisions of labour in sanitation tasks, with girls often more involved in cleaning and hygiene activities (Boateng et al., 2023). While this can provide opportunities for environmental leadership, it may

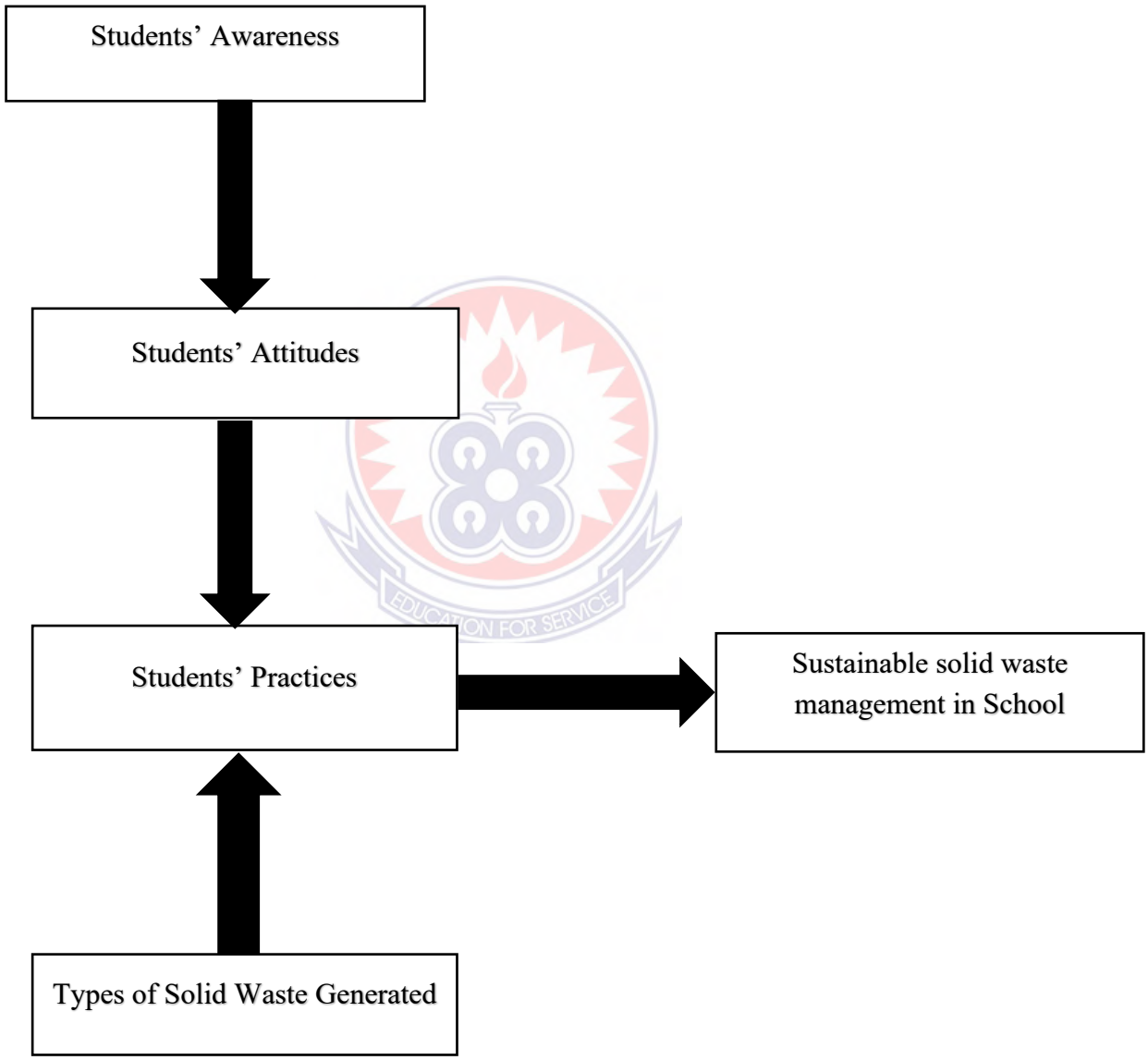
also reinforce stereotypes and limit boys' engagement. Recommendations call for gender-sensitive programming that deliberately involves all students equally. Institutional and policy contexts strongly influence outcomes. Schools collaborating with municipal waste services or NGOs achieve better results, since segregated waste can be collected for recycling or composting (Ijaz et al., 2024). Conversely, schools acting alone often struggle to sustain interventions. Comparative studies show that jurisdictions with clear policies, incentives, and enforcement achieve higher compliance than those relying solely on education (Ojuri et al., 2024). Financial limitations, inadequate space, irregular contractor services, and competing academic priorities often constrain schools (Henyo, 2024). Empirical studies suggest cost-effective alternatives, such as small-scale composting, partnerships with local recyclers, and student-led initiatives that turn waste into educational opportunities or even revenue. Emerging research emphasizes the need for longitudinal studies and robust mixed-method evaluations, combining waste audits, surveys, and qualitative interviews, to measure not just short-term changes but sustained behaviour (Boateng et al., 2023).

2.13 Conceptual Framework

This section highlights on the conceptual framework of the study which is shown in Figure 1.

Figure 1

Conceptual Framework



Source: Researcher's own Construct

Figure 1 provides the conceptual framework that illustrates how the types of solid waste generated, students' awareness, students' attitudes, and students' practices

interact to influence sustainable solid waste management in Senior High Schools within the New Juabeng North Municipality. The framework assumes that the nature and volume of waste generated in schools determine the level and type of awareness required to manage such waste appropriately. When students become aware of proper waste management methods such as segregation, recycling and responsible disposal, this knowledge is expected to shape their attitudes towards waste handling.

Students' attitudes act as a bridge between awareness and behaviour, as awareness alone may not lead to change unless students believe in the value and importance of proper waste management. Positive attitudes increase students' willingness to adopt environmentally responsible behaviours. This in turn influences students' actual waste management practices, such as the correct use of dustbins, avoiding littering, reusing materials, and participating in clean-up activities. These practices, when consistently adopted, contribute to sustainable solid waste management in schools.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This section entails the methodology on assessing sustainable solid waste management practices in selected senior high schools in the New Juabeng North Municipality. This chapter presents the study area, research design, population, sample and sampling technique, data collection instrument, validity and reliability, data collection procedure, data analysis and ethical considerations.

3.1 Study Area

The study was conducted in the New Juabeng North Municipality, which is located in the Eastern Region of Ghana. The municipality, with Effiduase as its capital, was carved out of the erstwhile New Juabeng Municipal Assembly in 2018 through Legislative Instrument (L.I. 2302). Geographically, New Juabeng North covers a total land area of approximately 110 square kilometers, and it shares boundaries with Abuakwa North Municipality to the north, New Juabeng South Municipality to the south, Suhum Municipality to the west, and Akuapem North Municipality to the east. Its central location within the Eastern Region makes it an important administrative and educational hub.

The municipality falls within the semi-deciduous forest zone, characterised by relatively high rainfall and moderate temperatures throughout the year. These climatic conditions have supported both urban development and agricultural activities. However, the growing population and rapid urbanisation in the area have also intensified the challenge of managing solid waste, particularly in public institutions such as senior high schools. New Juabeng North Municipality is predominantly urban,

with a few peri-urban and rural settlements. The urban nature of the municipality has contributed to a high generation of waste, particularly plastics, food remnants, and paper materials. This situation is more evident in schools, markets, and residential areas, where increasing human activities exert pressure on the existing waste management systems. The municipality has several senior high schools, both public and private, which play a significant role in the social and economic life of the area. Among the notable institutions are Pope John Senior High School and Minor Seminary, Effiduase Senior High Technical School, Ghana Senior High School, Oyoko Methodist Senior High School, Seventh Day Adventist Senior High School and other private schools that attract students from different parts of the country. New Juabeng North Municipality was chosen for this study because it is growing quickly, has many schools, and faces serious problems with managing waste.

3.2 Research Design

A research design serves as a master plan that carefully outlines and guides how a study will be carried out (Asenahabi, 2019). It plays an essential role in ensuring that the research achieves its objectives and answers its questions by creating a clear link between the findings and the aims of the study. According to Creswell (2014), a research design can also be seen as a logical plan of action that enhances the validity of data collected to address a given research problem.

A descriptive survey research design was employed in this study. The descriptive survey design was selected because it is best suited for studies that aim to describe the current state of affairs regarding a particular phenomenon without manipulating the environment (Siedlecki, 2020). The main focus of this design is on what is happening rather than on how or why it happens. This made it appropriate for the current study,

which sought to assess existing solid waste management practices among senior high school students without influencing their behaviours or the systems already in place.

The first objective of the study was to identify the different types of solid waste generated in the selected senior high schools. The use of the descriptive survey design allowed the researcher to collect quantitative data on the various forms of waste, such as plastics, paper, food waste, and metals, through structured questionnaires and observation of the school environment. The second objective was to assess students' awareness of sustainable solid waste management. The descriptive survey design was effective in measuring students' levels of knowledge regarding practices such as recycling, waste segregation, and environmental conservation. Structured questionnaires enabled the researcher to obtain measurable responses that could be analysed statistically to reveal patterns of awareness among students.

The third objective focused on determining students' practices toward sustainable solid waste management. The survey method enabled the researcher to collect self-reported data on students' behaviours, such as whether they separate waste, properly use waste bins, participate in clean-up exercises, or engage in recycling activities. The quantitative nature of the data made it possible to compare practices across schools and identify dominant behavioural trends. The final objective was to determine students' attitudes toward sustainable solid waste management. The descriptive survey design also allowed the researcher to measure attitudes by using scaled questionnaire items that quantified students' opinions, perceptions, and willingness to engage in environmentally responsible behaviours.

The study adopted a quantitative research approach because the objectives required the collection of measurable, numerical data that could be analysed statistically to

produce objective and generalizable findings. The quantitative approach was appropriate since it enabled the researcher to summarize large amounts of data using frequencies, percentages, and statistical comparisons, thereby enhancing accuracy and reducing subjectivity. Additionally, the use of structured questionnaires ensured uniformity in data collection, making it possible to draw reliable conclusions about patterns of waste generation, awareness levels, practices, and attitudes among students. The quantitative approach also allowed for easier comparison across schools and supported the generation of evidence-based recommendations for improving sustainable solid waste management practices within the municipality.

3.3 Population of the Study

Population refers to the complete group of individuals, objects, or elements that the findings of a research study are meant to generalize to (Shukla, 2020). It serves as the foundation from which a sample is drawn for analysis and conclusions. In this study, the population consisted of all senior high school students in the New Juabeng North municipality that generate solid waste. This broader population included approximately 842,500 students, comprising both male and female students from various senior high schools across the region.

3.3.1 Target population

The target population is defined as the specific group within the overall population that is relevant to a particular study (Willie, 2024). For this research, the target population was all students in SHS within the New Juabeng North Municipality. These students were 11,100 and included both males and females. The focus on this group was deliberate because the study aimed to assess solid waste management

practices within a manageable and geographically defined area where challenges with waste disposal had been observed.

3.3.2 Accessible population

The accessible population, also known as the study population, refers to the portion of the target population that the researcher could realistically reach and study (Asiamah et al., 2017). It represents the subset of the target group from which the sample was actually drawn. In this study, the accessible population comprised all students in the selected senior high schools in the New Juabeng North municipality. They were 1510 students from the selected senior high schools within the New Juabeng North Municipality.

3.4 Sample and Sampling Procedure

A sample is a smaller group carefully selected from a larger population to participate in a study, and it is used to make inferences about the entire population (Oribhabor & Anyanwu, 2019). In this study, a total sample of 80 students was selected to represent the broader accessible population.

The sampling procedure was carried out in two stages using different sampling techniques. First, the purposive sampling technique was used to select the senior high schools. Specifically, four senior high schools were chosen: Pope John Senior High School and Minor Seminary, Ghana Senior High School (GHANASS), Oyoko Methodist Senior High School, and Seventh Day Adventist Senior High School. The selection of these schools was informed by preliminary investigations conducted before the main data collection. These preliminary activities included informal visits to the schools, observation of waste disposal sites, consultations with sanitation prefects and school authorities, and review of municipal sanitation reports. These

investigations revealed recurring issues such as overflowing waste bins, indiscriminate dumping, inadequate waste segregation practices, and irregular waste collection services.

In addition, the selected schools were among the most populated senior high schools in the municipality and operate both boarding and day systems. This characteristic was an important consideration because mixed boarding–day environments generate diverse types and higher volumes of waste from dormitories, dining halls, classrooms, and student commercial activities. The schools also differed in their waste management infrastructure, including the availability of waste bins, frequency of waste collection, presence of environmental clubs, and level of sanitation monitoring. These variations made them suitable for comparative assessment of sustainable solid waste management practices. Accessibility to the researcher and official permission granted by school authorities further informed their selection. Thus, the purposive sampling ensured the inclusion of information-rich cases where the problem under study was most evident.

After selecting the schools, the researcher employed simple random sampling to select students within each school. The total sample size of 80 students was determined using Yamane's (1967) sample size determination formula:

$$n = \frac{N}{1 + N(e)^2}$$

where n represents the sample size, N is the accessible population of Form Two students in the selected schools, and e is the margin of error (0.05). Using the estimated accessible population of approximately 100 students across the selected

classes, the formula yielded a sample size close to 80 students. This sample size was considered adequate because it ensured statistical representativeness while remaining manageable within the time and resource constraints of the study. The allocation of 20 students from each school was determined using proportionate equal allocation to ensure balanced representation across the four selected schools. Dividing the total sample size (80) equally among the four schools resulted in 20 students per school. This approach prevented over-representation of any single school and enhanced comparability of findings.

Although simple random sampling was used to select respondents, the sampling frame was restricted to Form Two students. This decision was deliberate rather than contradictory to randomness. Form Two students were chosen because they had spent sufficient time in the school to be familiar with its waste management practices, unlike Form One students who were newly admitted. At the same time, they were not examination-bound like Form Three students, making them more accessible and available for participation. Within this defined group (Form Two students), simple random sampling was then applied to ensure that every eligible student had an equal chance of being selected.

Through this structured sampling procedure, the study ensured that the data collected were relevant to the research objectives, representative of the target population, and reliable for drawing valid conclusions about sustainable solid waste management practices among senior high school students in the New Juabeng North Municipality.

3.5 Research Instruments

According to Oben (2021), a research instrument is a measuring tool such as a test, questionnaire, interview, or observation, designed to collect data on a specific issue of

interest in a study. Research instruments are tools developed to monitor and gather information about a particular condition. In this study, observation checklist and questionnaires were used as research instruments.

3.5.1 Observation checklist

A checklist is a research instrument used to collect data through observation or documentation (Mirhosseini & Mirhosseini, 2020). It is a tool that consists of a list of items or tasks that are to be checked or marked as completed. The observation checklist was used to identify the different types of solid waste generated in the selected schools within the New Juabeng North Municipality. The observation was structured in such a way that the particular solid waste observed was counted and recorded as frequency in the selected schools. The observation checklist can be seen at Appendix A.

3.5.2 Questionnaire

According to Kuphanga (2024), a questionnaire is a tool used to collect data that is typically used in surveys. It is described as a systematically prepared form or document with a set of questions deliberately designed to elicit responses from respondents or research informants for the purpose of collecting data or information. The questionnaire was designed to measure students' awareness, practices, and attitudes toward sustainable solid waste management in the New Juabeng North Municipality. The questionnaire was designed using a three-point Likert scale (Agree, Neutral, Disagree). Questionnaire items can be found at Appendices B, C and D.

3.6 Validity of the Instruments

The validity of an instrument reflects how well it assesses the intended characteristics or variables (Taherdoost, 2016). This aspect is important for ensuring the accuracy

and effectiveness of the instrument in capturing the targeted construct or factor. Validity signifies the extent to which the instrument produces reliable and meaningful outcomes consistent with the research goals (Oluwatayo, 2012).

The validity of the observation checklist and the questionnaire items were established using content, face and construct validity. These forms of validity were essential in ensuring that the instruments accurately and comprehensively measured the intended variables. The observation checklist was developed to identify different types of solid waste in the New Juabeng North Municipality, while the questionnaire was designed to measure students' awareness, practices, and attitudes toward solid waste management in the same locality.

The content validity of the instrument was used to determine whether the items on the checklist and the questionnaire adequately represented all aspects of the concepts being measured. This form of validity was established through a thorough review process by the researchers' supervisor and science teachers from the four senior high schools in the municipality. The checklist was developed based on literature about types of solid waste commonly found in urban and peri-urban communities. It included categories such as food waste, plastics, paper, glass, metals, wood, and others. To validate the content of the checklist and the questionnaire, the instruments were submitted to the researcher's academic supervisor and a group of eight science teachers, two each from Pope John Senior High and Minor Seminary, Ghana Senior High School (GHANASS), Oyoko Methodist Senior High School, and Seventh Day Adventist (SDA) Senior High School. These experts were asked to examine the items to determine their relevance, representativeness, and coverage of the subject matter. They reviewed whether each item accurately reflected the domains of interest: types

of solid waste for the checklist and the dimensions of awareness, practices, and attitudes for the questionnaire. Based on their feedback, items that were deemed ambiguous, irrelevant, or redundant were revised or removed. This ensured that the final instruments reflected a comprehensive and representative coverage of the constructs.

Moreover, face validity was used to ensure that the instruments appeared appropriate and meaningful to both the experts and potential respondents. Although face validity is considered a more superficial form of validity compared to content or construct validity, it is important for enhancing respondent engagement and understanding (Johnson, 2021). In this study, face validity was assessed during the same review process by the supervisor and science teachers. They examined whether the items were clearly worded, logically arranged, and easy to understand by the respondents, senior high school students. Suggestions were made to improve clarity, eliminate confusing or technical terms, and rephrase items for better comprehension. The goal was to ensure that the instruments would be easily interpreted by students and would not result in misinterpretation or misrepresentation of responses. The construct validity was established to confirm that the questionnaire truly measured the abstract constructs of students' awareness, practices, and attitudes toward solid waste management. Construct validity involves the degree to which a test or instrument actually measures the theoretical construct it is intended to assess (Kane, 2012). For this purpose, the items in the questionnaire were developed based on a conceptual framework derived from relevant environmental education theories and existing literature. Each section of the questionnaire was structured to reflect one dimension of the construct. For example, the awareness section included items measuring students' knowledge of solid waste types, sources, and effects. The practice section covered

behaviours such as recycling, littering, and waste segregation, while the attitude section assessed students' feelings, beliefs, and willingness to participate in waste management activities. The expert panel evaluated whether the items in each section were consistent with the theoretical definitions of the constructs. The consistency among items within the same section and the logical relationship between sections served as evidence of construct validity. The validity of the observation checklist and the questionnaire items was determined two weeks before administering them to the respondents.

3.7 Reliability of the Instruments

Reliability is concerned with the accuracy, dependability, and repeatability of study findings (Olmsted, 2024). In this study, the observation checklist and questionnaire items were pilot tested, and this was done in Ofori Panin Senior High School in the Abuakwa North municipality. The pilot testing of the instruments was essential to identify any weaknesses in the design and to ensure that the tools would yield dependable data during the main study. The pilot test was carried out at Ofori Panin Senior High School, located in the Abuakwa North Municipality, which shares similar socio-demographic and environmental characteristics with the schools in the New Juabeng North Municipality, where the actual study was conducted. The questionnaire, which was designed to measure students' awareness, practices, and attitudes toward solid waste management, was administered to a sample of fifty (50) students at Ofori Panin Senior High School. The students were selected using a simple random sampling technique to reduce bias and to ensure that each student had an equal chance of participating. After administering the questionnaire, the responses were coded and entered into SPSS for analysis. To determine the internal consistency reliability of the questionnaire, Cronbach's alpha was calculated. Cronbach's alpha is

a widely used reliability coefficient that measures the degree to which the items in an instrument are correlated and, hence, consistently reflect the same underlying construct (Taber, 2018). The analysis revealed a Cronbach's alpha coefficient of 0.84, which is considered a good level of reliability. This indicated that the questionnaire items were well-structured and consistently measured the intended constructs of awareness, practices, and attitudes. The observation checklist was also subjected to pilot testing. The checklist was used by two trained observers to record the types of solid waste found in and around the school compound, including food waste, plastic, paper, metal, glass, and organic waste such as leaves and grass. To test the reliability of the checklist, the two observers conducted independent observations at the same time and location, ensuring that they did not influence each other's judgments. The data from the two observers were then compared using inter-rater reliability, which assesses the level of agreement between different observers using the same instrument. The degree of correlation between the observations was calculated using Pearson's correlation coefficient, which yielded a value of 0.79. This result indicated a strong positive correlation, suggesting that the checklist produced consistent and dependable results when used by different observers under similar conditions. Moreover, the pilot test also served to identify and rectify any ambiguities, vague terms, or unclear instructions in both the questionnaire and the checklist. For instance, some students at Ofori Panin Senior High School expressed confusion over certain terminology used in the questionnaire, such as "waste segregation" and "landfill management." These terms were revised and simplified to enhance clarity and comprehension. Similarly, in the observation checklist, certain waste categories were found to be too broad or overlapping. For example, "organic waste" was separated into subcategories such as "food waste" and "plant material" to improve specificity

and accuracy during data collection. The pilot test was done a week before administering them to the main respondents.

3.8 Data Collection Procedure

Data collection for this study was carefully organized and conducted over a four-week period across four senior high schools in the New Juabeng North Municipality: Pope John Senior High School and Minor Seminary, Ghana Senior High School (GHANASS), Oyoko Methodist Senior High School, and Seventh Day Adventist Senior High School. Two instruments were used to collect data: an observation checklist and a structured questionnaire. The observation checklist was used to identify and record the types of solid waste present within the school environments, while the questionnaire was designed to assess students' awareness, attitudes, and practices regarding solid waste management.

Each school was allocated one week for data collection. Within each week, the first three days were used for observation, and the remaining four days were used for questionnaire administration. Data collection began at Pope John Senior High and Minor Seminary. During the observation phase, the researcher, together with a research assistant, systematically examined key areas of the school, including dormitories, classrooms, dining areas, open spaces, and waste disposal points. The checklist covered categories such as plastics, food waste, paper, metals, glass, wood, leather, fabric, and organic waste. Observations were recorded based on physical presence and frequency of occurrence, and photographs were taken where permission was granted. Following the observation, the structured questionnaires were distributed to the selected students. Participants were given four days to complete the instrument, which measured their awareness of waste types, attitudes toward waste management,

and actual disposal practices. The researcher supervised the process, clarified items when necessary, and collected the completed questionnaires, which were checked for completeness before data entry. The same procedure used in the first school was consistently applied in the remaining three schools. In each case, the researcher followed the same observation schedule, locations, and checklist categories to ensure uniformity and reliability of data. Similarly, questionnaire administration was conducted under supervised conditions to promote accurate responses and minimize non-response errors.

3.9 Data Analysis

The data were carefully organised, coded, and entered into the Statistical Package for the Social Sciences (SPSS) Version 27 for analysis. The analytical approach was guided by the nature of the data collected from the two instruments: the observation checklist and the structured questionnaire. Each instrument addressed distinct research objectives and therefore required tailored analytical methods. The observation checklist was designed to record the types and occurrences of various solid wastes present in the school environments. These included categories such as plastic waste, food waste, paper, metal, glass, wood, leather, fabric, and organic waste like grass and fodder. After data collection, the raw observational data were first reviewed and tallied to determine the frequency of occurrence for each waste category within each school. The frequency count represented the number of times a particular type of waste was identified during the school survey. These counts were then entered into SPSS Version 27, where descriptive statistics were run to generate frequency tables. These tables provided a clear summary of how often each type of solid waste was encountered, enabling the researcher to identify the most common and least common types of solid waste in each school.

For the questionnaire data, which targeted students' awareness, attitudes, and practices concerning solid waste management, a more detailed analysis was performed. First, each questionnaire item was carefully coded into SPSS, assigning numerical values to each Likert-scale response (e.g., 1 for Disagree, 2 for Neutral and 3 for Agree). These codes allowed for both categorical and numerical analysis. The analysis began with frequency and percentage computations to describe how many students selected each response option for individual questionnaire items. This helped to provide an overview of students' general awareness levels, their practices regarding solid waste management, and their attitudes towards it. The use of percentages alongside frequencies allowed for easier interpretation and comparison across different items and constructs.

Mean scores were also calculated for each of the three constructs; awareness, practices, and attitudes. The mean represented the average response per item, which was useful in determining the trend or inclination of students towards each aspect of solid waste management. SPSS Version 27 software allowed for the generation of detailed output tables, including frequencies, percentages, and mean values. Furthermore, consistency checks were done during data entry to ensure data accuracy, and where necessary, data cleaning was carried out to remove or correct anomalies such as missing responses or outliers.

3.10 Ethical Considerations

Ethical considerations are fundamental to any research involving human participants, as they ensure the protection of participants' rights, safety, and dignity throughout the research process (Cacciattolo, 2015). This study involved collecting data from students across four senior high schools in the New Juabeng North Municipality; Pope

John Senior High and Minor Seminary, Ghana Senior High School (GHANASS), Oyoko Methodist Senior High School, and Seventh Day Adventist (SDA) Senior High School. Prior to the commencement of data collection, official introductory letters were granted by the Department of Integrated Science Education at the University of Education, Winneba, to the four schools in the New Juabeng North Municipality. Approval was formally granted by the respective school authorities before the researcher and research assistant were allowed access to the school premises and students. These letters outlined the purpose of the study, the nature of the data to be collected, the duration of the study, and assurances of confidentiality and voluntary participation.

Informed consent is a core principle in ethical research, and as such, the researcher met directly with the participants, students in the selected schools, to explain the purpose, scope, and procedures of study clearly and understandably. The discussion also included the timeframe for completing the data collection, what participation would involve (i.e., observation and questionnaire), and how the data would be used. Students were informed that their participation was entirely voluntary, and they were free to decline participation or withdraw at any point without facing any form of penalty or disadvantage. Consent was obtained verbally due to the age range of participants and the nature of the research. The anonymity and confidentiality were maintained when participants were asked not to write their names or any identifiable personal details on the questionnaires. All responses were coded and stored securely, and no information that could be traced back to individual students or schools was included in the data analysis or final reporting. This measure helped to protect participants from any potential risks associated with disclosure of their identities.

The researcher also assured participants that the data collected would be used solely for academic and research purposes and would not be shared with any third party outside the research context. The storage of data was done responsibly, with access limited to the researcher and research assistant. Hard copies of completed questionnaires were kept in a locked cabinet, while digital data were stored on a password-protected computer. In addition, the study was guided by the ethical principles of respect for persons, beneficence, and justice. The researcher took care not to impose any form of bias or prejudice based on race, religion, gender, or cultural background. All students were treated equally, and the study design ensured that no group was disadvantaged or excluded. The study did not cause any physical, emotional, or mental harm to the participants. The tools used to collect data were safe and did not involve any contact or discomfort. Also, the questionnaire items were simple and did not ask about private or sensitive issues. Moreover, the researcher conducted all activities in an environment that allowed students to feel comfortable and free from external pressure. This was necessary to ensure subject privacy.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents and analyses the data collected through the use of a checklist and a questionnaire. The data focused on two main areas: the types of solid wastes generated within the New Juabeng North Municipality and the level of awareness, attitudes, and practices of students regarding sustainable solid waste management. The checklist provided a systematic account of the different categories of solid waste produced in the study area, while the questionnaire captured students' awareness, attitudes, and practices on how waste should be properly managed to promote sustainability. The chapter does not only describe the types of waste identified and their sources but also explores the extent to which students are conscious of the environmental and health implications of poor waste management. In addition, it sheds light on the attitudes that guide students' day-to-day practices, such as segregation of waste, recycling, reuse, and proper disposal methods. Furthermore, the discussion integrates the findings from the checklist and questionnaire, drawing connections between the types of waste generated and how students respond to them in practice. This allows for a more comprehensive understanding of the challenges faced in promoting sustainable solid waste management and the potential strategies that can be adopted to improve students' involvement.

4.1 Research Question 1: What are the different types of solid waste generated in the selected schools within the New Juabeng North Municipality?

This section focused on the categories of solid wastes produced in all the campuses of the selected schools in the New Juabeng North Municipality based on the sampled population. This was sampled according to the checklist and it is presented in Table 1.

Table 1

Frequency Distribution of the Types of Solid Wastes Generated

No.	Type of Solid Waste Generated	Frequency
1	Leftover food and fruit/vegetable peels (organic waste)	52
2	Used notebooks and exercise books	60
3	Examination papers and test scripts	65
4	Empty water sachets	72
5	Beverage plastic bottles and food wrappers	80
6	Broken pens, rulers, and stationery plastics	88
7	Discarded plastic bags and packaging materials	95
8	Obsolete electronic devices (e-waste)	100
9	Damaged metal furniture and cans	110
10	Broken glass windows or lab apparatus	120
11	Used sanitary pads and tissues	130
12	Torn school uniforms and worn-out sportswear (textile waste)	140
13	Discarded mattresses and dormitory bedding	150
14	Administrative paper waste (letters, memos, printed reports)	160
15	Packaging boxes and cartons (from deliveries/stores)	170

Source: Field Data, 2025

Table 1 revealed a wide variety of solid wastes generated across the four senior high schools in the New Juabeng North Municipality. The data showed notable variations in the frequency of different waste types, providing insight into the daily activities of students as well as institutional practices that contribute to waste generation. The waste items recorded in this study were identified mainly from designated waste bins, open dumping points, and visible disposal areas within the school compounds, rather than from distant landfill sites. Observations focused on locations such as dormitory surroundings, classroom blocks, dining areas, waste collection points, and informal dumping spots within the school premises. Organic waste, particularly leftover food and fruit or vegetable peels, was the least frequent (52 occurrences). This relatively lower count may be attributed to the fact that food residues are often disposed of immediately after meals, sometimes outside designated collection points, or that some organic matter is repurposed informally, such as being fed to animals. Despite being lower in frequency compared to other categories, organic waste still represents a significant component of the school environment's solid waste stream.

Paper waste was another common type, represented by used notebooks and exercise books (60), examination papers and test scripts (65), and administrative paper waste (160). Among these, administrative paper waste recorded one of the highest frequencies, indicating that schools generate a substantial amount of documents through office activities such as memos, reports, and official letters. This underscores the need for strategies like digitization and double-sided printing to reduce excessive paper use. It is important to note that some of these waste types, particularly examination scripts and administrative documents, are not directly generated by students but are institutional by-products of academic assessment and school administration. Their presence therefore reflects systemic operational processes rather than students' personal disposal behaviours.

Plastic waste emerged as a dominant category, reflecting students' reliance on packaged food and beverages. Empty water sachets (72), beverage plastic bottles and food wrappers (80), broken pens, rulers, and stationery plastics (88), and discarded plastic bags and packaging materials (95) collectively contributed a large portion of the total waste observed. These figures point to the growing challenge of single-use plastics in the school environment, which, if not properly managed, can create serious environmental hazards due to their non-biodegradable nature.

Less frequent, but still notable, were wastes related to infrastructure and equipment, such as obsolete electronic devices (100), damaged metal furniture and cans (110), and broken glass from windows or laboratory apparatus (120). These categories are largely institutional wastes that arise from maintenance, replacement, and infrastructure deterioration rather than daily student activities. For example, obsolete electronic devices often originate from school offices or ICT laboratories, while damaged furniture and broken glass typically result from long-term wear and tear or

facility upgrades. Their inclusion in the waste stream therefore reflects institutional lifecycle management issues rather than students' consumption patterns. It is also important to clarify that these items were mostly observed at storage areas, maintenance zones, or near waste collection points awaiting disposal, rather than being found scattered randomly across school compounds. Their presence therefore indicates delayed removal or inadequate disposal systems rather than continuous daily generation.

Sanitary waste, including used sanitary pads and tissues, recorded a relatively high frequency (130). This category is particularly sensitive and requires proper disposal systems to prevent health risks and maintain hygienic conditions, especially in dormitories and washrooms. Similarly, textile wastes such as torn uniforms and worn-out sportswear (140), as well as discarded mattresses and dormitory bedding (150), highlight the contributions of boarding facilities to the waste stream, with replacements occurring as items become worn out over time.

The most frequent category observed was packaging boxes and cartons from school deliveries and stores (170). This suggests that institutional operations, such as procurement of supplies, contribute significantly to waste generation alongside student activities. These bulky materials, though recyclable, can create storage and disposal challenges if not properly managed. Field observations further showed that many of these cartons accumulated near storerooms, dining halls, and waste collection zones, often due to irregular waste collection schedules or lack of adequate recycling systems.

The findings indicate that solid waste generation in the schools is highly diverse, ranging from organic and paper waste to plastics, metals, textiles, and electronic

waste. While student consumption patterns, such as reliance on packaged foods and bottled water, play a major role, a substantial portion of the waste stream originates from institutional activities including administration, procurement, infrastructure maintenance, and academic processes. The pattern of waste accumulation observed suggests that the main challenge was not only the volume of waste generated but also the management of waste at collection points, including overloaded bins, temporary dumping areas, and delays in evacuation to final disposal sites. This demonstrates that effective school waste management strategies must address both behavioural factors among students and systemic operational practices within the institutions.

The observed pattern of solid waste in the four selected senior high schools in the New Juabeng Municipality closely reflects the multidimensional character of school-generated refuse described in the literature. As Hannan et al. (2015) note, solid waste comprises a wide spectrum of discarded materials from varied sources; similarly, the schools' waste profile reflects the multiple daily activities that occur within educational settings, including feeding, teaching, administration, maintenance, and residential life. This plurality of sources helps explain why the waste stream includes both frequently discarded consumables and intermittent bulky or hazardous items, emphasising the complexity of managing waste in growing school environments (Boateng et al., 2022).

The prominence of paper-based materials among the wastes is consistent with Nkansah and Boakye's (2020) observation that schooling processes still rely heavily on printed materials in many developing contexts. The presence of classroom-generated paper and institutional documents highlights a dual origin: instructional use on the one hand, and administrative operations on the other. This split points to opportunities to reduce overall paper throughput by addressing institutional practices

such as record-keeping and procurement alongside classroom habits. Mensah and Danquah (2023) further emphasise that paper makes up a substantial portion of school waste streams, reinforcing the importance of targeted reduction strategies at both pedagogical and administrative levels.

The observed pattern of solid waste in the four selected senior high schools in the New Juabeng Municipality closely reflects the multidimensional character of school-generated refuse described in the literature. As Hannan et al. (2015) note, solid waste comprises a wide spectrum of discarded materials from varied sources; similarly, the schools' waste profile reflects the multiple daily activities that occur within educational settings, feeding, teaching, administration, maintenance, and residential life. This plurality of sources helps explain why the waste stream includes both frequently discarded consumables and intermittent bulky or hazardous items, emphasising the complexity of managing waste in growing school environments (Boateng et al., 2022). The prominence of paper-based materials among the wastes is consistent with Nkansah and Boakye's (2020) observation that schooling processes still rely heavily on printed materials in many developing contexts. The presence of classroom-generated paper and institutional documents highlights a dual origin: instructional use on the one hand, and administrative operations on the other. This split points to opportunities to reduce overall paper throughput by addressing institutional practices (for example, record-keeping and procurement) as well as classroom habits. Mensah and Danquah (2023) emphasise on paper making up a substantive portion of school waste streams is relevant here: any effort to manage school waste must therefore consider paper reduction strategies at both pedagogical and administrative levels.

Plastic waste, visible in the form of packaging, bottles, sachets and single-use stationery components, aligns with the concerns raised by Uche and Okonkwo (2022) about the high share of plastics in school waste. The ubiquity of convenient, packaged food and bottled beverages in school life generates a persistent litter problem and long-lived environmental burden because such materials are non-biodegradable. The findings therefore reflect the literature's warning that changing consumption patterns, particularly growing dependence on packaged foods, increase plastic pollution in institutional settings. This also implies a need to target behavior as well as supply chains: reducing plastic waste in schools entails both student-level awareness and interventions that reduce the inflow of single-use packaging. E-waste and other equipment-related discards in the schools reflect the phenomenon Amankwah et al. (2021) describe, whereby increasing deployment of electronic devices for instruction and administration yields a nascent but important waste category. Although generated less frequently than daily consumables, electronic waste requires special handling because of hazardous components; its presence in school waste underlines the need for formal collection and safe disposal channels that prevent environmental contamination and protect school occupants' health.

Metal and glass wastes, stemming from damaged furniture, fittings, and laboratory apparatus correspond with the study of Tagoe and Essel's (2023) observations about injury risks and the need for cautious handling. These materials may be less voluminous than plastics or paper in the everyday tally, but they pose acute physical hazards and, in the case of laboratory-derived glass and chemical residues, potential chemical risks. Schools with active laboratory programmes or aging infrastructure are particularly vulnerable to these risks, reinforcing the literature's point that waste management must attend to both frequency and hazard potential. Textile wastes such

as worn uniforms, bedding and mattresses corroborate Owusu-Agyemang and Yeboah's (2021) account of bulky textile discard in boarding contexts. Because such items occupy significant storage space and are not readily processed through ordinary recycling streams, their management presents logistical and financial challenges for schools. The boarding-school dimension therefore compounds waste management needs: residential life produces episodic, high-volume wastes that differ from daily disposables and call for tailored solutions.

Sanitary waste surfaced as a sensitive yet substantial component of the waste profile, resonating with the study of Darko et al. (2022) whose work was on the rise of sanitary disposables in schools alongside increased female enrollment. The cultural taboos and infrastructural gaps associated with sanitary waste mean that it is often mishandled, with implications for hygiene and dignity particularly in female dormitories and shared washrooms. The literature's emphasis on inadequate facilities and social stigma highlights that technical solutions (e.g., appropriate bins and disposal systems) must be paired with education and culturally sensitive approaches to change practice. The findings exemplify how student behaviours, institutional procurement and administrative practices jointly shape the composition and management challenges of school solid waste, an observation that the reviewed scholars collectively emphasize. The data validate the literature's call for integrated responses that combine waste segregation at source, reduction in paper and plastic through institutional policy, provision of safe disposal routes for hazardous and sanitary waste, and targeted interventions for bulky textiles and e-waste.

4.2 Research Question 2: What are students' awareness about sustainable solid waste management in the New Juabeng North Municipality?

Table 2
Students' Awareness of Sustainable Solid Waste Management

No.	Item	A (%)	N (%)	D (%)	Mean
1	I know what sustainable solid waste management means.	63 (78.8%)	11 (13.8%)	6 (7.5%)	2.71
2	I have been taught how to properly separate different types of waste in school.	56 (70.0%)	14 (17.5%)	10 (12.5%)	2.58
3	I am aware that improper disposal of waste can harm human health and the environment.	69 (86.3%)	7 (8.8%)	4 (5.0%)	2.81
4	I understand that some waste materials (e.g., plastic) take years to decompose.	67 (83.8%)	8 (10.0%)	5 (6.3%)	2.78
5	I can identify which materials can be recycled and which cannot.	61 (76.3%)	10 (12.5%)	9 (11.3%)	2.65
6	I am aware of the waste management policies or rules in my school.	53 (66.3%)	14 (17.5%)	13 (16.3%)	2.50
7	Posters or awareness materials on waste management are available in my school.	50 (62.5%)	15 (18.8%)	15 (18.8%)	2.44
8	My school regularly educates us on how to manage waste sustainably.	55 (68.8%)	12 (15.0%)	13 (16.3%)	2.53
9	I have seen or participated in waste segregation or recycling activities in my school.	52 (65.0%)	12 (15.0%)	16 (20.0%)	2.45
10	I believe students play a key role in helping schools manage waste effectively.	68 (85.0%)	8 (10.0%)	4 (5.0%)	2.80
11	I know that electronic waste (e-waste) needs to be disposed of differently from regular waste.	61 (76.3%)	11 (13.8%)	8 (10.0%)	2.66
12	I believe waste management should be part of our school curriculum.	66 (82.5%)	9 (11.3%)	5 (6.3%)	2.76
13	I am aware that composting biodegradable waste helps improve soil fertility in school.	59 (73.8%)	12 (15.0%)	9 (11.3%)	2.63
14	I often discuss with classmates the importance of proper waste management in school.	56 (70.0%)	15 (18.8%)	9 (11.3%)	2.59

Source: Field Data, 2025

Table 2 presents students' awareness of sustainable solid waste management across several dimensions. The findings generally indicate a high level of awareness among

the respondents. Most students demonstrated strong understanding of key environmental concepts. A large majority indicated that they knew what sustainable solid waste management means, and an even higher proportion recognized that improper waste disposal can harm human health and the environment. Similarly, many students understood that certain materials, particularly plastics, take a long time to decompose. These high mean scores show that students possess substantial knowledge of the environmental implications of waste and the need for proper management.

Awareness related to specific waste management practices was also relatively high. Most respondents reported that they could identify recyclable materials and understood that electronic waste requires special disposal methods. In addition, many students agreed that composting biodegradable waste improves soil fertility. These findings suggest that students are not only aware of general waste management concepts but also have knowledge of specific sustainable practices. Students also showed strong recognition of their role in promoting sustainable waste management. A large majority agreed that students play a key role in helping schools manage waste effectively and supported the inclusion of waste management education in the school curriculum. This reflects positive environmental attitudes and a sense of responsibility toward sustainability.

However, awareness related to institutional support systems was comparatively lower. Fewer students indicated awareness of existing school waste management policies, and many reported limited visibility of posters or awareness materials within their schools. Similarly, participation in practical activities such as waste segregation or recycling was not widespread. These lower mean scores suggest that although students are knowledgeable about waste management, they may have limited

exposure to structured school-based programs and practical engagement opportunities. The results indicate that students possess strong theoretical awareness of sustainable solid waste management, particularly regarding environmental impacts, recycling, and personal responsibility. Nevertheless, the findings also reveal gaps in institutional awareness, practical exposure, and visibility of school-led initiatives. This suggests that while students understand waste management concepts, schools need to strengthen implementation through clear policies, regular awareness campaigns, and hands-on sustainability activities.

Several authors have argued that awareness alone does not guarantee action (Jerath, 2021; Kwarteng, 2017; Debrah et al., 2021), and the present data mirror that gap. While students display clear understanding of core concepts such as the environmental and health harms of improper disposal, the persistence of non-biodegradable materials, and the distinct handling needs of certain waste streams. Their reports point to less consistent exposure to school policies, visible awareness materials, and hands-on segregation or recycling activities. This mixed profile is precisely the type of knowledge–practice disjunction highlighted repeatedly in empirical studies. The literature on communication and education helps explain why knowledge can be high while practice remains uneven. Morara et al. (2023) demonstrate the power of strategic mass-media campaigns to raise awareness at scale; similarly, formal education and classroom discussions have been shown to improve pupils' understanding (Aforo, 2020). The students' strong conceptual knowledge in the present study suggests that some combination of messaging and classroom exposure is reaching learners which consistent with these findings. However, studies that evaluate interventions with a practical component (e.g., Nurul-Azita et al., 2020) show that hands-on demonstrations and community-based activities are far more

effective at converting awareness into habitual practice. The relative scarcity of reported participation in segregation and recycling initiatives in the schools indicates that such practical engagement is not yet widespread, which helps account for the limited translation of knowledge into sustained behaviour.

Policy awareness emerges as a critical lever for behaviour change in both the current data and the literature. Emmanouil et al. (2024) used the Theory of Planned Behavior to predict waste source separation and found that awareness of specific waste-management policies significantly predicts pro-environmental attitudes and actions; in our case, the students' lower awareness of formal school policies likely undermines efforts to institutionalize sustainable behaviours. This echoes Twumasi-Kwarteng's (2017) and Ghanbari et al.'s (2020) conclusions that policy visibility, enforcement and public education must go hand-in-hand to raise participation levels; without clear, communicated, and enforced policy frameworks, well-intentioned students have limited structural incentives to act consistently. Contextual and cultural factors also play a part. Mohd Nasir et al. (2023) and other regional studies stress that cultural values and perceived personal responsibility shape how people respond to awareness campaigns. The students' readiness to endorse education on waste management and their expressed belief in student roles suggest favourable attitudes, yet broader social and infrastructural constraints such as inadequate disposal facilities or norms that tolerate burning or indiscriminate dumping may impede practice. Where local or institutional norms are not supportive, awareness campaigns alone will not produce lasting change; messages must be culturally attuned and reinforced by visible facilities and routines.

Practical, incentive-based and participatory strategies recommended by recent studies are directly applicable to the schools. Kamanga et al. (2024) and Agya et al. (2024) point to public awareness campaigns combined with incentives, improved communication, and community engagement as means to boost participation. Translating this evidence into the school context implies introducing regular practical exercises (e.g., school composting projects, recycling drives, and e-waste drop-off days), recognition schemes for student groups, and clearer communication about school rules and responsibilities. Such measures replicate the successful elements of the Nurul Azita et al. (2020) interventions, where practical demonstrations produced measurable shifts in behaviour. The role of formal education and curriculum integration cannot be overstated.

Debrah et al. (2021) underscore a recurring shortcoming in developing-country settings: students often have positive attitudes and theoretical awareness but lack practical, curriculum-embedded instruction that teaches them how to act. The students' affirmative stance that waste management should be part of the curriculum aligns with this recommendation embedding SWM into lessons would pair knowledge with guided practice, creating routine opportunities for skills acquisition and behavioural reinforcement. The students' responses reflect a favourable starting point, sufficient awareness but also reveal structural and programmatic gaps that inhibit behaviour change.

4.3 Research Question 3: What are students' practices towards sustainable solid waste management in the New Juabeng North Municipality?

Table 3

Students' Practices towards Sustainable Waste Management

No.	Item	A (%)	N (%)	D (%)	Mean
1	I regularly categorise my waste into biodegradable and non-biodegradable materials.	22 (27.5%)	14 (17.5%)	44 (55.0%)	1.73
2	I often recycle plastic, paper, or metal waste instead of disposing of them in the general bins.	18 (22.5%)	12 (15.0%)	50 (62.5%)	1.60
3	I use separate bins for different types of waste at school.	16 (20.0%)	10 (12.5%)	54 (67.5%)	1.53
4	I dispose of electronic waste (e.g., old phones or batteries) properly through designated collection points.	20 (25.0%)	12 (15.0%)	48 (60.0%)	1.65
5	I avoid burning waste and encourage others to do the same.	26 (32.5%)	10 (12.5%)	44 (55.0%)	1.78
6	I participate in school clean-up exercises or waste collection activities.	24 (30.0%)	12 (15.0%)	44 (55.0%)	1.75
7	I have been involved in environmental or waste management clubs or campaigns in school.	18 (22.5%)	14 (17.5%)	48 (60.0%)	1.63
8	I have practiced composting or disposing of food waste in a compost pit or bin.	15 (18.8%)	13 (16.3%)	52 (65.0%)	1.54
9	I properly dispose of waste when in public places like markets, schools, or parks.	28 (35.0%)	12 (15.0%)	40 (50.0%)	1.85
10	I have reported or discouraged improper waste disposal when I see it happening.	19 (23.8%)	15 (18.8%)	46 (57.5%)	1.66
11	I apply what I learn about sustainable waste management in my daily life.	21 (26.3%)	14 (17.5%)	45 (56.3%)	1.70
12	I talk to my peers or family members about better ways to manage household or school waste.	22 (27.5%)	13 (16.3%)	45 (56.3%)	1.71
13	I find it easy to practice sustainable waste management due to the availability of facilities (bins, signs).	17 (21.3%)	11 (13.8%)	52 (65.0%)	1.56
14	I take part in school projects or assignments that involve practical waste management activities.	20 (25.0%)	12 (15.0%)	48 (60.0%)	1.65
15	I believe I have a personal responsibility in helping improve waste management in my community.	30 (37.5%)	14 (17.5%)	36 (45.0%)	1.93

Source: Field Data. 2025

Table 3 presents students' practices regarding sustainable solid waste management. The findings reveal generally low levels of practical engagement, despite relatively high awareness reported earlier. Most students did not consistently categorize waste, recycle materials, or use separate bins for different waste types. Similarly, proper

disposal of electronic waste, composting, and participation in school clean-up exercises were limited. Burning of waste remained common, indicating that environmentally harmful practices persist. Engagement in environmental clubs, campaigns, or school projects involving waste management was minimal, suggesting a lack of structured opportunities for students to apply their knowledge. Additionally, the availability of facilities such as bins and awareness signs appeared inadequate to support sustainable practices.

Among the items assessed, personal responsibility for improving community waste management recorded the highest mean, indicating that students recognize their role in promoting sustainability. However, this recognition has not yet translated into consistent practice, as reflected by low engagement in most activities. The data depict a clear gap between awareness and practice. While students understand the importance of sustainable waste management, institutional support, practical opportunities, and infrastructure are insufficient, limiting the translation of awareness into action. This underscores the need for schools to provide more hands-on initiatives, accessible facilities, and structured programs to encourage active participation in sustainable waste management.

The findings on students' practices towards sustainable solid waste management (SSWM) reveal that while awareness may be relatively high, actual adoption of sustainable behaviours is limited. This observation reflects a wider trend in both Ghana and other developing contexts where awareness has not translated into consistent practice. Cobbinah et al. (2017), Mudu et al. (2022), and Owusu-Ansah et al. (2021) have long emphasised that poor waste practices remain a major challenge to public health and environmental quality in Ghana. The present results reflect this concern, as many students showed reluctance or inability to engage in activities such

as recycling, waste segregation, composting, or proper disposal of e-waste, pointing to structural and behavioural barriers. Similar patterns have been reported in other Ghanaian settings. For example, Mensah and Larbi (2021) observed in Kumasi that although some households practised basic waste sorting, the majority still disposed of unsorted waste in communal bins, which made recycling efforts ineffective. The current findings align with this, suggesting that even where awareness exists, practical limitations and ingrained habits obstruct sustainable behaviour. Ofori et al. (2022) further identified lack of facilities and weak institutional support as barriers to best practices in Cape Coast, a conclusion that resonates with the students' limited access to separate bins and proper disposal systems in their schools.

The gap between knowledge and practice has been a recurring theme in sustainable solid waste management. Agyemang and Obour (2023) demonstrated that students exposed to environmental education programs were more likely to participate in recycling, while Asare and Boateng (2023) found that sensitization campaigns among market vendors fostered sustainable waste practices. In contrast, the current results suggest that without structured, consistent, and practical environmental education, students may recognize the importance of sustainable waste management but fail to actively engage in it. This supports Ahmed et al. (2021), who argued that awareness alone does not guarantee behavioural change when cultural practices and inadequate infrastructure constrain action. Schools are uniquely positioned to model and instill sustainable behaviours. Adjei and Darkwah (2022) emphasised that students who actively participate in school environmental clubs and campaigns tend to adopt better practices both in school and at home. However, in this case, participation in such clubs and school projects was generally limited, reinforcing Dlamini and Ntuli's (2021) claim that collaboration between schools and local waste management

authorities, alongside integration of practical waste management into curricula, is essential for long-term change. The lack of hands-on opportunities in schools weakens students' ability to translate theoretical knowledge into real-life application.

Nketiah et al. (2023) similarly noted that familiarity with sustainability concepts is insufficient without targeted interventions, including demonstrations and community participation. The relatively low engagement of students in composting and recycling activities echoes this, suggesting that practical exposure remains inadequate. Moreover, gender dynamics may also play a role. Adomako and Tetteh (2023) found that female students were more engaged in sustainable practices, partly due to their roles in domestic hygiene. If similar trends apply here, it would imply that male students may be less actively involved, which could explain some of the low levels of participation. Structural barriers also continue to shape behaviour. The limited access to adequate facilities such as waste bins, signage, and recycling points reported in this study aligns with the observations of Gyasi and Frimpong (2023), who stressed that government investment and institutional commitment are vital to overcoming infrastructural gaps. The absence of such support reduces students' capacity to put sustainable practices into action, even when they feel personally responsible for waste management. This emphasises Oliveira et al. (2021)'s conclusion that countries which successfully combine public education, infrastructure, and community participation experience stronger compliance with sustainable practices. Therefore, the findings indicate that while students generally recognise their personal responsibility toward SSWM, their practices remain limited due to insufficient facilities, lack of structured programs, and inadequate opportunities for experiential learning. These support the broader consensus in the literature that behavioural change is not achieved through

awareness alone. Rather, it requires a convergence of education, supportive infrastructure, institutional coordination, and inclusive policies (Woko, 2019).

4.4 Research Question 4: What are students' attitudes toward sustainable solid waste management in the New Juabeng North Municipality?

Table 4

Students' Attitudes towards Sustainable Solid Waste Management

No.	Item	A (%)	N (%)	D (%)	Mean
1	I believe proper waste management is important for protecting the environment.	72 (90%)	5 (6%)	3 (4%)	2.86
2	I feel responsible for how I dispose of my waste, both at home and in school.	70 (88%)	6 (7%)	4 (5%)	2.83
3	I am motivated to separate waste into different categories (e.g., plastic, food, paper) before disposal.	60 (75%)	12 (15%)	8 (10%)	2.65
4	I think sustainable waste management should be the responsibility of everyone, not just school authorities.	71 (89%)	6 (8%)	3 (3%)	2.86
5	I find it convenient to follow proper waste disposal practices at school.	58 (73%)	14 (18%)	8 (10%)	2.63
6	I am discouraged from practicing proper waste management because my community does not do the same.	30 (38%)	18 (22%)	32 (40%)	1.98
7	I believe male and female students should equally participate in school cleaning and waste management tasks.	69 (86%)	7 (9%)	4 (5%)	2.81
8	I think teachers should set a good example in how they manage their own waste in school.	73 (91%)	5 (6%)	2 (3%)	2.89
9	I am more likely to manage my waste properly when teachers talk about its environmental impact.	65 (81%)	10 (13%)	5 (6%)	2.75
10	I feel that waste management is not a priority in my community.	28 (35%)	14 (18%)	38 (48%)	1.88
11	I believe it is acceptable to dump waste in open spaces when no bin is available.	20 (25%)	10 (13%)	50 (63%)	1.63
12	I think school campaigns and education about proper waste practices help change how students behave.	68 (85%)	8 (10%)	4 (5%)	2.80
13	I am interested in joining environmental or waste management clubs in school.	62 (78%)	12 (15%)	6 (8%)	2.70
14	I think laws about waste management should be strictly enforced in our communities.	70 (88%)	6 (8%)	4 (5%)	2.83
15	I believe public education and awareness programs can help change people's attitudes toward waste.	72 (90%)	5 (6%)	3 (4%)	2.86

Source: Field Data, 2025

Table 4 highlights students' attitudes towards sustainable waste management. The findings indicate that students generally hold strongly positive attitudes. Most recognized the importance of proper waste management, felt personally responsible for their actions, and supported both individual and collective responsibility in

maintaining sustainability. Teacher influence and school campaigns were perceived as effective motivators for proper waste management, with students showing strong interest in participating in environmental clubs and related activities. Practical challenges and community influence were less encouraging. A smaller proportion of students felt discouraged by their communities' waste practices or recognized that waste management is not a priority locally. Similarly, attitudes towards open dumping were largely negative, indicating that students rejected irresponsible disposal habits. The results show that students are environmentally conscious, supportive of educational and legal interventions, and willing to take personal responsibility, though external factors such as community practices and facility availability can moderate their engagement. The consistently high mean scores for most items reflect a strong positive orientation toward sustainable solid waste management.

Students generally express pro-environmental orientations, personal responsibility, and support for institutional measures such as education and law enforcement. These favourable dispositions are important because, as Tuu (2023) argues, attitudes are central determinants of whether environmental projects succeed or fail. The students' largely positive stance therefore offers a useful starting point for program design but the literature warns that positive attitudes alone are rarely sufficient to secure behaviour change. Several studies help explain why the current attitudinal profile, while encouraging, must be purposefully converted into practice. Owusu-Ansah et al. (2022) found that broad public recognition of the harms of poor waste management did not automatically translate into consistent segregation and disposal behaviours. That gap between what people think and what they do is echoed across contexts: favourable attitudes create receptivity, but without concrete opportunities, skills, and enabling environments, behaviour often remains unchanged. Thus, the students'

readiness to endorse responsibility, education, and legal measures should be read as potential.

The role of educators and schools is especially salient in the literature and directly relevant to the attitude findings. Adongo et al. (2024) show that teachers who are aware of environmental harms and who model responsible waste behaviours can significantly influence learners' commitment to sustainable practices. Where students look to teachers as role models and report being more receptive when teachers discuss environmental impacts, schools have an immediate lever to turn positive attitudes into routine actions: teacher modelling, curricular emphasis, and regular classroom reinforcement. This view is reinforced by research showing that school-based clubs, projects and practical exercises strengthen students' translation of attitude into practice (Adjei & Darkwah, 2022; Dlamini & Ntuli, 2021). Henyo et al. (2023) highlight that sanitation roles in some schools are gendered, which can shape how boys and girls view their responsibilities. If students broadly endorse equal participation in cleaning and waste tasks, that attitudinal support is important but it must be accompanied by deliberate efforts to remove gendered barriers so that both boys and girls are empowered to practise and lead SSWM activities. Programs that are gender-sensitive and that explicitly invite diverse student leadership will better capitalise on positive attitudes.

Community context and social norms can either reinforce or undermine school gains. Sarpong-Anane (2015) documented community behaviours that de-prioritise proper disposal, and the literature shows that such external norms can dampen students' likelihood of sustaining good practice when they are outside school. This points to the need for coordinated school–community outreach: favourable student attitudes are

more likely to translate into consistent action when community norms, municipal services, and enforcement align with school messages. Aladago et al. (2024) emphasise social and behaviour change communication (SBCC) as a vehicle for shifting long-standing practices by using culturally sensitive, targeted messaging and by engaging audiences repeatedly.

The students' positive views about education and campaigns suggest that well-designed SBCC combined with demonstrations and participatory activities would be well received and could accelerate uptake of sustainable behaviours. It converges on the need for an integrated approach. Yamtana et al. (2023) and other reviews argue that attitudes must be supported by infrastructure, policy, and community engagement. In practice this means pairing the current pro-environmental attitudes with concrete measures: curriculum integration and teacher training; visible, enforced school policies; adequate facilities (segregated bins, composting sites, e-waste collection points); routine practical activities and clubs; and outreach to align community norms and municipal services. Such a multifaceted strategy addresses the common structural barriers noted across studies, lack of facilities, weak enforcement, and limited practical instruction and is the most reliable route from attitude to sustained practice. The attitudinal profile is encouraging: students value environmental protection, accept personal and collective responsibility, and support education and enforcement as tools for change.

CHAPTER FIVE

SUMMARY, CONCLUSION, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER STUDIES

5.0 Overview

This chapter of the study deals with the summary of the study, conclusion, recommendations and suggestions for further studies.

5.1 Summary of the Study

The study aimed to assess sustainable solid waste management practices in selected senior high schools in the New Juabeng North municipality. This study was conducted in four selected senior high schools in the New Juabeng North Municipality Descriptive survey was used as a research design where purposive and simple random sampling techniques were used to select 80 senior high school students. Observation checklist and questionnaire were the instruments used to collect the data. Statistical Package for Social Sciences (SPSS) version 27.0 was used to analyse the data into frequency, percentages and means. The following were the findings or outcomes of the survey;

5.1.1 Different Types of Solid Waste Generated in the Selected Schools within the New Juabeng North Municipality

The findings revealed that plastics and paper were the most common wastes generated in the selected schools, largely due to students' reliance on packaged food and beverages, as well as routine school documentation and office work. Sanitary waste, textiles from uniforms and dormitory items, and electronic or infrastructural waste also featured significantly, reflecting both student activities and institutional operations. Organic waste appeared less frequent, likely because of immediate

disposal or informal reuse, but still formed part of the waste profile. Packaging boxes and cartons were the most frequent, showing the impact of school procurement and supplies. Waste generation in the schools is shaped by both daily student consumption and broader institutional practices, with plastics, paper, and bulky waste streams standing out and requiring targeted disposal and recycling strategies.

5.1.2 Students' Awareness about Sustainable Solid Waste Management in the New Juabeng North Municipality

The findings showed that students in the New Juabeng North Municipality had generally high awareness of sustainable solid waste management. Most of them understood the dangers of improper waste disposal, the persistence of plastics, the importance of recycling, and the need for proper handling of e-waste. They also recognised their own role in managing waste and supported the inclusion of waste management in the school curriculum. However, awareness of school policies, posters, and campaigns was relatively low, and participation in practical activities like waste segregation and recycling was limited. While students' knowledge and attitudes were strong, institutional support and hands-on opportunities were not consistent. This suggests that although students are well-informed, schools need to strengthen awareness programs and provide more practical initiatives to ensure sustainable practices.

5.1.3 Students' Practices towards Sustainable Solid Waste Management in the New Juabeng North Municipality

The findings revealed that students' actual practices of sustainable solid waste management were generally low, despite their awareness of its importance. Most students did not regularly separate biodegradable from non-biodegradable waste,

recycle materials, or use separate bins, with very few engaging in composting or proper e-waste disposal. Participation in school clean-up exercises, environmental clubs, and projects was also limited, and many did not consistently apply what they learned in daily life or encourage peers and family to adopt better practices. Facilities such as bins and awareness signs were noted to be insufficient, creating further barriers. However, a relatively higher number of students acknowledged their personal responsibility in contributing to better waste management in their communities, though this recognition did not consistently translate into action. Overall, the results suggest that while students recognise the value of sustainable waste management, their active engagement remains weak, pointing to a gap between knowledge and practice.

5.1.4 Students' Attitudes toward Sustainable Solid Waste Management in the New Juabeng North Municipality

The findings showed that students generally held very positive attitudes toward sustainable solid waste management. Most of them strongly recognised the importance of proper waste practices, felt personally responsible, and supported the idea that sustainability should be a shared responsibility rather than left to school authorities alone. They also valued the role of teachers as role models, with many indicating they were more likely to manage waste properly when guided by teachers' actions and discussions. Students endorsed gender equality in waste management tasks and supported the inclusion of campaigns, education, and school clubs to promote sustainable practices. They further believed in the enforcement of waste management laws and the power of public education to change attitudes. At the same time, weaker attitudes were noted in relation to community influence, as some students reported discouragement due to poor community practices and recognized

that their communities often failed to prioritize waste management. However, most still rejected irresponsible behaviors such as open dumping. The findings reflect a strong environmental consciousness and a favourable orientation toward both personal and collective responsibility in managing waste, though community influence and facility-related challenges remain areas for improvement.

5.2 Conclusion

The study concludes that sustainable solid waste management in the selected senior high schools within the New Juabeng North Municipality is influenced by a combination of student activities and institutional practices. Plastics, paper, and packaging materials dominated the waste stream, highlighting both student consumption habits and school operational practices as key contributors. Students demonstrated high levels of awareness and positive attitudes toward sustainable waste management, particularly in recognising personal responsibility, valuing teacher influence, and supporting education and laws as tools for change. Despite these positive orientations, practical engagement remained limited, with low participation in waste segregation, recycling, composting, and other hands-on activities. This gap between knowledge, attitude, and practice was often linked to inadequate facilities, insufficient institutional support, and lack of structured programs.

The study recommends integrating waste management education into the school curriculum, ensuring that students not only learn the concepts theoretically but also apply them through practical exercises such as school clean-up projects, recycling initiatives, and composting programs. Additionally, schools should provide adequate infrastructure, such as clearly labelled bins and awareness materials, alongside policies that encourage consistent and responsible waste practices. By combining

students' enthusiasm and positive attitudes with structured education, practical opportunities, and community-linked initiatives, schools can cultivate responsible behaviors that contribute to healthier school environments and prepare students to address broader environmental challenges as informed and environmentally conscious citizens.

5.3 Recommendations

The following are the recommendations based on the findings:

1. School authorities in the selected schools should set up designated recycling corners or units within the school compounds to manage plastic, paper, and other waste streams effectively.
2. The Ghana Education Service, in collaboration with school management in the selected schools should incorporate practical waste management activities, awareness posters, and campaigns into both the formal curriculum and co-curricular programs.
3. The selected schools should ensure the availability of sufficient bins for different types of waste, composting facilities for biodegradable materials, and regular supervised clean-up exercises.
4. Authorities in the selected schools should implement school-specific rules and guidelines on proper waste disposal, complemented by awareness campaigns and demonstrations.

5.4 Suggestions for further Studies

1. Future research could examine the effectiveness of integrating practical waste segregation and recycling programs directly into the senior high school

curriculum in the New Juabeng North Municipality, assessing their impact on students' knowledge, attitudes, and actual practices over time.

2. A study could investigate the role of teaching and non-teaching staff in influencing students' sustainable waste management behaviors, particularly how staff modeling, guidance, and supervision affect compliance with school waste policies.
3. Further research could explore variations in students' awareness, attitudes, and practices across different academic programs (e.g., General Arts, Science, Business), to determine whether program-specific factors influence engagement with sustainable waste management.
4. Comparative studies could be conducted between single-gender and mixed schools within the municipality to identify whether school composition affects students' perceptions, participation, and practices regarding sustainable waste management.

REFERENCES

Abalo, E. M., Agyemang, S., Atio, S., Ofosu-Bosompem, D., Peprah, P., & Ampomah-Sarpong, R. (2017). Environmental sanitation unleashed: Effectiveness and challenges of the National Sanitation Day as a community sanitation participatory approach in Aboabo, Ghana. *Cogent Environmental Science*, *3*(1), 1405888.

Abu, M., Asumadu-Sarkodie, S., & Owusu, P. A. (2020). Solid waste management in Ghana: A review. *Journal of Environmental Management*, *256*, 109945. https://doi.org/10.1016/j.jenvman.2019.109945

Ackerman, T. (2000). Environmental education and nature protection: Enhancing public awareness. *Journal of Environmental Management, 62*(4), 357–365.

Ádám, B., Tóth, J., Barna, Z., & Varga, L. (2021). From inequitable to sustainable e-waste processing: Environmental and health challenges in low-income contexts. *Science of the Total Environment, 773*, 145–159. https://doi.org/10.1016/j.scitotenv.2021.145159

Addaney, M., & Oppong, R. A. (2019). Waste governance in Ghana: Strengthening policy and institutional frameworks. *Sustainability*, *11*(18), 4801. https://doi.org/10.3390/su11184801

Aderiye, P. C., & Ovwromoh, B. C. (2024). Waste management practices for sustainable learning in secondary schools in Rivers State. *Rivers State University Journal of Education (RSUJOE), 27*(1), 45–58.

Adeyemi, B., Olaosebikan, O., & Adesina, F. (2023). Leveraging digital innovation for sustainable waste management in Nigerian cities. *Journal of Urban Technology*, *30*(2), 115-132. https://doi.org/10.1080/10630732.2023.1234567

Adjei, M., & Darkwah, S. (2022). The role of school-based waste education in promoting sustainable practices among students in Ghana. *Journal of Environmental Education and Sustainability, 15*(3), 178–189. https://doi.org/ 10 .1016/j.jees.2022.03.006

Adomako, R., & Tetteh, E. (2023). Gender and environmental sustainability: A study of solid waste practices in Ghanaian schools. *Sustainability Studies Review*, *11*(2), 203–215. https://doi.org/10.3390/susrv11020203

Adongo, R., Kuuder, C. J. W., Amoako, E. E., Asare, W., Duwiejuah, A. B., & Arthur, V. (2015). Stakeholder views on waste and its management in Tamale Metropolis, Ghana. *Journal of Scientific Research and Reports*, *6*(5), 340-349.

Adongo, R., Yeboah, S., & Mensah, K. (2024). Understanding the perception and awareness of senior high school teachers on the environmental impacts of plastic waste: Implications for sustainable waste education and management. *Environmental Research Communications*, *6*(2), 123-135. https://doi.org/ 10.1016/j .envrescom.2024.02.005

Adu-Boahen, K., Antwi, B. O., & Osei, J. (2014). Urban solid waste segregation at source: A case study of the Kumasi metropolis. *Journal of Urban and Environmental Engineering*, *8*(1), 1–10. https://doi.org/10.4090/juee. 2014.v 8n1.001010

Adu-Boahen, K., Atampugre, G., Antwi, K. B., Osman, A., Osei, K. N., Mensah, E. A., & Adu-Boahen, A. O. (2014). Waste management practices in Ghana: challenges and prospect, Jukwa Central Region. *International Journal of Development and Sustainability*, *3*(3), 530-546.

Adusei, A., & Ankomah, G. (2023). Community participation and solid waste practices in Ghana: The role of local government engagement. *African Journal*

of Environmental Management, *9*(1), 45–59. https://doi.org/10.4314/ ajem. v9i1.004

Aforo, O. Y. (2020). *Awareness of solid waste management practices among basic school pupils in Dormaa Municipality*. University of Cape Coast. Retrieved from http://hdl.handle.net/123456789/6479 on April, 12, 2025.

African Development Bank. (2020). *Urban waste management in Africa: Challenges and opportunities*. AfDB Publications.

Agya, B. A., Rückert, A., & Dornack, C. (2024). Effectiveness of traditional solid waste management system of rural communities: A case study in the Kwahu East District, Ghana. *Environmental Challenges*, *15*, 100869.

Agyemang, A., & Obour, K. (2023). Awareness and sustainable waste behaviour among tertiary students in Ghana. *International Journal of Waste Management and Education, 8*(4), 312–326. https://doi.org/10.1016/j.ijwme.2023.06.005

Agyeman-Prempeh, N., Acheampong, P., Freeman, E., Mochiah, E. E. A., Abubakar, R., & Annor, L. D. J. (2021). Sustainable Waste Management Practices in a Higher Education Institution of Ghana. In *2021 International Conference on Computing, Computational Modelling and Applications (ICCMA)* (pp. 145-152). IEEE.

Agyepong, A., & Asare, W. (2022). Community participation and urban solid waste management in Ghana: Challenges and prospects. *Journal of Environmental Planning and Management, 65*(3), 451–467. https://doi.org/10.1080/09640568.2021.1930631

Agyepong, S. A., & Osei, K. A. (2020). Local governance and the politics of urban waste management in Ghana. *African Studies Quarterly*, *20*(3), 35-54.

Ahmed, A., Musa, B., & Olaleye, T. (2021). Barriers to sustainable waste management in urban Nigeria: A cultural and infrastructural perspective. *Waste and Society, 6*(2), 134–149. https://doi.org/10.1016/j.wasoc.2021.03.007

Akintunde, E. A., Akinyemi, A. O., & Olamiju, I. O. (2021). Municipal solid waste management in fast-growing African cities: A review. *Waste Management & Research*, *39*(12), 1453–1463. https://doi.org/10.1177/0734242X211040100

Akpan, V. E., & Olukanni, D. O. (2020). Hazardous waste management: An African overview. *Recycling*, *5*(3), 15.

Aladago, N., Diedong, A. L., & Dzisah, W. S. (2024). The relevance of social and behaviour change communication in sanitation and solid waste management in Techiman South, Ghana. *Journal of Policy and Development Studies*, *17*(1), 45-60. https://www.ajol.info/index.php/jpds/article/view/285583

Ali, S. M., Wang, W., & Chaudhry, N. (2020). Emerging challenges and opportunities in municipal solid waste management in South Asia. *Environmental Science and Pollution Research*, *27*, 22515–22530. https://doi.org/10.1007/s11356-020-08468-9.

Almasi, A., Ghanbari, S., Khosravi, T., & Mohammadi, M. (2019). Effect of education on knowledge, attitude and practices of waste management among rural residents. *Environmental Health Engineering and Management Journal, 6*(2), 125–132. https://doi.org/10.15171/ehem.2019.17

Amankwah, E. K., Mensah, J., & Obeng, P. (2021). Managing electronic waste in educational institutions: A Ghanaian perspective. *Journal of Environmental and Public Health*, 1–9. https://doi.org/10.1155/2021/6614732

Ampofo, J. A. (2020). Waste Disposal Management Practices in Selected Senior High Schools within the Wa Municipality of Ghana. *International Journal of Management & Entrepreneurship Research*, *2*(4), 273-290. https://doi.org/ 10.51 594/ijmer.v2i4.157

Ampofo, J. A. (2020). Waste disposal management practices in selected senior high schools within the Wa Municipality of Ghana. *International Journal of Management & Entrepreneurship Research*, *2*(4), 273-290. https://doi.org/1 0.51594/ijmer.v2i4.157

Anarfi, K., Shiel, C., & Hill, R. A. (2022). The public's perspectives of urban sustainability: A comparative analysis of two urban areas in Ghana. *Habitat International*, *121*, 102496.

Anderson, J. E. (2011). *Public policymaking* (7th ed.). Cengage Learning.

Anku, R., Asare, B., & Boateng, M. (2021). Assessment of organic waste generation in school environments in Ghana. *Waste and Biomass Valorization*, *12*(8), 4567–4578. https://doi.org/10.1007/s12649-020-01234-9

Anokye, K., & Mohammed, A. S. (2024). Indigenous traditional knowledge for cleaner waste systems and sustainable waste management system in Ghana. *Cleaner Waste Systems*, 100165.

Anokye, K., Mohammed, A. S., Agyemang, P., Agya, A. B., Amuah, E. E. Y., Kwabi, L. A. & Apea, H. B. (2023). Improving Effective Solid Waste Management Systems in Ghana: A Comparative Study of the Cities of Karlsruhe, Germany and Navrongo, Ghana. *Open Access Library Journal*, 10: e10854. https://doi.org/10.4236/oalib.1110854

Anokye, K., Mohammed, A. S., Agyemang, P., Agya, A. B., Amuah, E. E. Y., & Sodoke, S. (2024). A systematic review of the impacts of open burning and

open dumping of waste in Ghana: A way forward for sustainable waste management. *Cleaner Waste Systems*, 100152.

Appiah, D. O., Poku, A. A., & Kumi, E. (2022). Challenges of solid waste management in urban Ghana: Evidence from Kumasi Metropolis. *International Journal of Environmental Studies*, *79*(4), 600–616. https://doi.org/10.1080/00207233.2021.2011005

Appiah-Effah, E., Duku, G. A., Azangbego, N. Y., Quansah, D. A., Nyarko, K. B., & Moriarty, P. (2015). Ghana's post-2015 WASH targets: Re-thinking the rural-urban dichotomy. *Journal of Water, Sanitation and Hygiene for Development*, *5*(3), 389–399. https://doi.org/10.2166/washdev.2015.077

Asante, E. A., & Agyemang, E. (2019). Historical overview of waste disposal and sanitation reforms in Ghanaian cities. *Ghana Journal of Geography*, *11*(1), 45–62. https://doi.org/10.4314/gjg.v11i1.4.

Asare, S., & Boateng, F. (2023). Community sensitization and sustainable waste practices among market vendors in Accra. *Waste Management and Society, 10*(1), 97–110. https://doi.org/10.1016/j.wms.2023.01.008

Asenahabi, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, *6*(5), 76-89.

Asiamah, N., Mensah, H., & Oteng-Abayie, E. F. (2017). General, target, and accessible population: Demystifying the concepts for effective sampling. *The qualitative report*, *22*(6), 1607-1621. http://doi.org/10.46743/2160-3715/2017.2674.

Baffour-Awuah, S., & Owusu, P. (2022). Integrating environmental sustainability into Junior High School curricula: Effects on student behavior. *African Journal of Curriculum and Instruction, 12*(1), 80–94. https://doi.org/10.10 16/j.ajci. 2022.01.009

Bai, X., & Bai, Y. (2020). Urban systems and sustainability: A systematic review of the literature. *Nature Sustainability, 3*(1), 1–9. https://doi.org/10.1038/s41893-019-0436-6

Bardach, E., & Patashnik, E. M. (2019). *A practical guide for policy analysis: The eightfold path to more effective problem solving* (6th ed.). CQ Press.

Bernache-Pérez, G., De Medina-Salas, L., Castillo-González, E., & Giraldi-Díaz, M. R. (2023). Strategies to strengthen integrated solid waste management in small municipalities. *Sustainability*, *15*(5), 4318.

Boateng, G., Mensah, A., & Abebrese, D. (2022). Recognizing the informal sector in Ghana's waste management policy. *Waste Management & Research*, *40*(6), 791-802. https://doi.org/10.1177/0734242X221089676

Boateng, S., Owusu, K., & Appiah, R. (2023). Solid waste management practices and challenges in urban and rural senior high schools in the Ashanti Region, Ghana. *International Journal of Environmental Management, 12*(3), 112–128.

Boateng-Opoku, C. (2021). *Impact of solid waste disposal on the health of residents of Kpone-Katamanso municipality* (Masters's dissertation, UCC).

Cacciattolo, M. (2015). Ethical considerations in research. In *The Praxis of English Language Teaching and Learning (PELT) Beyondthe Binaries: Researching Critically in EFL Classrooms* (pp. 61-79). Rotterdam: SensePublishers. http://doi.org/10.1007/978-94-6300-112-0_4

Cobbinah, P. B., Addaney, M., & Agyeman, K. O. (2017). Locating the role of urbanites in solid waste management in Ghana. *Environmental Development*, *24*, 9-21.

Coker, D. C. (2022). A Thematic Analysis of the Structure of Delimitations in the Dissertation. *Online Submission*, *17*, 141-159.

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches.* Sage publications.

Darko, S., Afriyie, K., & Kumah, E. (2022). Sanitary waste management challenges in female senior high schools in Ghana. *African Journal of Reproductive Health*, *26*(3), 118–127. https://doi.org/10.29063/ajrh2022/v26i3.12

Debrah, J. K., Vidal, D. G., & Dinis, M. A. P. (2021). Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review. *Recycling*, *6*(1), 6.

Dery, F. (2017). *Investigating University Students' Knowledge and Practices Towards Appropriate Solid Waste Management Practices in the Greater Accra Region, Ghana*. GRIN Verlag.

Dlamini, N., & Ntuli, M. (2021). School collaborations for sustainable waste outcomes in Southern Africa. *Journal of Education and Environment, 14*(2), 99–113. https://doi.org/10.1080/13504622.2021.1951372

Ekhoragbon, E. (2024). Public health impacts of open defecation in sub-Saharan Africa: Lessons from Ghana. *African Journal of Environmental Health*, *9*(1), 45–59.

Ekow, D., & Owusu-Agyapong, J. (2021). Gender-sensitive sustainability education: Strategies for inclusive waste management in Ghana. *Journal of Gender and Environment, 5*(3), 145–158. https://doi.org/10.1016/j.jgenv.2021.05.006

Emmanouil, C., Chachami-Chalioti, S. E., Kyzas, G. Z., & Kungolos, A. (2024). Application of the Theory of Planned Behavior to predict waste source separation. *Science of The Total Environment*. https://doi.org/10.1016/j.scitotenv.2024.177356

EPA Ghana. (2022). *National guidelines for waste classification and disposal in Ghana*. Environmental Protection Agency. Retrieved from https://www.epa.gov.gh on April, 11, 2025.

Gebrekidan, T. K., Weldemariam, N. G., Hidru, H. D., Gebremedhin, G. G., & Weldemariam, A. K. (2024). Impact of improper municipal solid waste management on fostering One Health approach in Ethiopia—challenges and opportunities: a systematic review. *Science in One Health*, 100081.

Ghana Statistical Service. (2022). *2021 Population and Housing Census: General Report Volume 3M – Water and Sanitation*. Accra, Ghana: GSS. https://www.statsghana.gov.gh/

Ghanbari, R., Ghanbari, M., & Ghanbari, A. (2020). Public awareness, education and participation in solid waste management in Tehran. *Journal of Behdasht dar Arseh (Health in the Field)*. Retrieved from https://journals.sbmu.ac.ir/jhf/article/view/10527/0 on April, 12, 2025.

Greeniacs, L. M. (2024). Collaborative school–community initiatives for sustainable waste management: A case analysis of eco-friendly practices. *Journal of Sustainable Education and Practice*, *7*(2), 120–134. https://doi.org/10.51423/jsep.2024.07208

Grimm, N. B., Faeth, S. H., Golubiewski, N. E., Redman, C. L., Wu, J., Bai, X., & Briggs, J. M. (2008). Global change and the ecology of cities. *Science, 319*(5864), 756–760. https://doi.org/10.1126/science.1150195.

Guerrero, L. A., & Maas, G. (2019). Solid waste management challenges for cities in developing countries. *Waste Management & Research*, *37*(1), 3–12.

Gumbo, T., & Mkhize, N. (2023). Organic waste and climate-smart strategies in Sub-Saharan Africa. *Environmental Management*, *72*(3), 481-495. https://doi.org/10.1007/s00267-023-01754-z

Gupta, P., Sharma, A., & Bhardwaj, L. K. (2023). Solid waste management (SWM) and its effect on environment & human health. *Preprints*, 2023090384.

Gyasi, E., & Frimpong, A. (2023). Policy gaps in sustainable solid waste management in Ghanaian schools. *Environmental Policy and Education, 7*(2), 167–179. https://doi.org/10.1080/09640568.2023.1847502

Hajam, Y. A., Kumar, R., & Kumar, A. (2023). Environmental waste management strategies and vermi transformation for sustainable development. *Environmental Challenges*, *13*, 100747. https://doi.org/10.1016 /j.envc.2023.100747.

Hannan, M. A., Al Mamun, M. A., Hussain, A., Basri, H., & Begum, R. A. (2015). A review on technologies and their usage in solid waste monitoring and management systems: Issues and challenges. *Waste Management*, *43*, 509-523.

Henyo, I. K. (2024). Implications of poor waste disposal management practices on senior high schools within the Wa Municipality of Ghana. *Contemporary Journal of Education and Social Science, 6*(2), 55–72.

Henyo, I. K., Owusu-Addo, A., Blewu, G. A., Opoku-Manu, M., & Owusu, A. Y. (2023). Sanitation culture among students: Evidence from a senior high school in Ghana. *Canadian Journal of Educational and Social Studies*, *4*(6), 89-102. https://cjess.ca/index.php/home/article/view/270

Hnatyuk, V., Pshenychna, N., Kara, S., Kolodii, V., & Yaroshchuk, L. (2024). Education's role in fostering environmental awareness and advancing sustainable development within a holistic framework. *Multidisciplinary Reviews*, *7*.

Hoornweg, D., & Bhada-Tata, P. (2012). *What a waste: A global review of solid waste management*. World Bank. https://openknowledge.worl dbank.org/handle/10986/17388

Hoornweg, D., Bhada-Tata, P., & Kennedy, C. (2020). Environment: Waste production must peak this century. *Nature*, *502*(7473), 615–617.

Howlett, M., Ramesh, M., & Perl, A. (2020). *Studying public policy: Policy cycles and policy subsystems* (4th ed.). Oxford University Press.

Ijaz, S., Danso, E., & Darko, A. (2024). Students in Ghana champion sustainable waste management through school–community partnerships. *International Water Management Institute Blog*. Retrieved from https://www.iwmi.cgiar.org

Iyer, L. S. (2018). Knowledge, attitude and behaviour (KAB) of student community towards electronic waste-a case study. *Indian Journal of Science and Technology*, *11*(10).

Jerath, N. (2021). Awareness and attitude of students towards municipal solid waste management to achieve sustainable development goals - A case study. *International Journal of Plant and Environment*, *7*(01), 78-85. Retrieved from https://www.ijplantenviro.com/index.php/IJPE/article/view/1329 on April, 12, 2025.

Johnson, E. (2021). Face validity. In *Encyclopedia of autism spectrum disorders* (pp. 1957-1957). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-91280-6_308

Joshi, A., Morales, L. G., Klarman, S., Stellato, A., Helton, A., Lovell, S., & Haczek, A. (2021). A knowledge organization system for the united nations sustainable development goals. In *The Semantic Web: 18th International Conference, ESWC 2021, Virtual Event, June 6–10, 2021, Proceedings 18* (pp. 548-564). Springer International Publishing.

Kamanga, T. W., Chitete, M. M. N., Kamanga, B. C. G., Damazio, C., Yafeti, Y., & Sibande, M. (2024). Towards Sustainable Solid Waste Management Systems: Empirical Evidence From Northern Malawi. *Environmental Health Insights*, *18*, 11786302241255800. https://doi.org/10.1177/11786302241255800

Kane, M. (2012). All validity is construct validity. Or is it?. *Measurement: Interdisciplinary Research & Perspective*, *10*(1-2), 66-70. http://doi.org/10.10 80/15366367.2012.681977.

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *Urban waste futures: Evaluating the impact of integrated and inclusive waste systems in developing cities*. *Global Journal of Urban Sustainability*, *9*(3), 201–219. https://doi.org/1 0.482 21/gjus.2018.09304

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. World Bank.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260. https://doi.org/10.1080/ 13504620220145401

Kuffour, R. A. (2020). Possibility of Improving Solid Waste Management in Senior High Schools in the Ashanti Region of Ghana. *African Journal of Environmental Science and Technology*, *14*(8), 231-240. https://doi.org/ 10 .5897/AJ EST2020.2859

Kumari, A., & Raghubanshi, A. S. (2023). School waste management in the Global South: A pathway towards environmental sustainability. *Environmental Education Research*, *29*(2), 243–260. https://doi.org/10.1080/13 504622.2022. 2136783

Kuphanga, D. (2024). *Questionnaires in research: Their role, advantages, and main aspects*. Preprint. https://doi. org/10.13140/RG, 2(15334.64325).

Kwarteng, T. A. (2017). Awareness and Practice of Solid Waste Management in the Winneba Municipality of Ghana. *European Journal of Earth and Environment*, *4*(1), 39-47. https://www.researchgate.net/publication/320719375.

Lafferty, W. M., & Hovden, E. (2003). Environmental policy integration: Towards an analytical framework. *Environmental Politics*, *12*(3), 1–22. https:// doi.org/10 .1080/09644010412331308254

Lebbie, T. S., Mansaray, M., & Conteh, J. (2021). E-waste in Africa: A serious threat to the health of children. *International Journal of Environmental Research and Public Health, 18*(6), 345–359. https://doi.org/10.3390/ijerph1806345

Maalouf, A., & Agamuthu, P. (2023). Sustainable waste governance in low-income regions: Challenges and emerging solutions. *International Journal of Environmental Management*, *58*(2), 145–159. https://doi.org/10.1080/ijem. 2023.0045123

Mashudi, A., Mensah, T. K., & Owusu, R. B. (2023). Strategic planning for effective municipal waste systems in Sub-Saharan Africa. *Journal of Waste Policy and Practice*, *12*(1), 33–48. https://doi.org/10.3254/jwpp.2023.120104

Mbama, C. A., Otegbulu, A., Beverland, I., & Beattie, T. K. (2023). Solid waste recycling within higher education in developing countries: a case study of the University of Lagos. *Journal of Material Cycles and Waste Management*, *25*(2), 886-898.

McMullen, J. S., Bagby, D. R., & Palich, L. E. (2008). Economic freedom and the motivation to engage in entrepreneurial action. *Entrepreneurship Theory and Practice*, *32*(5), 875-895.

Medina, M. (2008). *The informal recycling sector in developing countries: Organizing waste pickers to enhance their impact*. Gridlines, No. 44. The World Bank.

Mensah, G. (2022). *Assessing the solid waste management practices in some selected Senior High Schools in the Adansi North District of Ghana* (Masters dissertation, University of Education, Winneba).

Mensah, J. K., Awuni, Y., & Boateng, E. A. (2023). Health implications of proximity to unmanaged waste disposal sites in urban communities. *Journal of Environmental Health and Safety*, *18*(1), 72–86. https://doi.org/10.5 623/ jehs.2023.180107

Mensah, J. T., Ofori-Darko, C., & Baah, R. (2021). From waste to wealth: Re-examining urban waste reuse in Ghana. *Cities*, *115*, 103250. https://doi.org/ 10.1016/j.cities.2021.103250

Mensah, K. O., & Danquah, S. (2023). Paper waste in public schools: Patterns and implications for sustainable education. *Waste Management & Research*, *41*(1), 79–89. https://doi.org/10.1177/0734242X221121854

Mensah, K., & Larbi, F. (2021). Household waste practices and challenges in Kumasi, Ghana. *Waste Management Perspectives, 13*(2), 210–224. https://doi.org/10.1016/j.wamp.2021.02.004

Ministry of Information. (2023). *Government's progress on water and sanitation infrastructure*. Government of Ghana. https://www.moi.gov.gh/

Mirhosseini, S. A., & Mirhosseini, S. A. (2020). Collecting data through observation. *Doing qualitative research in language education*, 61-84. https://doi.org/10.1007/978-3-030-56492-6_4.

Mngomezulu, N., & Mkhize, T. (2023). Public participation in municipal waste management in South Africa. *African Journal of Public Affairs*, *15*(1), 1-15.

Moghadam, K. S., & Diabat, A. (2021). Waste management challenges in Africa: A multi-criteria decision-making approach. *Waste Management*, *131*, 16-27. https://doi.org/10.1016/j.wasman.2021.06.032

Mohd-Nasir, M. H., & Nasrun, M. N. M. (2023). Sustainable public awareness on solid waste management and environmental care using logistics regression. *Jurnal Kejuruteraan*. Retrieved from https://journalarticle.ukm.my/21445/ on April, 12, 2025.

Moqsud, M. A., Bushra, Q. S., & Rahman, M. (2020). Stakeholder participation in sustainable solid waste management. *Journal of Environmental Management*, *260*, 110148.

Moqsud, M. A., Rahman, M. A., & Mahmud, K. (2011). Possibilities of sustainable waste management through composting in Bangladesh. *International Journal of Environmental and Waste Management*, *8*(1-2), 133–145.

Morara, M., Djongana, C., & Awuor, Q. (2023). Effectiveness of mass media in creating public awareness on proper solid waste management: A case of Kawangware, Nairobi County. *African Multidisciplinary Journal of Research*, 231–248.

Mrema, M., & Mwakalukwa, J. (2021). Enhancing community participation in solid waste management: Lessons from Tanzania. *Waste Management & Society*, *9*(2), 114-127.

Mudu, P., Nartey, B. A., Kanhai, G., Spadaro, J. V., & Fobil, J. (2022). *Solid waste management and health in Accra, Ghana*. World Health Organization.

Mwakitalima, A., Mwakitalima, A., & Mwakitalima, A. (2020). Sustainable solid waste management measures in Tanzania: An exploratory descriptive case study among vendors at Majengo market in Dodoma City. *BMC Public Health*, *20*, 1-13. https://doi.org/10.1186/s12889-020-08670-0.

Mwangi, T., & Kiptoo, J. (2022). Structured systems and behavior change in school-based waste management in Nairobi. *Journal of Urban Sustainability, 9*(1), 45–59. https://doi.org/10.1016/j.jus.2022.01.005

Nabegu, A. B., & Mustapha, A. (2020). Socio-economic determinants of household waste management practices. *Environmental Quality Management*, *29*(3), 55–63.

Nanda, S., & Berruti, F. (2021). Municipal solid waste management and landfilling technologies: a review. *Environmental chemistry letters*, *19*(2), 1433-1456.

Nartey, A. K., & Nyarko, P. (2020). Solid waste management practices in Ghana: challenges and prospects. *African Journal of Current Medical Research*, *4*(1).

Nguyen, A. T., Nguyen, N., Phung, P., & Yến-Khanh, N. (2023). Residents' waste management practices in a developing country: a social practice theory analysis. *Environmental Challenges*, *13*, 100770.

Nimoh, F., Kwarteng, J. A., & Ohene-Yankyera, K. (2014). Cultural beliefs and practices in relation to sanitation and hygiene in Ghana. *International Journal of Development and Sustainability*, *3*(5), 1059–1071.

Nixon, H. (2016). The future of landfilling: Policy perspectives on waste treatment. *Waste Management Journal*, *34*(10), 1751–1760. https://doi.org/10.10 16/j. wasm an.2016.07.003

Nkansah, D. A., & Boakye, E. (2020). Educational waste generation in Ghana: An overlooked challenge. *Journal of Sustainable Education*, *18*(2), 34–45.

Nketiah, D., Baah, C., & Andoh, R. (2023). Understanding sustainability concepts among urban residents in Accra. *Journal of African Environmental Psychology, 6*(4), 282–296. https://doi.org/10.1016/j.jaep.2023.04.009

Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., & Campbell, B. M. (2009). Principles for knowledge co-production in sustainability research. *Nature Sustainability*, *2*(3), 182–190. https://doi.org/ 10.1038/s41893-019-0448-2

Nshimiyimana, E., & Uwimana, P. (2022). ICT applications in municipal solid waste management in Rwanda. *Smart Cities and Society*, *5*(1), 88-101. https://doi. org/ 10.1007/s42421-022-00045-6

Nurul-Azita, S., Fadhilah, M. Z., Zakirah, O., Noor Hidayah, A., Aviasti, A., Rushanim, H., & Nasrun, M. N. M. (2020). Sustainable solid waste management knowledge and practices among rural community in Malaysia. *International Journal of Advanced Science and Technology*, *29*(6s), 1951-1956.

Nzeadibe, T. C., & Anyadiegwu, N. C. (2020). Waste governance and urban sustainability in Africa. *Journal of African Urban Studies*, *1*(2), 35-52.

Oben, A. I. (2021). Research instruments: A questionnaire and an interview guide used to investigate the implementation of higher education objectives and the attainment of Cameroon's Vision 2035. *European Journal of Education Studies*, *8*(7). http://doi.org/10.46827/ejes.v8i7.3808.

Obeng, D., Boateng, S. D., & Quansah, J. O. (2020). Household waste generation and disposal in peri-urban Ghana: The case of Ejisu-Juaben Municipality. *Waste Management*, *104*, 79–86. https://doi.org/10.1016/j.wasman.2020.01.039.

Obeng, K. K., Osei, J., & Darko, A. (2021). Plastic pollution and aquatic ecosystems in Ghana. *African Journal of Ecology*, *59*(4), 793-805. https://doi.org/10.1111/aje.12873

Oduro-Kwarteng, S., Essandoh-Yeddu, J., & Mensah, A. (2021). Policy coherence in Ghana's environmental sanitation framework. *Waste Management & Research*, *39*(4), 445–454. https://doi.org/10.1177/0734242X20982948

Ofori, B., Agyapong, I., & Addai, L. (2022). Challenges of household waste segregation and recycling in Cape Coast. *Ghana Journal of Urban Management, 8*(1), 59–73. https://doi.org/10.1016/j.gjum.2022.02.002

Ogunbiyi, O. J., Adeoye, D. O., & Ajayi, K. (2021). Perspectives on the circular economy in African cities: Sustainable solid waste management in Lagos, Nigeria. *Sustainability*, *13*(15), 8427. https://doi.org/10.3390/su13158427

Ojedokun, O. A., & Balogun, S. K. (2011). Environmental attitude as a mediator of the relationship between self-concept, environmental self-efficacy and responsible environmental behavior among some Nigerian secondary school students. *Environmental Education Research, 17*(3), 353–361. https://doi.org/10.1080/13504622.2010.542449

Ojewale, O. O., & Olayiwola, M. M. (2021). Knowledge, attitudes, and practices of waste management in Nigerian urban centres. *Journal of Urban and Environmental Studies*, *6*(3), 144-157.

Ojuri, O. O., Adeyemi, A. O., & Yusuf, M. (2024). Sustainable integrated solid waste management for educational institutions: A systems approach. *Waste Management & Research, 42*(4), 512–528. https://doi.org/10.1177/0734242X231145867

Okello, J., Kato, M., & Abalo, D. (2022). Media outreach and sustainable waste practices in Uganda. *Environmental Communication and Development, 4*(1), 88–101. https://doi.org/10.1080/17524032.2022.1723890.

Oliveira, L., Kumar, A., & Ndlovu, T. (2021). Cross-country analysis of sustainable solid waste management: Brazil, India, and South Africa. *International Journal of Waste Policy, 12*(2), 199–213. https://doi.org/10.1016/j.ijwp.2021.04.006

Olmsted, J. (2024). Research Reliability and Validity: Why do they matter?. *American Dental Hygienists' Association*, *98*(6), 53-57.

Olukanni, D. O., & Nwafor, C. O. (2019). Public-private sector involvement in providing efficient solid waste management services in Nigeria. *Recycling*, *4*(2), 19.

Oluwatayo, J. (2012). Validity and reliability issues in educational research. *Journal of Educational and Social Research, 2*, 391-400.

Onyemaechi, S. B., Akinyemi, P. A., Aribodor, D. N., Fajobi, O., & Okoro, N. E. (2022). Burden and determinants of open defecation: the reality across the Rural and urban areas of Osun state, southwest Nigeria. *Texila International Journal of Public Health.* https://doi.org/10.21522/TIJPH.2013.10.02.Art022.

Oribhabor, C. B., & Anyanwu, C. A. (2019). Research sampling and sample size determination: a practical application. *Journal of Educational Research (Fudjer)*, *2*(1), 47-57.

Osei-Mensah, J., & Amoah, D. (2022). Institutional gaps in school waste management in Ghana: Evidence from Eastern Region. *African Journal of Environmental Science*, *16*(3), 111–124. https://doi.org/10.4314/ajes.v16i3.7

Osei-Wusu, I., Amankwah, J., & Frimpong, E. (2021). Historical evolution of waste management in Ghana: From traditional systems to formal approaches. *African Journal of Environmental Science and Technology*, *15*(2), 68–78. https://doi.org/10.5897/AJEST2020.2961

Oteng-Ababio, M. (2019). Rethinking waste as a resource: Insights from Ghana. *Waste Management & Research*, *37*(10), 1033-1042.

Owusu-Agyemang, S., & Yeboah, F. (2021). Textile waste in school environments: Composition and management practices. *Environmental Sustainability*, *4*(3), 210–220. https://doi.org/10.1007/s42398-021-00167-2

Owusu-Ansah, P., Obiri-Yeboah, A., Nyantakyi, E. K., & Yeboah, S. (2022). Ghanaian inclination towards household waste segregation for sustainable waste management. *Scientific African*, *17*, e01335. https://doi.org/10.1016/j.sciaf. 20 22.e01335

Owusu-Ansah, P., Woangbah, S., Anim, B., & Azabu, F. (2021). Solid waste disposal management practices in Ghana, a case study of subin metropolis. *Environmental Management and Sustainable Development*, *10*(1).

Oyake-Ombis, L. (2016). Governance and waste management in urban Africa: Evidence from Kenya. *Waste Management & Research*, *34*(5), 421–428. https://doi.org/10.1177/0734242X16634177

Oyebode, O. J. (2024). Promoting integrated and sustainable solid waste management system in A developing city for public health and cleaner environment. *Journal of Harbin Engineering University*, *45*(01).

Palczynski, R. J., & Scotia, W. N. (2002). Study on solid waste management options for Africa. *African Development Bank*, *131*.

Pan, J., Zhang, L., & Liu, Y. (2024). Exploring waste separation using an extended theory of planned behavior: Evidence from student populations. *Frontiers in Psychology, 15*, 1345721. https://doi.org/10.3389/fpsyg.2024.1345721

Park, R. E., Burgess, E. W., & McKenzie, R. D. (1925). *The City*. University of Chicago Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Ruocheng, L., & Badolo, F. (2020). Governance constraints in urban solid waste management: A comparative assessment of developing nations. *Waste*

Management Reviews, *41*(3), 210–224. https://doi.org/10.1177/wmr.2020.00487

Sabatier, P. A., & Jenkins-Smith, H. C. (1993). *Policy change and learning: An advocacy coalition approach*. Westview Press.

Safo-Adu, G., Owusu-Adzorah, N., & Mensah, E. (2023). Solid Waste Characterisation and Recycling Potential: A Study in Secondary Schools in Kumasi Metropolis, Ghana. *Waste Management & Research*, *41*(3), 456-467. https://doi.org/10.1177/0734242X221147891.

Sarpong-Anane, A. B. (2015). Public perceptions, attitudes and challenges towards solid waste management in Ghana: The case of Mamobi community. *University of Ghana*. http://197.255.68.203/handle/123456789/21153.

Schübeler, P. (1996). *Conceptual framework for municipal solid waste management in low-income countries*. Swiss Centre for Development Cooperation in Technology and Management.

Schübeler, P., & Wehrle, K. (2018). *Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries*. UN-Habitat.

Schultz, P. W. (2014). Strategies for promoting pro-environmental behavior: Lots of tools but few instructions. *European Psychologist, 19*(2), 107–117. https://doi.org/10.1027/1016-9040/a000163

ScienceDirect. (2024). Bridging the gap: Transforming waste management awareness into action. *Waste Management*, *35*(1), 1-10. https://doi.org/10.1016/j.wasman.2024

Scott, R. E., Mensah, C. A., & Frimpong, S. (2017). Public-private partnerships for urban sanitation in Ghana: Challenges and policy implications. *Journal of Urban Management*, *6*(2), 37–44. https://doi.org/10.1016/j.jum.2017.09.001

Shukla, S. (2020). *Research Methodology and Statistics: concept of Population and Sample.* Ahmedabad: Rishit Publications.

Siedlecki, S. L. (2020). Understanding descriptive research designs and methods. *Clinical Nurse Specialist*, *34*(1), 8-12. https://doi.org/10.1097/NUR. 0000000000000493.

Singh, B., Singh, A., & Verma, N. (2025). From Awareness to Action: Evaluating Awareness, Attitude, Behaviour and Practices of Students towards Solid Waste Management in India. *Management Insight*, *21*(02), 114-131. https://doi.org/10.21844/mijia.21.2.9

Sridhar, M. K. C., & Hammed, T. B. (2017). Climate change mitigation and adaptation through strategic waste management options. *International Journal of Science and Engineering Investigations*, *6*(10), 1-7.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*, *48*, 1273-1296. https//:doi.10.1007/s11165-016-9602-2.

Tagoe, R. A., & Essel, C. (2023). Solid waste risks in science-based senior high schools: Laboratory waste assessment. *Ghana Journal of Science, Technology and Development*, *9*(1), 52–63. https://doi.org/10.4314/gjstd.v9i1.5

Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *International Journal of Academic Research in Management (IJARM), 53*, Pp. 28-36.

Tawiah, P., Appiah, B., & Akoto, S. (2022). Financing municipal waste services in Ghana: The case for inclusive tariff structures. *Public Finance and Management*, *22*(2), 69-84.

Theofanidis, D., & Fountouki, A. (2018). Limitations and delimitations in the research process. *Perioperative Nursing-Quarterly scientific, online official journal of GORNA*, *7*(3 September-December 2018), 155-163.

Timoshenko, A., & Berman, M. (2014). Funding challenges in school sanitation in Africa: A review of strategies. *Journal of Public Policy*, *36*(2), 235–249. https://doi.org/10.1017/S0143814X15000176

Timoshenko, A., & Berman, M. (2014). The United Nations Environment Programme and the United Nations Development Programme. In *Greening international institutions* (pp. 38-54). Routledge.

Tuu, M. B. (2023). *Solid waste management; knowledge, attitudes and behaviour of residents of Techimantia, Ahafo Region, Ghana* (Doctoral dissertation, University of Education, Winneba).

Uche, C. O., & Okonkwo, I. J. (2022). A quantitative analysis of plastic waste generation in Nigerian public schools. *International Journal of Waste Resources*, *12*(5), 1–10. https://doi.org/10.35248/2252-5211.22.12.498.

UN Ghana. (2023). *UN support to Ghana's sanitation strategy: National Open Defecation Free Action Plan*. https://ghana.un.org/en/249251-national-open-defecation-free-action-plan

UNEP. (2016). *Global Waste Management Outlook*. United Nations Environment Programme.https://www.unep.org/resources/report/global-waste-management-outlook

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education: All means all*. UNESCO Publishing. https://en.unesco.org/gem-report

UN-Habitat. (2022). *Integrated solid waste management in African cities*. UN-Habitat Publications.

UN-Habitat. (2023). *Global review of sustainable urban waste management practices*. United Nations Human Settlements Programme. https://unhabitat.org

UNICEF Ghana. (2023). *Water, Sanitation and Hygiene (WASH) in Ghana: 2023 Report*. https://www.unicef.org/ghana/reports/wash-2023

United Nations Environment Programme (2021). *Global Waste Management Outlook 2021*. UNEP.

United Nations Environment Programme (UNEP). (2021). *Waste Management Outlook for Africa*. https://www.unep.org/resources/report/waste-management-outlook-africa

United States Environmental Protection Agency (USEPA). (2020). *Solid Waste Management*. Retrieved from https://www.epa.gov/solid-waste-management on April, 10, 2025.

Uzorka, A., Akiyode, O., & Isa, S. M. (2024). Strategies for engaging students in sustainability initiatives and fostering a sense of ownership and responsibility towards sustainable development. *Discover Sustainability*, *5*(1), 320.

Valavanidis, A. (2023). *Global Municipal Solid Waste (MSW) in Crisis. Two billion tonnes of MSW every year, a worrying worldwide environmental problem*.

Water. A. (2023). *Sanitation infrastructure deficit in Ghana: A critical review*. *Water Research Ghana*, *4*(2), 22–35.

Willie, M. M. (2024). Population and target population in research methodology. *Golden Ratio of Social Science and Education*, *4*(1), 75-79. http://doi.org/10.52970/grsse.v4i1.405

Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, C., & Simonett, O. (2019). Global waste management outlook: Waste hierarchy in practice. *Waste Management & Research*, *37*(2), 95–112.

Wilson, D. C., Velis, C., & Cheeseman, C. (2019). Role of informal sector recycling in waste management in developing countries. *Habitat International*, *53*, 12-22.

Woko, F. C. (2019). Effect of poor management strategies of solid waste in secondary schools in Onelga, Rivers State Rivers State. *International Journal of Educational Research and Management Technology*, *4*(4), 103-115.

Yamtana, T. D., Duha, T., Riduan, A., Sabir, M., & Aprianto, M. C. (2023). *The effect of waste management policies, community participation, and waste treatment technology on environmental pollution levels in West Java*.

Yin, E. T., Kofie, N., & Atupare, P. A. (2021). Waste Management Practices as Local Order: Attitudes and Perceptions of Residents in Ashaiman, Ghana. *Yin, ET, Kofie, F., & Atupare, PA (2021). Waste Management Practices as Local Order: Attitudes and Perceptions of Residents in Ashaiman, Ghana. Journal of Sustainable Development in Africa*, *23*(2), 1-25.

Yoada, R. M., Chirawurah, D., & Adongo, P. B. (2014). Household perspectives on waste disposal systems and sanitation challenges in urban Ghana. *International Journal of Environmental Health Research*, *24*(5), 456–468. https://doi.org/10.1080/ijehr.2014.882214

Yousuf, T. B., & Rahman, M. A. (2022). Waste management: Challenges and prospects in the context of developing countries. *Journal of Environmental Management*, *316*, 115321. https://doi.org/10.1016/j.jenvman.2022.115321

Zaman, A. U., & Lehmann, S. (2013). The zero waste index: A performance measurement tool for waste management systems in a 'zero waste city' concept. *Journal of Cleaner Production, 50*, 123–132. https://doi.org/10.1016/j.jclepro.2012.11.041.

Zarewa, G. A. (2019). Barriers to effective stakeholder management in the delivery of multifarious infrastructure projects (MIPs). *Journal of Engineering, Project & Production Management*, *9*(2).

Zhang, Z., Chen, Z., Zhang, J., Liu, Y., Chen, L., Yang, M., & Yap, P. S. (2024). Municipal solid waste management challenges in developing regions: A comprehensive review and future perspectives for Asia and Africa. *Science of the Total Environment*, 172794.

Zhou, X., Wu, H., & Zhang, Y. (2020). Public perceptions and behavior towards waste classification: A case study in Shanghai, China. *Waste Management*, *105*, 246–254. https://doi.org/10.1016/j.wasman.2020.02.021.

Zurbrugg, C., Gfrerer, M., Ashadi, H., Brenner, W., & Kühr, R. (2012). Determinants of sustainability in solid waste management. The Gianyar Waste Recovery Project in Indonesia. *Waste Management*, *32*(11), 2126–2133. https://doi.org/10.1016/j.wasman.2012.03.014.

Zurbrugg, C., Gfrerer, M., Ashadi, H., Brenner, W., & Kuper, D. (2019). Determinants of sustainability in solid waste management systems. *Waste Management*, 87, 37–45.

APPENDICES

APPENDIX A

OBSERVATION CHECKLIST FOR DIFFERENT TYPES OF SOLID WASTE GENERATED

No.	Type of Solid Waste Generated	Frequency
1	Leftover food and fruit/vegetable peels (organic waste)	
2	Used notebooks and exercise books	
3	Examination papers and test scripts	
4	Empty water sachets	
5	Beverage plastic bottles and food wrappers	
6	Broken pens, rulers, and stationery plastics	
7	Discarded plastic bags and packaging materials	
8	Obsolete electronic devices (e-waste)	
9	Damaged metal furniture and cans	
10	Broken glass windows or lab apparatus	
11	Used sanitary pads and tissues	
12	Torn school uniforms and worn-out sportswear (textile waste)	
13	Discarded mattresses and dormitory bedding	
14	Administrative paper waste (letters, memos, printed reports)	
15	Packaging boxes and cartons (from deliveries/stores)	

Adapted from (UNEP, 2016; EPA Ghana, 2020)

APPENDIX B

QUESTIONNAIRE ITEMS ON STUDENTS' AWARENESS ABOUT SUSTAINABLE SOLID WASTE MANAGEMENT

No	Item	A (%)	N (%)	D (%)
1	I know what sustainable solid waste management means.			
2	I have been taught how to properly separate different types of waste in school.			
3	I am aware that improper disposal of waste can harm human health and the environment.			
4	I understand that some waste materials (e.g., plastic) take years to decompose.			
5	I can identify which materials can be recycled and which cannot.			
6	I am aware of any waste management policies or rules in my school.			
7	Posters or awareness materials on waste management are available in my school.			
8	My school regularly educates us on how to manage waste sustainably.			
9	I have seen or participated in waste segregation or recycling activities in my school.			
10	I believe students play a key role in helping schools manage waste effectively.			
11	I am aware of the dangers of burning solid waste (e.g., health and environmental risks).			
12	I know that electronic waste (e-waste) needs to be disposed of differently from regular waste.			
13	I believe waste management should be part of our school curriculum.			
14	I am aware that composting biodegradable waste helps improve soil fertility.			
15	I often talk with friends or classmates about the importance of waste management.			

Adapted from UNESCO (2014)

APPENDIX C

QUESTIONNAIRE ITEMS ON STUDENTS' PRACTICES TOWARDS SUSTAINABLE SOLID WASTE MANAGEMENT

No.	Item	A (%)	N (%)	D (%)
1	I regularly categorise my waste into biodegradable and non-biodegradable materials.			
2	I often recycle plastic, paper, or metal waste instead of disposing of them in the general bins.			
3	I use separate bins for different types of waste at school.			
4	I dispose of electronic waste (e.g., old phones or batteries) properly through designated collection points.			
5	I avoid burning waste and encourage others to do the same.			
6	I participate in school clean-up exercises or waste collection activities.			
7	I have been involved in environmental or waste management clubs or campaigns in school.			
8	I have practiced composting or disposing of food waste in a compost pit or bin.			
9	I properly dispose of waste when in public places like markets, schools, or parks.			
10	I have reported or discouraged improper waste disposal when I see it happening.			
11	I apply what I learn about sustainable waste management in my daily life.			
12	I talk to my peers or family members about better ways to manage household or school waste.			
13	I find it easy to practice sustainable waste management due to the availability of facilities (bins, signs).			
14	I take part in school projects or assignments that involve practical waste management activities.			
15	I believe I have a personal responsibility in helping improve waste management in my community.			

Adapted from UNEP (2020)

APPENDIX D

QUESTIONNAIRE ITEMS ON STUDENTS' ATTITUDES TOWARDS SUSTAINABLE SOLID WASTE MANAGEMENT

No.	Item	A (%)	N (%)	D (%)
1	I believe proper waste management is important for protecting the environment.			
2	I feel responsible for how I dispose of my waste, both at home and in school.			
3	I am motivated to separate waste into different categories (e.g., plastic, food, paper) before disposal.			
4	I think sustainable waste management should be the responsibility of everyone, not just school authorities.			
5	I find it convenient to follow proper waste disposal practices at school.			
6	I am discouraged from practicing proper waste management because my community does not do the same.			
7	I believe male and female students should equally participate in school cleaning and waste management tasks.			
8	I think teachers should set a good example in how they manage their own waste in school.			
9	I am more likely to manage my waste properly when teachers talk about its environmental impact.			
10	I feel that waste management is not a priority in my community.			
11	I believe it is acceptable to dump waste in open spaces when no bin is available.			
12	I think school campaigns and education about proper waste practices help change how students behave.			
13	I am interested in joining environmental or waste management clubs in school.			
14	I think laws about waste management should be strictly enforced in our communities.			
15	I believe public education and awareness programs can help change people's attitudes toward waste.			

Adapted from UNESCO (2014)