

**KNOWLEDGE AND PRACTICES OF IMPROPER SOLID WASTE DISPOSAL
AMONG UNDERGRADUATES IN THE UNIVERSITY OF BENIN**

BY

**Oluebube Miracle AKUNWANNE
EDU2102493**

**DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION
FACULTY OF EDUCATION
UNIVERSITY OF BENIN
BENIN CITY**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF HEALTH,
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STATE, NIGERIA.**

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CERTIFICATION

We the undersigned, hereby certify that this work was carried out by **Oluebube Miracle AKUNWANNE** with the matriculation number **EDU2102493** in the Department of Health, Safety and Environmental Education, Faculty of Education, University of Benin, Benin City, Edo State in partial fulfillment of the requirement for the award of Bachelor of Science (BSc.Ed) degree in Environmental Education.

Mrs. T. A Egbon
(Project Supervisor)

Mrs. B. H Enabulele
(Project Coordinator)

Date

Date

Dr. O. H. Obasuyi
Ag. Head of Department

Date

DEDICATION

I dedicate this work first to Almighty God, the giver of wisdom and knowledge, for sustaining me with strength, health, and grace throughout this study. I also dedicate it to my wonderful parents for their endless sacrifices, encouragement, and prayers, which gave me the courage to complete this work.

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ABSTRACT

Solid waste management remains a pressing concern in developing nations, especially within Nigerian universities where high population densities and inadequate waste infrastructure worsen the problem. The University of Benin, as a micro-community, generates various wastes including plastics, food remnants, and hazardous materials. While students often have knowledge of the dangers of improper waste disposal, many still engage in practices such as littering, open dumping, and burning. This knowledge–practice gap is influenced by peer behavior, poor enforcement of regulations, and insufficient awareness programs. The literature review provided a conceptual and theoretical basis for the study, drawing on frameworks such as the Theory of Planned Behavior, the Knowledge-Attitude-Practice model, and the Value-Belief-Norm theory to explain waste management behaviors. It also examined the concept of solid waste, types and sources, implications of improper disposal, student practices, and relevant policies and regulations in Nigeria. The review emphasized that while students may possess awareness, factors such as inadequate facilities, weak institutional support, and social norms hinder effective practice.

The methodology adopted was a descriptive survey research design. The study population comprised 43,679 undergraduates of the University of Benin, from which a sample of 240 was selected using a multi-stage sampling technique. A structured questionnaire titled 'Knowledge and Practices of Improper Solid Waste Disposal' served as the research instrument. The instrument was validated by experts in the field and its reliability established at 0.73 using Cronbach Alpha. Data were collected personally by the researcher and analyzed using descriptive statistics such as frequency counts, percentages, and mean scores to answer the research questions. This approach provided an effective framework for assessing both knowledge and practices of undergraduates regarding solid waste management.

The analysis of results revealed that most undergraduates had high knowledge of proper waste disposal but their practices often fell short, as many admitted to dumping waste in drains, classrooms, and unauthorized sites. Contributing factors included inadequate waste bins, irregular collection, and poor enforcement of rules. The discussion highlighted that knowledge alone does not guarantee sustainable practices, aligning with findings from earlier studies. The summary emphasized the persistence of improper disposal despite awareness, the conclusion underscored the knowledge–practice gap, and the recommendations called for more environmental education campaigns, provision of adequate sanitation facilities, active student engagement in waste management initiatives, and stronger enforcement of waste regulations.

CHAPTER ONE

INTRODUCTION

Background of the Study

Solid waste management has become a major public health and environmental concern in urban area in developing countries. Solid wastes are unwanted wastes comprise all the wastes arising from human and non-human activities that are normally solid, discarded as unwanted or useless. Solid waste is any discarded solid materials from residential activities that causes environmental, social and health problems. Waste has been defined as “any substance or object which the owner no longer wants at a given time and space and which has no current or perceived market value” (World Health Organization [WHO], 2001).

Solid waste management remains a pressing environmental and public health issue across many developing countries, including Nigeria. Rapid urbanization, population growth, and the expansion of educational institutions have significantly increased the volume and diversity of waste generated daily. Universities, as microcosms of larger societies, generate a variety of solid waste materials, ranging from food remnants and plastics to paper, electronics, and hazardous laboratory waste. Despite the presence of policies and regulations aimed at waste control, the level of awareness and the waste disposal practices of undergraduates have raised concerns about sustainability and environmental safety (Mbama, Otegbulu, Beverland, & Beattie, 2023).

In Nigerian Universities, the challenges of waste disposal are further exacerbated by inadequate infrastructure, insufficient waste bins, irregular collection services, and poor waste segregation systems. Undergraduates, who constitute a significant portion of the campus population, play a crucial role in the generation and disposal of waste. However, several studies have suggested that students often lack the necessary knowledge and motivation to adopt appropriate waste management practices, leading to the proliferation of improper disposal methods such as open dumping, burning, and littering (Adeleke et al., 2017; Olufemi & Adewoye, 2019). These practices not only contribute to environmental degradation but also pose significant health risks, particularly in densely populated residential areas on campuses. However, many universities lack comprehensive and organized systems for waste segregation, recycling, and proper disposal (Ihuoma & Onyebuchi, 2017). The situation is further compounded by inadequate environmental education, limited infrastructure, and weak enforcement of sanitation policies within campus environments.

The knowledge–practice gap has been identified as a critical issue in understanding environmental behavior. While some students may possess basic knowledge of the health and environmental consequences of improper waste disposal, this does not always translate into responsible action. Factors such as peer influence, lack of environmental education, and inadequate enforcement of campus waste policies contribute to the persistence of poor disposal practices (Nwankwo & Abude, 2024).

Furthermore, the absence of structured awareness programs in many universities leaves a gap in the students' understanding of the long-term implications of their actions on waste handling.

Addressing this issue requires a comprehensive understanding of both the level of knowledge and the prevailing practices among undergraduates. Such understanding can inform the design of effective interventions that promote sustainable behavior, enhance waste management infrastructure, and instill a culture of environmental responsibility within the university system (Salami, Akanbi-Gada, Iyanda, & Ishola, 2024). As Nigeria continues to grapple with environmental challenges, improving waste management in institutions of higher learning is not only necessary for campus sanitation but also essential for fostering a generation of environmentally conscious citizens.

Given the critical role of students in waste generation and the observed gaps in their knowledge and practices, this study seeks to assess the level of awareness, attitudes, and behaviors relating to solid waste disposal among undergraduates in Nigerian universities. The findings of this research are expected to contribute to policy recommendations and the development of targeted educational programs aimed at enhancing sustainable waste management on campuses.

Studies have shown that while many Nigerian undergraduates possess basic knowledge of environmental issues, this does not always translate into positive waste management behavior (Afon, 2012). The Knowledge–Attitude–Practice (KAP) framework has been widely used to explore this gap, highlighting the importance of combining environmental knowledge with

attitudinal change and practical support for behavior modification (Owojori, Mulaudzi, & Edokpayi, 2021).

Barriers such as lack of waste bins, poor waste collection schedules, and limited student engagement in environmental initiatives often hinder the development of a sustainable waste culture on campuses.

The University of Benin, located in Edo State, Nigeria, is one of the nation's prominent federal universities, attracting students from various socio-cultural backgrounds. The daily academic, residential, and recreational activities on campus result in the generation of different forms of solid waste, including paper, plastics, food remnants, and other non-biodegradable materials. When these wastes are not disposed of properly, they accumulate in drainage channels, open spaces, and surrounding environments, leading to pollution, flooding, and public health risks (Igbinomwanhia, 2011).

The attitudes and practices of students toward solid waste disposal are crucial factors influencing the effectiveness of waste management on campus. A lack of awareness or insufficient knowledge about proper waste handling and environmental consequences may lead to negative behaviors such as indiscriminate dumping and littering (Ifegbesan, Ogunyemi, & Rampedi, 2017). Moreover, inadequate facilities such as waste bins, poorly coordinated waste collection systems, and insufficient enforcement of environmental policies can further hinder proper waste disposal practices.

Despite efforts by university management to implement waste management initiatives—including designated disposal points and awareness programs—the visible signs of improper waste handling suggest that more needs to be done. Research has shown that there is often a significant gap between knowledge and practice: even when students are aware of the consequences of poor waste management, they may still engage in harmful practices due to convenience, apathy, or social norms (Ayodeji, Ifegbesan, Ogunyemi, & Rampedi, 2017)

Understanding the current level of knowledge and actual practices among undergraduates is essential for developing effective and sustainable waste management strategies. By identifying key factors that influence behavior, including knowledge gaps, attitudes, and perceived barriers, targeted interventions can be designed to promote responsible environmental behavior and foster a culture of sustainability within the university community. This study, therefore, seeks to examine the knowledge and practices of improper solid waste disposal among undergraduates in the University of Benin. The goal is to provide evidence-based recommendations that will support policy development, environmental education, and infrastructural improvements aimed at enhancing solid waste management on campus.

Statement of the Problem

Improper waste disposal remains a pressing environmental issue, particularly within university campuses where high population density and inadequate waste management practices often lead to unsanitary conditions. As a result of increased urbanization and industrialization that we have experienced over the decades one would be convinced that we have attained a great deal of

prosperity in the department of environmental protection, sustainability and progression as well, we ought to have gotten an understanding of our environment and how to better improve and how to improve a better living condition and how to effectively and efficiently manage wastes in the society at large through appropriate measures such as, adequate funding, effective legislations and innovations, proper waste containment and plans and facilities. Increased urbanization and infrequent environmental sanitation exercises, urban residents dump waste carelessly or haphazardly anywhere they deem fit. Such controversial tendencies and attributes would seem incomprehensible; if we desire to live in a beautiful environments. Despite the concern of individuals and government about improper solid waste management students and workers are faced with indiscriminate dumping of waste, refuse and poor solid waste management. Solid waste management remains a significant environmental challenge globally, and university communities are no exception. At the University of Benin, the increasing student population has led to corresponding rise in the amount of solid waste generated daily. However, despite the availability of waste disposal systems, improper solid waste disposal practices persist among undergraduates. These behaviors not only contribute to environmental degradation but also pose health risk and also affect the aesthetic quality of the campus. There appears to be a gap between students' knowledge of proper waste management and the actual practices. Understanding the extent of their awareness and the factors influencing their disposal habits is critical for developing effective management strategies.

Therefore, this study seeks to investigate the knowledge and practices related to improper solid waste disposal among undergraduates at the University of Benin, aiming to identify key areas for intervention promote a more sustainable campus environment. The ideal solid waste management is geared towards social, environmental and health development but because of its planned nature the practice has not been effective as it ought to be, thus the main concern of this study is to identify the problem of improper solid waste management among undergraduates in the University of Benin and also find out solutions to the problem.

Research Questions

1. What is the level of knowledge regarding proper solid waste disposal among undergraduates at the University of Benin.
2. What are the common practices of solid waste disposal among undergraduates at the University of Benin.
3. What factors influence improper solid waste disposal practices among undergraduates?
4. What measures can improve proper solid waste disposal among undergraduates at the University of Benin?

Purpose of the Study

Specifically the study seeks to:

1. Assess the level of knowledge regarding proper solid waste disposal among undergraduates at the University of Benin.

2. Identify the common practices of solid waste disposal among undergraduates at the University of Benin.
3. Examine the factors that influence improper solid waste disposal practices among undergraduates.
4. Explore possible measures that can enhance proper solid waste disposal among undergraduates at the University of Benin.

Significance of the Study

This study is significant because it emphasizes the importance of proper waste management with the University of Benin environs. By assessing the knowledge and practices of undergraduates, the research will provide a useful insights into the gaps between awareness and behavior regarding waste disposal. The findings will help the school authorities, environmental units and policy makers develop targeted strategies to promote better waste management practices among students. The findings of this study will also form the basis for further investigations in this area of study.

Moreover, the study will contribute to environmental sustainability efforts on campus by encouraging practices that reduces hazard and health issues. It will also serve as a reference for future research on waste management in other higher institutions and create awareness among students about their role in maintaining a clean and healthy environment.

Finally, it will help in the prevention, reduction and control of disease associated with solid waste, blockage of drainage system, water pollution and food poisoning.

Scope and Delimitation of the Study

This study will cover knowledge of the undergraduates of the University of Benin on solid waste management, assess their perception on solid waste management, identify their solid waste practice[s], and how this practices affect the university community. The study is however delimited to undergraduates of the University of Benin (2024/2025) academic session.

Definition of Terms

Solid Waste: This means any discarded material that is no longer useful or that is unwanted, including paper, plastic, food waste, cans, and other waste generated by human activities.

Solid Waste Disposal: The process of collecting, segregating, transporting, treatment and discarding solid waste in a safe and environmentally friendly manner.

Improper Solid Waste Disposal: This is the act of disposing waste in an unsafe, unauthorized, or environmentally harmful manner, such as open dumping, littering or burning waste in undesignated places.

Knowledge: The level of awareness, understanding, and information students have regarding proper method of solid waste management.

Practice: The actual habit or behavior of students regarding how to dispose their solid waste on campus.

Undergraduates: Students who are pursuing their first degree [bachelor's degree] at the University of Benin and have not yet graduated.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The review of related literature will be discussed under the following sub-headings;

- Theoretical framework
- Concept of Solid Waste and Solid Waste Disposal
- Improper Solid Waste Disposal
- Knowledge of Solid Waste Management
- Practices of Solid Waste Disposal Among Students
- Health and Environmental Implications of Improper Disposal
- Policies and Regulations on Solid Waste Management
- Summary of Literature Review

Theoretical Framework

To investigate the issue of improper solid waste disposal among undergraduates, several behavioral and social science theories offer useful insights. One of the most widely applied is the Theory of Planned Behavior (TPB), developed by Icek Ajzen in 1991. This theory proposes that an individual's behavior is primarily determined by their intention to perform that behavior, which in turn is shaped by three factors: their attitude toward the behavior, the subjective norms they perceive (i.e., the social pressures they feel), and their perceived behavioral control (i.e., how easy or difficult they believe the behavior is to perform). In the context of waste management, even students with positive attitudes toward recycling may fail to act if they

believe that their peers don't care or if they find it inconvenient due to a lack of proper disposal facilities.

Another relevant framework is the Knowledge-Attitude-Practice (KAP) model, which suggests that an individual's knowledge about a subject influences their attitudes, which then shape their actual behavior. This model is often used in public health and environmental education and is particularly useful for identifying gaps between awareness and action. For example, many students may be aware of proper waste disposal methods but still engage in improper practices due to weak attitudes or habitual behavior.

The Value-Belief-Norm (VBN) theory also offers a deeper psychological perspective, emphasizing the role of personal values and moral norms in influencing environmental behavior. This theory suggests that individuals who hold strong ecological values and a sense of moral responsibility are more likely to engage in environmentally responsible behaviors, even when external pressures or conveniences are lacking. Among undergraduates, promoting personal responsibility and awareness of environmental consequences can help foster better waste management practices.

Furthermore, Social Cognitive Theory (SCT) highlights the reciprocal relationship between personal factors, behavioral patterns, and environmental influences. It underscores the importance of observational learning, self-efficacy, and the physical and social environment in shaping behavior.

Lastly, Environmental Determinism, though more structural in orientation, provides insight into how the physical campus layout and availability of disposal infrastructure influence student behavior. When bins are not clearly marked or conveniently located, even motivated students may dispose of waste improperly.

Concept of Solid Waste and Solid Waste Disposal

Waste

Waste has Latin roots from the 'vastum' meaning empty or desolate. The word originally had association with nature, as it referred to land where nothing could be grown or wastelands. Waste is a substance which is no longer suited for its intense use. It is any discarded material that is useless and unwanted by human, animals and plants in the components of the ecosystem (Uchegbu, 2002; Adewole,2009).

Solid Waste

The spread of solid waste everywhere has a clear negative impact on human health and the environment due to its dangerous effects. Hazardous impacts on human health, society, and the economy have been reported, so a large number of researchers are interested in studying how to collect, sort, recycle and manage them to reduce environmental pollution as much as possible. Solid waste is defined as any material that is thrown away by a person because it is no longer needed and is no longer usable by that person at that time, despite the possibility of benefiting from those materials thrown away in another place and at another time.

Solid waste is defined by the United States Environmental Protection Agency as useless, unwanted or discarded materials with insufficient liquid content to be free from flowing. It is also considered as any superfluous or rejected solid material consisting of garbage, rubbish, ashes, street sweeping, Dead animals, abandoned automobiles, industrial waste, demolition and construction materials, agricultural wastes and mining industrial waste that do not decompose. (Herbert, 2007).

Solid Waste Disposal

Solid waste refers to any garbage, refuse, or unwanted material that is discarded as a result of human activities and is not liquid or gaseous in nature. It encompasses a broad range of items including household waste, industrial by-products, construction debris, and agricultural waste (UNEP,2023). In and around campus, plastic bottles, paper, packaging materials, and other forms of waste are generated from both academic and residential activities.

Solid waste disposal refers to the methods and processes used to collect, transport, treat, and finally dispose of these solid materials in a manner that is safe for both humans and the environment. Proper disposal practices are essential for maintaining public health and ensuring environmental sustainability (World Health Organization [WHO], 2022). Some common methods of disposal include landfilling, incineration, composting, and recycling. However, in many developing countries, improper methods such as open dumping and uncontrolled burning are still prevalent, leading to serious environmental and health concerns (Ajani & Okunlola, 2021).

Improper solid waste disposal, particularly in densely populated areas like university campuses, can result in clogged drainage systems, breeding grounds for disease vectors, and overall degradation of the learning environment. This makes it crucial to understand not just the methods of disposal, but also the knowledge and attitudes of individuals involved in the waste generation process—particularly undergraduates, who represent a significant portion of campus population (Ezeudu, Ugochukwu, & Eboatu, 2023). Understanding the concept and implications of solid waste disposal provides a foundation for assessing current waste management practices.

Classification of Solid Wastes

There are several different ways of classifying solid waste. As you have seen, one way is to classify it by where it is generated. Another way is based on whether the waste is biodegradable or not.

- Biodegradable solid wastes are those that can be broken down (decomposed) into their constituent elements by bacteria and other micro-organisms. Food waste, manures and waste from producing crops are the main biodegradable wastes. If the decomposition process takes place in the absence of air (anaerobically), methane gas can form. Methane is a powerful greenhouse gas and can explode if enough of it accumulates and an ignition source (such as an electrical spark) is present. The decomposition (breakdown) may also produce offensive and irritating smells. However controlled anaerobic decomposition can produce biogas – a useful fuel for heating, cooking and even power generation that you learned about in Study Session 5– as well as fertilisers and soil conditioners. Waste that decomposes in the presence of an adequate air

supply (aerobically) under controlled conditions can produce compost, which can be used to improve the quality of soils.

- Non-biodegradable (also sometimes called inorganic) solid wastes are those that do not decompose by microbial action. These wastes include plastic containers, scrap metal, food and drink cans and plastic bags. Materials in solid wastes can also be classified as combustible or non-combustible, depending on whether they will burn or not. Depending on the inherent dangers associated with its physical and chemical properties, solid waste can be classified as either hazardous or non-hazardous. Hazardous wastes substantial or potential threats to public health or the environment. For example, toxic, infectious and corrosive (acidic or alkaline) substances are all likely to be classed as hazardous. Nonhazardous wastes are those that do not possess hazardous characteristics, although they can still be harmful to people or the environment.

Types of solid Waste

- Household (residential) waste: It often depends on the daily activities of human beings. Therefore, the economic level and the rate of income are among the main factors in the disposal of household (residential) waste. Residential waste constitutes the largest proportion of solid waste in urban areas, as it constitutes 55%–65% of solid waste. Food residues constitute the main component of household waste, as well as varying proportions of food waste, paper, glass, plastic, leather, metals, and spent electronic devices.

- Industrial waste: What is meant by "industrial" is that which is generated by various industries and that is thrown into the environment is a solid, liquid, or gaseous state. They are of a

continuous and diversified nature with the diversity of industries such as chemical industries, metals and leather industries, food industries, and other by-products that lag behind manufactured materials such as peels of fruits and vegetables.

- Solid commercial waste: It is commercial waste that is generated from commercial centers such as offices, restaurants, markets, and hotels. It is very similar to household waste in term of waste quality, except that it differs in terms of the proportion of components and the amount of waste produced. Commercial waste resulting from office work includes large quantities of paper, warehouse waste, and large quantities of cartons and packaging boxes, while restaurants and markets contain a large proportion of food waste.

- Municipal services waste: It is defined as waste collected by municipal institutions and generated by residential homes, shops, and government institutions such as schools, hospitals, and others. It includes waste from garages, squares, and parks, and waste from street sweeping. The main components of municipal waste are paper, cardboard, and organic materials such as food waste and garden plants, plastics, metals, glass, and textiles.

- Construction and demolition waste: It is the materials resulting from the demolition and construction of facilities and buildings. They are inert materials and do not pose a danger to human health. Therefore, it can be used in backfilling, road construction, and others. But if it is thrown randomly, it leads to a distortion of the general view of the area, and if it is placed on agricultural lands, it will lead to the loss of these lands. The rubble resulting from construction, restoration, and demolition operations constitutes the constituents of construction waste. An

implicit environmental problem, and to reduce its risks, it is necessary to start first from the project design phase, as materials are selected for construction that allows their use and/or reuses in new projects and the development of objectives and methods for importing materials.

- Medical waste: It is defined by the World Health Organization (WHO) as clinical waste resulting from the treatment of patients in research centers and medical facilities. It is classified as hazardous waste and accounts for approximately 10–25% of the total waste based on its source, type, and risk factors associated with its handling, storage, transportation, and disposal. Contaminated waste includes pathogenic agents, sharp equipment, surgical waste, chemicals, and radioactive waste . The most prominent waste product of medical hospitals is plastic. This includes paws, syringes, plastic tubes, feeder bags, blood bags, and others. Second, glass: It includes glass containers and bottles used in the preservation of pharmaceutical materials, as well as all-glass instruments used in analytical laboratories. Third, fabric, including cotton, gauze, and all the bandages used in the process of tying wounds and fractures (bandage) and others. Fourth, metals, which include metal needles, cans, staples, scalpels, and others. Fifth, organic materials include parts of the human body organs that result from cutting and amputations, as well as waste products resulting from the birth process, such as the placenta. Sixth, paper and cardboard, including papers and forms for medical examination and treatment, and boxes in which medicines, devices, and medical supplies are packed. Seventh, food waste, including all waste resulting from the process of cooking food, as well as the remains of meals provided to sleeping patients and others.

- Hazardous waste: It is waste that is usually industrial or medical and has negative effects on human health and the environment due to its chemical, physical, and biological properties. This includes clinical waste from therapeutic activities and waste resulting from the manufacture of any pharmaceutical preparations, medicines, organic solvents, inks, dyes, paints, pesticides, and fertilizers. It can be said that hazardous wastes (solid, liquid, and gaseous) are those that are legally allowed to be treated in waste complexes and treated in classified units approved by local authorities.
- Non-hazardous (benign) waste: It is a group of materials that do not have serious environmental problems and, at the same time, are easy to dispose of in an environmentally safe manner. They include household, commercial, and non-hazardous factory waste.
- Green waste: It includes plant pruning products, which are important, especially as they can be used to produce a good soil conditioner or cubes used in energy production incinerators.
- Agricultural solid waste: All waste and residues result from all agricultural activities, including plant waste, including plant residues, leaves, etc., and animal waste, including animal secretions and slaughterhouse waste. Waste from the agricultural sector usually consists of crop residues, animal manure, and unwanted agricultural chemicals. The process of estimating the amount of waste generated by the agricultural sector is further complicated by the fact that large quantities of animal waste are used directly as organic fertilizer for the land. It is estimated that between 20% and 50% of animal waste is used in this way within the European Union. It is the waste

resulting from various types of agricultural activity and starts from the initiation and confirmation processes, which are the activities of crop collection .

- Street waste: This waste is represented by the dust accumulated on the sidewalks, leaves of trees, discarded water bottles, and the like, which are collected from the city's streets and alleys. However, sometimes such waste is left, especially the dust, which often takes part of the sidewalk into the street.
- Treatment Plant Waste: These include wastes resulting from water treatment plants and sewage treatment plants, as well as industrial waste treatment plans.
- E-Waste (Electronic Waste): Consists of discarded electrical or electronic devices like computers, phones, batteries, and televisions.

Source of solid wastes

Every day, significant amounts of solid waste are disposed of in landfill sites, originating from various sources such as households, offices, industries, and agricultural operations. If improperly managed, these sites can emit unpleasant odors and contribute to air and soil pollution, posing serious risks to human health, wildlife, and the surrounding environment.

Residential areas are one of the primary sources of solid waste. Common household waste includes food scraps, paper, plastics, glass, leather, yard waste, metals, ashes, and special items like used electronics, tires, and batteries. These wastes are usually collected in bins and later removed by waste management services (Hoornweg & Bhada-Tata, 2012).

Industrial activities contribute significantly to solid waste through operations in manufacturing, construction, and chemical production. Such wastes include packaging materials, by-products, hazardous substances, and demolition debris. Because of their large volumes and potentially hazardous characteristics, industrial wastes require specialized handling and disposal approaches (Wilson, Velis, & Cheeseman, 2012).

Commercial sources such as markets, restaurants, hotels, and office buildings also generate diverse waste streams. These include plastics, paper, food waste, cardboard, glass, and electronic items. The waste composition often depends on the type of commercial activity involved (UNEP, 2016).

Institutional sources, including universities, schools, prisons, and government buildings, generate waste such as paper, food waste, plastics, and electronic materials. Institutions like universities, in particular, can generate a significant amount of solid waste due to their population size and range of activities (Nabegu, 2011).

Construction and demolition activities produce waste such as steel, concrete, wood, and other debris. These materials, though largely inert, can lead to environmental problems when dumped indiscriminately. According to Jones(1905, developing countries have no problems in major malustoty buildings in construction and demolition debris. He however, asserts that activities related to small buildings, particularly where the construction materialsbis clay soil can contribute significantly to the waste in municipal refuse.

Municipal services, including street sweeping, park and beach maintenance, and wastewater treatment, also contribute to urban solid waste. This includes organic waste, plastics, garden trimmings, and sludge from treatment plants (Hoorweg & Bhada-Tata, 2012).

Agricultural sources, such as farms, orchards, and dairies, produce waste including crop residues, pesticide containers, and spoiled food. These materials can be hazardous and contribute to environmental degradation if not properly managed (UNEP, 2016).

Biomedical waste comes from hospitals, clinics, and laboratories. It includes used syringes, bandages, gloves, chemicals, and pharmaceutical waste. These materials are particularly hazardous and require careful disposal to prevent infection and environmental contamination (WHO, 2022).

Improper Solid Waste Disposal

Improper solid waste disposal refers to the indiscriminate dumping, burning, or abandonment of solid waste in unauthorized or inappropriate locations without due consideration for environmental and public health standards. In many developing countries, including Nigeria, poor waste management practices are a pressing concern, particularly in densely populated areas like university campuses. Despite the existence of waste collection systems, a significant portion of solid waste ends up in open spaces, drainage systems, roadsides, and waterways due to inadequate infrastructure, poor enforcement of environmental laws, and low levels of environmental awareness among the population.

In the context of university environments such as the University of Benin, improper solid waste disposal may arise from students and staff indiscriminately dumping waste in unauthorized locations due to insufficient waste bins, irregular waste collection services, and lack of sensitization on best practices. Common improperly disposed waste includes food remnants, plastic bottles, paper, nylon bags, and electronic waste. This practice not only degrades the aesthetic quality of the campus but also creates breeding grounds for pests such as rodents, flies, and mosquitoes, which are vectors of diseases such as malaria, typhoid, and cholera (WHO, 2022).

Furthermore, when solid waste blocks drainage systems, especially during the rainy season, it increases the risk of flooding and environmental contamination. Flooded areas can serve as vectors for waterborne diseases, affecting the health and productivity of students and staff (Adewumi & Ajibola, 2015). The open burning of waste, often employed as a quick disposal method, releases harmful gases such as carbon monoxide, dioxins, and furans into the atmosphere, contributing to air pollution and climate change (UNEP, 2016; WHO, 2018).

Improper disposal practices also have long-term consequences on soil and water quality. Leachate from decomposing waste can seep into the ground and contaminate groundwater sources, posing risks to human and animal health (Gupta & Yadav, 2015). In Nigeria, multiple studies have confirmed this threat—for instance, research in Benin City revealed that heavy metals like lead, nickel, and iron in groundwater around dumpsites exceeded safe limits, demonstrating contamination from leachate plumes (Omorogieva & Andre-Obayanju, 2020).

Similarly, assessments in Rivers State showed elevated levels of various pollutants, including heavy metals and chemical oxygen demand, indicating serious groundwater pollution near dumpsites (Ugbebor & Ntesat, 2019).

In addition, the visual pollution caused by littered environments may discourage learning and reduce quality of life on campus. The psychological impact of unclean surroundings can negatively influence academic concentration and overall student well-being (Evans, 2003).

The persistence of improper solid waste disposal is often linked to gaps in policy implementation, inadequate funding for waste management infrastructure, and poor stakeholder engagement. Addressing this issue requires a multi-pronged approach including proper sensitization, provision of adequate waste bins, regular waste collection, enforcement of environmental regulations, and active participation from students, staff, and waste management authorities

Examples of Improper Waste Disposal

- **Littering**

Littering is one of the most common forms of improper waste disposal. When waste such as plastic bottles, wrappers, or cigarettes are carelessly discarded on the ground instead of in a bin, it creates significant environmental issues. In fact, about 70% of litter is food wrappers and packaging in the UK. Cigarette butts are also the most littered item in the world, with 4.5 trillion cigarette butts littered around the world every year. Litter can clog drains, pollute bodies of water, and disrupt natural habitats. Sea animals, in particular, are often affected, as they may ingest

plastic waste or become entangled in it. Properly disposing of waste in designated bins can prevent these problems and protect aquatic ecosystems.

- **Illegal Dumping**

Illegal dumping occurs when individuals or businesses discard waste in unauthorised areas, such as forests, vacant sites, or along roadsides. This practice can lead to severe consequences, including air pollution and contaminated water sources. Hazardous materials, such as chemicals or electronics, can leach toxins into the soil and nearby water sources, threatening human health and wildlife. Communities suffer from the aesthetic and financial burden of cleaning up these illegal dumping sites, underscoring the importance of proper waste disposal.

- **Avoiding Recycling**

Failing to recycle materials that could be reused or repurposed contributes to the depletion of natural resources and the increase of waste in landfills. When recyclable materials like cardboard, paper, or electricals are improperly disposed of, they often end up in incinerators or landfills. At these sites, they release greenhouse gases such as methane and carbon dioxide. By avoiding recycling, individuals and businesses miss an opportunity to reduce their carbon footprint and contribute to a more sustainable future.

Common Practices of Solid Waste Disposal in Developing Countries

Solid waste management remains a major challenge in many developing nations due to factors such as rapid urban growth, weak infrastructure, and inadequate financial resources. As a result,

informal and improper waste disposal methods are widespread, creating serious threats to both the environment and public health (Guerrero, Maas, & Hogland, 2013).

One of the most common practices is open dumping, where refuse is deposited in streets, vacant plots, rivers, and open spaces without treatment or regulation. This approach is widespread because of limited access to engineered landfills and poor waste collection systems. Such dumpsites serve as breeding grounds for pests and disease vectors, which contribute to outbreaks of illnesses like cholera, malaria, and typhoid (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018).

Another frequent practice is open burning, used particularly to reduce the volume of plastics and organic waste. However, this method releases hazardous emissions such as dioxins, furans, and particulate matter, which degrade air quality and endanger human health (UNEP, 2019).

Informal recycling is also common, where waste pickers or scavengers collect and sell recyclable items. While this activity contributes to resource recovery, it is often carried out without protective equipment, exposing workers to sharp objects, pathogens, and toxic substances (Wilson, Velis, & Cheeseman, 2015).

Efforts to improve waste management include community-based initiatives promoting source separation, increased access to waste bins, and public education campaigns. However, these are often limited by funding and governance issues (Guerrero et al., 2013).

Solid Waste Management

Solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal

solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

Solid waste management (SWM) is the comprehensive process of collecting, transporting, processing, recycling, or disposing of solid waste materials in a manner that minimizes their impact on health, the environment, and aesthetics. It includes all activities that seek to manage waste generated from residential, commercial, industrial, institutional, and other sources

Objectives of Solid Waste Management

The primary objectives of solid waste management are to:

- Protect public health and the environment.
- Minimize pollution of land, air, and water.
- Promote recycling, reuse, and waste reduction.
- Enhance the aesthetic quality of urban and rural areas.
- Conserve natural resources through sustainable practices.

Waste Generation

The process begins with waste generation, which is the creation of waste as a result of daily human activities, including cooking, packaging, manufacturing, and consumption. The amount and type of waste produced depend on several factors such as population size, economic

activities, lifestyle, and consumption patterns. In developing countries, waste is often generated at a higher rate in urban centers due to increased industrialization and population density.

Storage

Once waste is generated, the next step is storage and segregation at the source. Waste should be stored in covered bins to prevent exposure to pests and reduce the spread of disease. Segregating waste into different categories—such as organic, recyclable, non-recyclable, and hazardous—is essential for efficient management. For example, separating biodegradable kitchen waste from plastics and metals can make composting and recycling easier and more effective

Collection and transportation.

Collection and transportation follow as the next important steps. Waste is collected from various points by municipal authorities or private waste contractors and transported to designated processing or disposal sites. In many developing countries, irregular or inefficient collection services lead to the accumulation of waste in streets, drainage systems, and open spaces, contributing to environmental degradation and public health hazards.

Processing and recovery

Treatment and processing of waste aim to reduce its volume and potentially recover usable resources. Organic waste can be composted to produce nutrient-rich soil amendments, while recyclable materials such as paper, plastic, glass, and metals can be sorted and sold to industries for reuse. Advanced methods like waste-to-energy (WTE) technologies are used in some regions

to convert non-recyclable waste into electricity or heat. However, these technologies require substantial investment and proper regulation.

Disposal

The final step is disposal, which is often the least preferred but necessary component of the waste management chain. Landfilling remains the most common disposal method, especially in developing countries. Ideally, landfills should be engineered with liners and leachate collection systems to prevent soil and water contamination. However, many landfills in low-income regions operate as open dumps, posing significant environmental and health risks. Incineration, another disposal method, involves burning waste at high temperatures to reduce its volume, although it can lead to air pollution if not properly controlled.

Reduction and Incineration

In most towns and cities in developing countries, it is evident that waste are indiscriminately dumped opening on lands and in gutters. Those in the peri-urban and rural communities usually burn there waste . This practice causes air Pollution and respiratory related diseases.

Effective Waste Management Practice

Effective waste management practices are crucial for minimizing the environmental impacts of waste generation. These practices involve the proper handling, storage, transportation, treatment, and disposal of waste and much more.

- **Recycling:**

Recycling refers to recovery of useful materials such as glass, paper, plastics, wood, and metals from the waste stream so they may be incorporated into the fabrication of new products. With greater incorporation of recycled materials, the required use of raw materials for identical applications is reduced. Recycling reduces the need of natural resource exploitation for raw materials, but it also allows waste materials to be recovered and utilized as valuable resource materials. Recycling of wastes directly conserves natural resources, reduces energy consumption and emissions generated by extraction of virgin materials and their subsequent manufacture into finished products, reduces overall energy consumption and greenhouse gas emissions that contribute to the global climate change, and reduces the incineration or landfilling of the materials that have been recycled. Moreover, recycling creates several economic benefits, including the potential to create job markets and drive growth.

- **Reuse:**

Reuse is the action or practice of using an item, whether for its original purpose (conventional reuse) or to fulfill a different function (creative reuse or repurposing). It should be distinguished from recycling, which is the breaking down of used items to make raw materials for the manufacture of new products. Reuse—by taking, but not reprocessing, previously used items—helps save time, money, energy and resources.

- **Reduction/Waste Minimization:**

Waste minimization, or source reduction, refers to the collective strategies of design and fabrication of products or services that minimize the amount of generated waste and/or reduce the toxicity of the resultant waste. Often these efforts come about from identified trends or specific products that may be causing problems in the waste stream and the subsequent steps taken to halt these problems. In industry, waste can be reduced by reusing materials, using less hazardous substitute materials, or by modifying components of design and processing. Many benefits can be realized by waste minimization or source reduction, including reduced use of natural resources and the reduction of toxicity of wastes.

- **Landfill:**

Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly-designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly-designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid Leachate. Another common byproduct of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically.

- **Energy recovery:**

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Recycling through thermal treatment ranges from using waste as a fuel source for cooking or heating, to anaerobic digestion and the use of the gas fuel, to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon.

- **Incineration:**

Incineration is a disposal method that involves combustion of waste material. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash. Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in

countries such as Japan where land is scarcer, as these facilities generally do not require as much area as landfills.

- **Waste Segregation:**

This is the separation of wet waste and dry waste. The purpose is to recycle dry waste easily and to use wet waste as compost. When segregating waste, the amount of waste that gets landfilled reduces considerably, resulting in lower levels of air and water pollution. Importantly, waste segregation should be based on the type of waste and the most appropriate treatment and disposal. This also makes it easier to apply different processes to the waste, like composting, recycling, and incineration. It is important to practice waste management and segregation as a community. One way to practice waste management is to ensure there is awareness. The process of waste segregation should be explained to the community.

- **Technologies:**

Traditionally, the waste management industry has been a late adopter of new technologies such as RFID (Radio Frequency Identification) tags, GPS and integrated software packages which enable better quality data to be collected without the use of estimation or manual data entry. This technology has been used widely by many organizations in some industrialized countries. Radiofrequency identification is a tagging system for automatic identification of recyclable components of municipal solid waste streams. Smart waste management has been implemented in several cities, including San Francisco, Varde or Madrid. Waste containers are equipped with

level sensors. When the container is almost full, the sensor warns the pickup truck, which can thus trace its route servicing the fullest containers and skipping the emptiest ones.

These practices can help reduce waste, promote sustainability and mitigate environmental impacts.

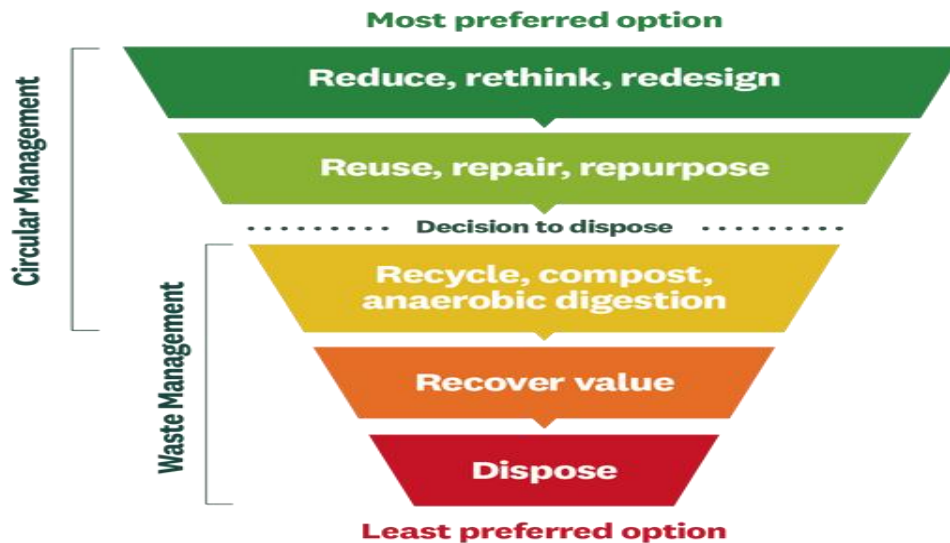
Conservation of Matter

Matter can be defined as anything that has mass and occupies space. According to the law of conservation of matter, matter is neither created nor destroyed but continuously recycled in different forms. It may be transformed or combined in various ways, but it never disappears.

In modern society, the increased use of disposable products has made waste management a growing challenge. Contemporary waste management emphasizes the hierarchy of the “3Rs”: Reduce, Reuse, and Recycle (Wilson et al., 2012). More recently, this framework has been expanded to include two additional principles: Refuse and Repurpose, forming the 5Rs of sustainable waste management (Meshram, 2024).

According to this model, four actions should ideally be prioritized before recycling: Refuse, Reduce, Reuse, and Repurpose, with Recycle considered as the last option. Incorporating the 5Rs approach into daily practices reduces reliance on landfills, promotes circular economy principles, and advances sustainable environmental Management (Meshram,2024).

THE WASTE HIERARCHY



Source: Waste Nothing. (n.d.). Our zero waste journey: The waste hierarchy. Waste Nothing New Zealand.

Hierarchy of Waste Management

Step One: Refuse

The first element of the 5 R's hierarchy. Learning to refuse waste can take some practice, but incorporating this step into your business' strategy is the most effective way to minimize waste. Talk to your procurement team about refusing to buy wasteful or non-recyclable products. When working with vendors, refuse unnecessary product packaging and request reusable or returnable containers. Making smarter purchasing decisions and setting standards and expectations early in the process makes it easier for organizations to “refuse” waste in the first place.

Step Two: Reduce - Reduce the harmful products. Reducing dependency on these kinds of products results in less waste materials ending up in landfill and the associated negative environmental impacts. We recommend always using the minimum amount required to avoid unnecessary waste. For example, when printing a document, print double-sided to cut your waste output in half. Other commonly used items businesses can focus on reducing include single-use plastics, plastic packaging, organic waste, and Styrofoam cups.

Step Three: Reuse

Single-use plastics have created a "throw-away" culture by normalizing consumer behavior of using materials once and then throwing them away. The rate at which we consume plastics has become unimaginable, and the plastic crisis has become one of the world's greatest environmental challenges. In an effort to reduce waste, reuse items throughout the workplace instead of buying new ones. Begin by focusing on one area of your business at a time, like the break room. Replace all of the single-use eating utensils, Styrofoam cups, water bottles, and paper plates with compostable or reusable alternatives. Once you master one area, prioritize reuse for other products in your facility like packaging peanuts, printer cartridges, cardboard boxes, food containers, and rechargeable batteries.

Step Four: Repurpose

For every item that can't be refused, reduced, or reused, try repurposing it. Many people in the green community refer to this method as upcycling. You may be surprised to learn how many common office products serve more than one purpose. Sometimes it requires using some

creativity, but the possibilities are endless. Try using wasted printer paper for scrap paper, cardboard boxes for storing supplies, binder clips to hold power cords and chargers in place, and even mason jars, coffee mugs, and tin cans for holding pens and pencils. Designate an area of your office as an Upcycle Station for collecting and storing supplies. Encourage your colleagues to add items to the station they no longer need and to check there before purchasing new supplies. Embrace technology to help find more ideas and new ways to repurpose your items.

Step Five: Composting

Composting is one of the best solid waste disposal methods when it comes to households.

Experts have estimated that 30% of waste generation can be reduced by using the composting process at homes..If you are using coloured bins for segregation, as mentioned, it becomes easier to turn food leftovers, fruits and vegetable peels, and garden waste into valuable soil fertilizer. All you need to do is prepare the compost pile and allow the living microorganisms to break down the organic waste materials.nThe compost, once ready, can be used for improving soil quality and plant growth. Thus, composting is an easy method that gives individuals the best opportunity to do their bit in solving the solid waste disposal crisis in India. For effective composting, you can use SoilMate from Organica Biotech. It helps to decompose the organic waste matter efficiently and naturally. The fast-acting bacteria decompose a variety of biodegradable waste and accelerate the composting process.

Step Six: Recycle

Once you've gone through all of the other R's, recycling is the most environmentally friendly waste disposal method. If your business doesn't already, it should start collecting cardboard, mixed paper products, commingled materials (plastics, aluminum, glass) and organics. Most companies we speak with are surprised by the amount of waste they reduce by establishing an effective recycling program.

Step Seven: Disposal

In the waste management hierarchy, disposal represents the final and least desirable option. It involves the permanent placement of waste in landfills or the incineration of waste materials without energy recovery. Unlike other stages in the hierarchy, such as reduction, reuse, recycling, or recovery, disposal offers no environmental or economic benefits. Instead, it simply removes waste from immediate sight while creating long-term challenges.

Landfilling, the most common form of disposal, can result in soil and groundwater contamination through leachate, as well as the emission of methane gas, a potent contributor to climate change. Similarly, open dumping, which is prevalent in areas with inadequate waste management systems, poses serious health and environmental risks by providing breeding grounds for pests and disease vectors. Incineration without energy recovery, another form of disposal, reduces the volume of waste but releases harmful substances such as dioxins, carbon dioxide, and particulate matter into the atmosphere, thereby worsening air pollution.

Knowledge of Waste Management Among Students

Waste management and environmental sustainability are crucial global concerns in the 21st century. Waste management, which involves the process of collecting, transporting, and disposing of waste, with a focus on recycling and converting waste into valuable resources, plays a significant role in minimizing environmental impact and promoting sustainable practices. Drawing upon extensive research and scholarly sources, we will explore the reasons behind the lack of awareness and knowledge among students, examine the potential benefits of waste management education, and propose effective strategies to enhance waste management knowledge among students.

Knowledge with regards to a specific subject is intimately linked to some form of education in that subject. Education has been recognized to possess the capability to meet these challenges through promoting awareness and knowledge on various environmental issues, changing the attitudes of people, generating critical thinking, actions and working towards achieving sustainable development. Education should also aim to increase public awareness about environmental problems and their solutions and provide required skills and knowledge. However, attitude cannot be changed by simple education. Wahid (2015) stated that: "Acceptance of new attitude depends on the knowledge obtained, how it is presented, how the person is perceived, the credibility of the communicator, and the conditions by which the knowledge was received". Research in social sciences has also shown that knowledge on a selected topic may increase;

people may even change attitudes, but that the step to improved behaviours and practice depends on a complex set of social and psychological factors (Wahid, 2015).

According to a 2017 study by MD Dung, who polled college of education students, students with a high level of solid waste management knowledge had a frequency of 337, or 18.70%, while those with a moderate level of knowledge had a frequency of 645, or 45.50%. The findings showed that these education college students typically knew very little about solid waste management. This suggests a sizable knowledge gap that must be filled in order to guarantee future waste management procedures that are efficient. Another research study done by Abuhuraira and Shehu (2021), surveyed Husuren-Kwari community in Kano and found that only 24.4% of the respondents were aware of the modern methods of solid waste disposal. Little above half (51.1%) of the respondents were using the burning method to dispose of the waste, and close to half (46.7%) of the respondents were dumping the waste in front of the house. The finding reported a poor level of knowledge, negative attitude, and poor level of practice regarding waste disposal among the people of this community.

Another study by Elijah A. Akintunde & Caleb A. Akintunde (2023) indicated that, though a very negligible positive relationship existed between knowledge and waste management, this relationship was not significant enough to cause such knowledge, or the lack of it, to influence waste management practices. In other words, there are other factors such as the internal and external locus of control, attitude and disposition towards solid waste management, skills, capacity for individual and group actions among others that significantly influence waste

management practices. This result has been corroborated by Liu, Teng & Han, (2020) who found that good environmental knowledge alone does not necessarily translate into pro-environmental behaviors among youths. Furthermore, a good knowledge of environmental variables may not necessarily translate to good and sustainable waste management practice, and the lack of environmental knowledge or awareness may also not necessarily imply a poor waste management practice (Akintunde, 2017). Environmental knowledge has been established as a behavior-distal, but necessary antecedent of proenvironmental behavior (Geiger, Geiger and Wilhelm, 2019).

Effective Strategies for Enhancing Waste Management Knowledge

- Integrate waste management into the curriculum:

To promote waste segregation knowledge, incorporating waste management education into the curriculum is vital. This integration should include theoretical knowledge, practical training, and interactive activities to engage students actively.

- Teacher training:

Providing teachers with comprehensive training on waste management practices and effective teaching methodologies is crucial. This will equip educators with the necessary skills to impart knowledge effectively and inspire students to adopt sustainable waste management practices (UNESCO 2017).

- **Implementing Waste Segregation Practices:**

One effective approach to waste management in schools is the implementation of waste segregation practices. Schools can designate specific garbage bins for organic and inorganic waste, encourage their students to reduce the amount of single-use plastic they use, and promote recycling initiatives.

- **Regular Audits and Assessments:**

Audits and assessments help to identify areas for improvement, allowing school administrators to make timely adjustments in order to reduce waste. By studying the amount of material that is going into the waste stream, schools can understand what types of materials they need to focus on for better waste management.

- **Encourage community engagement:**

Raising awareness about waste management is crucial for long-term success. Organizing community events with local authorities, waste management organizations, and community members can enhance waste management knowledge among students. Engaging students in community clean-up drives, awareness campaigns, and workshops will provide practical exposure and foster a sense of collective responsibility.

The knowledge of waste management among students is a critical aspect of environmental sustainability. By incorporating waste management education into school curricula, providing teacher training, implementing waste segregation practice, regular audits and assessment and

engaging communities, we can empower students to become active contributors in creating a sustainable future.

Practices of Solid Waste Disposal Among Students

Solid waste management practices among undergraduate students play a crucial role in promoting environmental sustainability within academic institutions. However, the level of awareness, commitment, and participation among students tends to vary significantly depending on various factors such as institutional policies, infrastructure, and individual attitudes.

Among undergraduates, the segregation of waste at the source is generally limited. Many students are not fully aware of the importance of separating biodegradable and non-biodegradable waste. As a result, recyclable materials like plastics, paper, and glass often get mixed with organic waste, reducing the efficiency of recycling efforts. In many campuses, the lack of clearly labeled and strategically placed waste bins further discourages proper waste segregation. Where bins are available, students often do not use them correctly due to inadequate sensitization on their purpose and use.

Recycling and reuse practices are observed to some extent among undergraduates, especially when encouraged through campus initiatives or personal values. Some students choose to reuse plastic bottles, shopping bags, and notebooks, while others engage in informal recycling by collecting and selling recyclable items. However, the overall recycling culture is not deeply ingrained, and many students remain passive participants due to limited incentives or institutional support.

The disposal of waste is typically carried out through the use of communal bins located in dormitories, lecture halls, and dining areas. Despite this, improper waste disposal remains a concern, with some students resorting to littering or dumping waste in unauthorized areas. This behavior is often attributed to apathy, lack of enforcement of waste disposal rules, and inadequate education on the consequences of poor waste management.

Awareness about proper waste management varies widely. Students pursuing environmental or related courses tend to exhibit better practices and attitudes towards waste management. However, the general student population often lacks sufficient exposure to environmental education, leading to a gap in knowledge and responsible behavior. Occasional awareness campaigns and clean-up exercises help improve this situation, but their impact tends to be short-lived without continuous engagement.

Institutional support plays a critical role in shaping students' waste management practices. Universities that have implemented clear waste management policies, provided adequate infrastructure, and involved students in sustainability initiatives tend to report better waste handling behaviors. Student organizations and environmental clubs, when active, also contribute significantly by organizing events, promoting eco-friendly habits, and leading by example.

In conclusion, while there are efforts among undergraduates to manage solid waste responsibly, these practices are often inconsistent and limited by infrastructural, educational, and motivational challenges. Strengthening institutional support, enhancing awareness, and fostering a culture of

environmental responsibility can significantly improve solid waste management practices among undergraduate students.

Health and Environmental Implications of Improper Disposal

Waste disposal is one of the most important industries in the world. Without waste disposal, the massive production industries produce too much and quickly destroy the environment. This is apparent when you consider how improper waste disposal affects the environment. If you want a better understanding of why waste disposal is so important, here's a brief look at the effects of improper waste disposal.

Land Pollution

Land pollution happens whenever waste ends up on soil or other land that people should process instead. This garbage doesn't just sit there; the contents break down, whether by rotting or time and seep into the area around it. This means the dirt and all surrounding areas absorb the pollution and become dangerous for people and animals.

Water Pollution

Whatever waste doesn't go into landfills or other disposal areas usually finds its way into the ocean or other bodies of water. It then breaks down into the ocean, slowly contaminating the water and choking out the life that water hosts. This process raises the toxicity of the water, making freshwater unsafe for human consumption and any body of water toxic for those swimming in the water. Since water travels and is a great solvent, the pollutants don't easily leave the area and can contaminate other water sources.

Air Pollution

Air pollution is a major issue worldwide, and understanding how improper waste disposal affects the environment through air pollution is necessary. A basic understanding of air pollution states that greenhouse gases build up in the atmosphere and cause massive global climate change. Improper waste disposal is a contributor to excess gases entering the atmosphere and causing these problems. The breakdown of the waste releases gases like methane, which is a major factor in global climate change.

Climate Change

A huge issue that comes from all forms of pollution is the contribution and impact it has on the global climate. Waste contributes to the gases that thicken the ozone layer. This, in turn, worsens the weather and melts the ice caps, raising the sea level and negatively impacting natural habitats and the homes of billions of people.

Extreme Weather

Climate change has also caused a gradual increase in the frequency of extreme weather and natural disasters. Due to the change in climate, there has been a noticeable increase in disasters like tornadoes and floods. Even the presence of hurricanes has become more prevalent because of climate change.

Disease

Unprocessed waste is a huge breeding ground for major diseases. All kinds of diseases can use places like landfills; even contaminated waters can host all manners of horrible diseases. These

diseases can affect animals, plants, and people alike—improperly processed waste is horrible for the health of all living things.

Plant Death

Contaminants in both the air and water have horrible effects on plants, as soil with contaminants will kill most plants. Even if there are no contaminants in the soil, the water brought by the rain can be toxic for plants and kill them.

Animal and Marine Death

Plants aren't the only things that suffer when it comes to waste; both land and sea animals die from waste left around. From sea turtles and fish dying because of plastic in the sea to animals eating hazardous materials left lying around, there's a lot of death in nature because of this waste. In this way, improper waste disposal directly leads to the extinction of many species every day, causing permanent damage to ecosystems across the globe.

Loss of Habitats

Every animal has a range of environments it can survive in. This is why you only see specific species in certain locations. However, waste contributes to global climate change, which changes the size of the habitats animals need to survive. A decreasing habitat size drives species like polar bears to extinction as they attempt migrations out of the areas.

Lower Biodiversity

The extinction of species and deaths of crops means the biodiversity across the world is slowly lowering. This is bad for the health of nature, as lower biodiversity increases the chances of

complete extinction during a disaster. With fewer different species, diseases have an easier time traveling, and leaving fewer species that can survive environmental changes.

Radiation and Hazardous Materials

Most people don't consider the dangers of radioactive waste because of strict regulations, but improper handling can lead to radiation poisoning in areas near the waste. Even other materials that prove harmful to humans can find their way into local areas if industries don't properly process their waste with an industrial disposal service capable of handling their waste.

“Dead” Zones

We often don't consider places like landfills as “dead” space, but they're exactly that. The more trash and waste flows into these fills, the bigger they grow and the more numerous they become. These create places where nothing else can exist, as the space is useful only for waste and garbage, thus creating an area that serves no other purpose.

Human Impact

Between all the diseases and climate change that improperly processed waste creates, it's easy to see how this impacts every person. The worsening of the environment stems partially from the mistreatment of waste, and ending any practices that contribute to extra waste can help save many lives and keep the world's environment in a healthy place. For many people, the reduction of waste and commitment to handling waste properly is a daunting task. Some even feel that it's too late and there's no point. However, every change people make by properly disposing of waste can save lives and suffering in the future, even if it's only a few people. Additionally, it

increases the chance of something major changing and fixing the issue overall. So always be sure you're assisting in the proper management of waste and not speeding the environment towards a dangerous end.

Impact of Solid Waste on Human Health and Environment (Animals and Aquatic life)

There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the general public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats (Pervez & Kafeel, 2013). Uncontrolled hazardous wastes from industries mixing up with municipal wastes create potential risks to human health. Traffic accidents can result from toxic spilled wastes. There is specific danger of concentration of heavy metals in the food chain, a problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and/or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these.

Solid waste mismanagement has been associated with various environmental and health problems. According to Pervez and Kafeel (2013), some of these problems include:

- Chemical poisoning through inhalation of hazardous substances
- Obstruction of stormwater runoff due to uncollected waste, resulting in flooding
- Low birth weight among infants

- Increased risk of cancer
- Congenital malformations
- Neurological diseases
- Nausea and vomiting
- Mercury toxicity from consuming contaminated fish
- Plastics ingested by birds, leading to digestive complications
- Elevated algal populations in rivers and seas (algal blooms)
- Degradation of both water and soil quality

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations. Very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future. The problem is again compounded by the issues associated with rapid urbanization.

A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (Cointreau-Levine, 1997 in Pervez & Kafeel, 2013). A second problem with these gases is their contribution to the enhanced greenhouse gas effect and climate change. Liquid leachate management varies throughout the landfills of the

developing world. Leachate poses a threat to local surface and groundwater systems. The use of dense clay deposits at the bottom of waste pits, coupled with plastic sheeting-type liners to prevent infiltration into the surrounding soil, is generally regarded as the optimum strategy to contain excess liquid.

Ways to Mitigate Improper Solid Waste Disposal

- **Waste Segregation**

According to the Ministry of Urban Development (MOUD), municipal solid waste generated in India constitutes around 30-40% of organic waste produced in households.

Additionally, it contains recyclable materials like plastic, glass, and metals.

Solid waste disposal of unsegregated waste can put undue pressure on landfills and waste management authorities. Thus, waste segregation at home is one of the best methods to reduce the burden on those handling the waste.

It is easy to segregate waste at your home, in campuses and other areas where waste are generated from. You can use color-coded bins like green, blue, and yellow for waste segregation and identification. Segregate organic and biodegradable waste, such as food waste and garden waste, in green. The organic waste can be used for composting.

Furthermore, you can use yellow for glass & paper and blue for plastic and non-biodegradable waste.

Waste segregation at source can reduce up to 250 tonnes of dump from entering into landfills.



Source: Green Sutra

- **Public Awareness and Education**

One of the foremost strategies for improving waste disposal is the promotion of public education. When individuals understand the dangers of indiscriminate dumping and the benefits of responsible waste management, they are more likely to adopt sustainable practices.

- **Provision of Adequate Infrastructure**

The availability of waste bins, collection points, and recycling stations in both urban and rural areas is essential. A lack of such facilities often encourages littering and improper disposal, making infrastructure development a key priority.

- **Enforcement of Policies and Regulations**

Government agencies play a critical role in ensuring proper waste management. Strict laws, regular monitoring, and penalties for non-compliance instill discipline and promote adherence to safe disposal practices.

- **Application of Modern Technologies**

Technological solutions such as waste-to-energy conversion, incineration, and bio-digestion provide innovative ways to transform waste into useful products like electricity, biofuel, and organic manure.

Policies and Regulations on Solid Waste Management

Waste Management Regulation in Nigeria

Effective waste management all depends on regulations and policy guidelines for environmental sustainability. These regulations show how Nigeria is committed to sustainable and efficient management of the environment. There exist several agencies and laws that regulate waste management. These include the Federal Ministry of the environment, the Lagos State Waste Management Authority (WMA); The National Environmental Standards Regulatory and Enforcement Agency (NESREA); the Ministry of Water Resources.

According to Osinibi (2014) environmental management regulations in Nigeria are on the national policy of 1989. The purpose of waste management regulation in Nigeria is to attain workable development. That is; raise public awareness and understanding of essential connections between environmental development and improvement; upgrade ecological measures and save the sustainable utilisation of ecosystems and natural resources; to bring good quality environment for the prosperity and wellbeing of Nigerians. More so, to join other countries in compliance with international agencies to achieve utilisation of natural resources and successful remedial action of transboundary environmental pollution. The most significant legal

basis for waste management in Nigeria is the Federal Environmental Protection Agency (FEPA) Act. In July 2007, Nigeria's president revoked all FEPA and NESREA laws and signed them into law. In the Nigerian states, the minimum standards are the federal laws. According to Article 33, the government is allowed to enforce stricter measures and firmer sanctions on violators. By law, the local governments manage municipal solid waste, but because of inadequacy, the involvement of other state environmental agencies became a necessity. The National Environmental Protection (NEP) regulations of 1991 mandate industries to have environmental audits, implement boundaries on toxic substance emission and set requirements for monitoring pollution. Collection, disposal of solid and hazardous and treatment wastes.

What are the Current Regulations in Nigeria?

The basis of environmental policy in Nigeria is contained in the 1999 Constitution of the Federal Republic of Nigeria. Pursuant to section 20 of the Constitution, the State is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. In addition to this, section 2 of the Environmental Impact Assessment Act of 1992 (EIA Act) provides that the public or private sector of the economy shall not undertake or embark on or authorise projects or activities without prior consideration of the effect on the environment.

The Federal Government of Nigeria has promulgated various laws and Regulations to safeguard the Nigerian environment. These include:

Federal Environmental Protection Agency Act of 1988 (FEPA Act). The following Regulations were made pursuant to the FEPA Act:

- National Environmental Protection (Effluent Limitation) Regulations;
- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations; and
- National Environmental Protection (Management of Solid and Hazardous Wastes) Regulations.

Environmental Impact Assessment Act of 1992 (EIA Act).

Harmful Wastes (Special Criminal Provisions etc.) Act of 1988 (Harmful Wastes Act).

The Federal Ministry of Environment (FME) administers and enforces environmental laws in Nigeria. It took over this function in 1999 from the Federal Environmental Protection Agency (FEPA), which was created under the FEPA Act. FEPA was absorbed and its functions taken over by the FME in 1999.

The Federal Ministry of Environment has published several guidelines for the administration of the FEPA and EIA Acts and procedures for evaluating environmental impact assessment reports (EIA Reports). Other regulatory agencies with oversight over specific industries have also issued guidelines to regulate the impact of such industries on the environment such as the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) 2002, published by the Department of Petroleum Resources (DPR).

However, pursuant to the FEPA Act, each State and local government in the country may set up its own environmental protection body for the protection and improvement of the environment within the State. Each State is also empowered to make laws to protect the environment within its jurisdiction. All the States have environmental agencies and State laws; e.g. Abuja, the Federal Capital Territory has issued the Abuja Environmental Protection Board (Solid Waste Control/Environmental Monitoring) Regulations 2005 ("the Abuja Environmental Protection Board Regulations") which principally governs solid waste control in Abuja. In Lagos State, the Lagos State Environmental Protection Agency Law, was enacted to establish the Lagos State Environmental Protection Agency (LASEPA). LASEPA's functions include monitoring and controlling the disposal of waste in Lagos State and advising the State Government on all environmental management policies. Lagos State has also enacted the Environmental Pollution Control Law, to provide for the control of pollution and protection of the environment from abuse due to poor waste management. Akwa Ibom State, has enacted the Environmental Protection and Waste Management Agency Law, which established the Environmental Protection and Waste Management Agency. This Agency is charged with responsibilities which include identifying and proffering solutions to environmental protection problems in Akwa Ibom, and monitoring and enforcing environmental protection standards and regulations.

The federal government has established three regulations on waste management and sanitation.

These are.

- a. National Policy Guidelines on Solid Waste Management are tasked with ensuring economic and sustainable environmental health through efficient sanitary solid waste management ways.
- b. National Policy Guidelines on Sanitary Inspection of Premises aim at promoting a healthy and clean environment for the public.
- c. National Environmental Sanitation Policy aims at strengthening, stimulating, and promoting government policies on sanitation and environmental education.

The Federal Ministry of Environment (FME) was empowered by the FEPA act to examine permits or licenses given to any person and arrest anyone against regulations on the environment.

The FEPA act also gives FME power to seize anything used in going against the Act. The Act provides that any person who violates its provisions is liable to a fine, imprisonment, or both.

Any person or organisation who disposes of hazardous materials will take the responsibility of any remedial measures.

Regulation enforcement and procedures

The Customary Courts and Magistrate courts handle Nigerian environmental matters.

Environmental planning and protection were the small units in the Federal Ministry of Works and Housing that dealt with environmental protection when a bill was taken to parliament in

1981 for the formation of the Federal Environmental Protection Agency, the members of

parliament did nothing to the bill, and the industrial pollution continued. The enforcement of the environmental policies in Nigeria was slow due to the political differences in the country and procedures by the successive government. The federal government of Nigeria implemented the ecological sanitation policy to handle the challenges of waste. Still, it didn't work efficiently because the agencies only implemented the procedure in a few states. The Federal government implemented the waste projects to deal with the cleaning of the environment, they carried out workshops and the study of waste generation, Nigerian government, decided that every citizen should participate in the cleaning of the atmosphere every Saturday of the month.

Enforcement Training Requirement.

The government of Nigeria has made attempts to educate its citizens about waste management (Nwachukwu, 2008). Several workshops have been done to train people to understand hazardous waste and the need for proper disposal of garbage in designated dumpsites. The emphasis of these training workshops is to encourage the safe disposal of waste and encourage recycling activities.

Summary of Reviewed literature

The review of related literature in this chapter has provided the conceptual perspective of the study, under the conceptual perspective, the conceptual framework of solid waste was discussed, these solid wastes are useless, unwanted and discarded materials resulting from community activities, school activities, recreational and production process. Solid waste could be food waste, street waste e.t.c and they are all gotten from different sources.

However, Solid waste management was discussed in details; this involved the management of all processes and resources for proper handling of solid waste material from maintenance of solid waste, transportation of waste and dumping facilities. The various methods of solid waste management such as land fill, Incineration, open dumping, recycling was discussed properly. The waste management hierarchy was explained extensively; the 5'RS- reduce, reuse, Repurpose, refuse and recycle. Also another concept of solid waste was discussed; the impact of improper solid waste disposal, the effect and ways to Mitigate it.

Lastly, policies and regulations of solid wastes such as the Federal Ministry of the environment, the Lagos State Waste Management Authority (WMA); The National Environmental Standards Regulatory and Enforcement Agency (NESREA) and the Relevant theories to the study were analyzed.

CHAPTER THREE

METHODOLOGY

This chapter presented the procedures the researcher used in gathering and analyzing data for the study. It was discussed under the following subheadings:

- Design of the Study
- Population of the Study
- Sample and Sampling Technique
- Research Instrument
- Validity of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Design of the Study

The study adopted a descriptive survey research design. A descriptive survey design, according to Nworgu (2018), is one in which a group of people or items is studied by collecting and analyzing data from only a few individuals or items considered to be representative of the entire group. This design is deemed appropriate for this study as it enabled the researcher to describe and analyze undergraduate students' awareness of climate change and their corresponding adaptation strategies without manipulating any variables.

Population of the Study

The Population of the study comprises of the 15 faculties of the University of Benin. The target population comprises of full time undergraduate students of the various faculties during the

2024/2025. The present population of the University of Benin undergraduate is 43,697 students.

The faculties are shown in the table below:

| S/N | Faculties | Population of the Study |
|------------|-----------------------|--------------------------------|
| 1. | Agriculture | 1685 |
| 2. | Art | 6262 |
| 3. | Basic Medical Science | 3437 |
| 4. | Dentistry | 111 |
| 5. | Education | 7416 |
| 6. | Engineering | 5481 |
| 7. | Environmental Science | 1015 |
| 8. | Law | 1078 |
| 9. | Life Science | 5132 |
| 10. | Management Science | 3506 |
| 11. | Medicine | 685 |
| 12. | Pharmacy | 1107 |
| 13. | Physical Science | 3283 |
| 14. | Social Science | 3411 |
| 15. | Veterinary Medicine | 70 |
| | Total | 43,679 |

Source: Academic Planning Unit, Student Affair Division, University of Benin, Ugbowo campus.

Sample and Sampling Technique

This study adopted a multi-stage sampling technique to select 240 undergraduate students from the University of Benin. Systematic sampling was used to select five faculties out of the fifteen

available. The faculties was arranged in alphabetical order, and the first and every other third faculty was selected. The selected faculties included; Agriculture, Dentistry, Environmental Science, Management Sciences, and Physical Sciences.

Proportionate sampling determined the number of respondents from each faculty. Exactly 2.5% of the total undergraduate population of each selected faculty was calculated, resulting in 240 students. Simple random sampling was then be used to select respondents from departments and levels within each faculty. Balloting with replacement ensured equal chances of selection for all students.

The breakdown of the sample of the study is presented in Table one.

Table 1: Breakdown of the Sample for the Study

| S/N | Faculties | Students per | No. Of Respondent department (2.5) |
|------------|-----------------------|---------------------|---|
| 1. | Agriculture | 1685 | 42 |
| 2. | Dentistry | 111 | 3 |
| 3. | Environmental Science | 1015 | 25 |
| 4. | Management Science | 3506 | 88 |
| 5. | Physical science. | 3283 | 82 |
| | Total | 9600 | 240 |

Source: Field survey (2025)

Research Instrument

The instrument for data collection was a structured questionnaire titled: Questionnaire on Knowledge and Practices of Improper Solid Waste Disposal Among Undergraduates in the University of Benin. It was divided into two sections:

Section A: Focused on demographic information such as faculty, level, and gender.

Section B: This section contained items designed to assess students' knowledge and practices of improper solid waste disposal. To ensure a comprehensive evaluation, a combination of response formats was used. Specifically, items were measured using a 4-point Likert scale (ranging from Strongly Agree to Strongly Disagree), multiple-choice questions (to allow selection of the most appropriate option), and dichotomous Yes/No items (to capture straightforward responses).

Validity of the Instrument

The questionnaire was subjected to face and content validation by the researcher's project supervisor and two lecturers from the Department of Health, Safety, and Environmental Education, Faculty of Education, University of Benin. Their feedback and suggestions improved the clarity, relevance, and accuracy of the instrument.

Reliability of the Instrument

The reliability of the instrument was established using the Cronbach's Alpha method. A pilot test was conducted on 20 undergraduate students from departments not included in the main study. The reliability test yields a Cronbach's alpha value of 0.73, indicating an acceptable level of internal consistency.

Method of Data Collection

The researcher, assisted by a trained research assistant, administers the questionnaires to the selected respondents across the sampled departments. The instruments were distributed and retrieved on the same day to ensure a high response rate and data accuracy.

Method of Data Analysis

The data collected from respondents were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequency, percentage, mean (\bar{x}), and standard deviation (SD) were used to answer the research questions. The Pearson Product Moment Correlation (PPMC) was used to test the hypotheses at the 0.05 level of significance, using SPSS version 23.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapters deals with the presentation, analysis and interpretation of findings based on the data collected from respondents in relation to the research questions guiding the study. The results of the respondents are carefully analyzed and presented in the following tables below. A mean score of 2.50 will be taken as a minimum score so items which have mean score above 2.50 are accepted while items which have mean score below 2.50 are rejected.

The Benchmark mean was gotten as 2.5 through the following procedure:

$$N = \frac{\text{Total Response value}}{\text{No of responses}}$$

Where:

Strongly agree = 4

Agree = 3

Disagree = 2

Strongly Disagree = 1

$$\text{Therefore: Benchmark mean (n)} = \frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$$

Research Question 1: What is the level of knowledge regarding proper solid waste disposal among undergraduates in the University of Benin?

Table 1: Knowledge of proper solid waste disposal

| S/N | Level of knowledge (Score) | Frequency & Percentage |
|-----|----------------------------|------------------------|
| 1. | Low | 36 (15%) |
| 2. | High | 204 (85%) |
| | TOTAL | 240 (100%) |

(1-3; Low Knowledge, 4-5; High Knowledge)

Table 1 above represents the descriptive statistics on the knowledge regarding proper waste disposal among undergraduates in the University of Benin. From the table above, it was found out that majority 204 (85%) of undergraduates in the university of Benin have high knowledge while 36 (15%) have low knowledge of proper solid waste disposal

Based on the data above, it was therefore found out that majority of Undergraduates in the University of Benin have high knowledge of proper solid waste disposal.

Research Question 2: What are the common practices of solid waste disposal among undergraduates in the University of Benin?

Table 2: Common Solid Waste Disposal Practices

| S/N | ITEMS | SA (%) | A (%) | D (%) | SD (%) | MEAN | S.D | DECISION |
|---------------------|--|------------|------------|------------|-----------|-------------|------|----------|
| 1 | I use designated waste bins to dispose of my trash on campus. | 111 46% | 104 43% | 24 11% | 0 0% | 3.36 | .671 | Accepted |
| 2 | I dispose of food wrappers, plastic bottles, or other items in open spaces or gutters. | 24 10% | 48 20% | 109 45% | 59 25% | 2.15 | .909 | Rejected |
| 3 | I separate waste into categories like paper, plastic, and organic before disposal. | 34 14% | 73 30% | 114 48% | 19 8% | 2.51 | .833 | Accepted |
| 4 | I regularly engage in environmentally friendly waste practices such as recycling, reuse of plastics. | 35 15% | 95 40% | 96 40% | 14 5% | 2.63 | .803 | Accepted |
| 5 | I sometimes throw waste into open spaces or bushes around the campus. | 18 8% | 98 41% | 90 37% | 34 14% | 2.42 | .824 | Rejected |
| | | | | | | 2.61 | | |
| CLUSTER MEAN | | | | | | | | |

(Cluster mean; 2.61, Benchmark mean; 2.50)

Source: Field survey, 2025.

Table 2 above represents the common solid waste disposal practices by undergraduates in the University of Benin. From the data above, it was found out that majority of respondents accepted the statement “I use designated waste bins to dispose of my trash on campus” with a mean score of 3.36, majority rejected the statement “I dispose of food wrappers, plastic bottles, or other items in open spaces or gutters” with a mean score of 2.15, majority accepted the statement “I separate waste into categories like paper, plastic, and organic before disposal” with a mean score of 2.51, majority accepted the statement “I regularly engage in environmentally friendly waste practices such as recycling, reuse of plastics” with a mean score of 2.63 and lastly, majority rejected the statement “I sometimes throw waste into open spaces or bushes around the campus” with a mean score of 2.43.

Based on the data above, it was found out that the cluster mean is 2.61 which is above the benchmark mean of 2.50 used in making decisions. Thus, it was found out that common solid waste disposal practices among undergraduates in the University of Benin include use of designated waste bins, separation of waste into categories, before disposal, and engagement in environmental friendly waste disposal practices such as recycling and reuse of plastics.

Research Question 3: What factors influence improper solid waste disposal practices among undergraduates?

Table 3: Factors influencing improper solid waste disposal practices

| S/N | ITEMS | SA (%) | A (%) | D (%) | SD (%) | MEAN | S.D | DECISION |
|---------------------|--|-----------|------------|------------|-----------|---|------------------------------------|----------|
| 1 | The lack of waste bins in convenient locations makes proper disposal difficult. | 90 38% | 105 44% | 37 15% | 8 3% | 3.15 | .800 | Accepted |
| 2 | I do not dispose of waste properly because I am not aware of the correct method. | 18 8% | 73 30% | 115 48% | 34 14% | 2.31 | .807 | Rejected |
| 3 | Peer influence affects how I manage and dispose of my waste. | 29 12% | 90 38% | 92 38% | 29 12% | 2.50 | .858 | Accepted |
| 4 | Poor maintenance of waste bins discourages proper waste disposal. | 62 26% | 126 53% | 44 18% | 8 3% | 3.00 | .759 | Accepted |
| 5 | Time constraints or laziness can lead me to dispose of waste improperly. | 69 29% | 103 43% | 53 22% | 15 6% | 2.94 | .870 | Accepted |
| | | | | | | 2.78 | | |
| CLUSTER MEAN | | | | | | | | |
| | | | | | | (Cluster mean; 2.78, Benchmark mean; 2.50) | <i>Source: Field survey, 2025.</i> | |

Table 3 above represents the factors influencing improper waste disposal among undergraduates in the University of Benin. Based on the table above, it was found out that majority of respondents accepted the statement “The lack of waste bins in convenient locations makes proper disposal difficult” with a mean score of 3.15, majority rejected the statement “I do not dispose of waste properly because I am not aware of the correct method” with a mean score of 2.31, majority accepted the statement “Peer influence affects how I manage and dispose of my waste” with a mean score of 2.50, majority accepted the statement “Poor maintenance of waste bins discourages proper waste disposal” with a mean score of 3.00 and lastly, majority accepted the statement “Time constraints or laziness can lead me to dispose of waste improperly” with a mean score of 2.94.

Based on the data above, it was found out that the cluster mean is 2.78, which is higher than the benchmark mean of making decisions. Thus it was found out that factors influencing improper solid waste disposal among undergraduates in the University of Benin includes: lack of waste bins, peer influence, poor maintenance of waste bins, and time constraints.

Research Question 4: What measures can improve proper solid waste disposal among undergraduates?

Table 4: measures that can improve proper solid waste disposal

| ITEMS | YES (%) | NO (%) | TOTAL (%) |
|---|--------------------|-------------------|----------------------|
| Awareness campaigns would help increase proper waste disposal on campus | 234 (97%) | 6 (3%) | 240 (100%) |
| Providing more waste bins across campus would encourage better disposal practices. | 229 (95%) | 11 (5%) | 240 (100%) |
| Incorporating waste management education into student orientation would be effective. | 228 (95%) | 12 (5%) | 240 (100%) |
| Punishing improper waste disposal can reduce poor practices. | 222 (93%) | 18 (7%) | 240 (100%) |
| Student-led clean-up initiatives would motivate me to manage waste properly. | 227 (95%) | 13 (5%) | 240 (100%) |

Table 4 above represents the measures that can improve proper solid waste disposal among undergraduates in the University of Benin. Based on the data above, it was found out that majority 234 (97%) agreed that awareness campaigns would help increase proper waste disposal on campus, 229 (95%) agreed that providing more waste bins across campus would encourage better disposal practices. 228 (95%) agreed that incorporating waste management education into student orientation would be effective, 222 (93%) agreed that Punishing improper waste disposal can reduce poor practices and lastly, 227 (95%) agreed that Student-led clean-up initiatives would motivate them to manage waste properly.

Based on the data above, it was found out that measures that can improve solid waste disposal practices among undergraduates include awareness campaigns, provision of waste bins, incorporating waste management education into student orientation, punishing improper waste disposers and initiating student led clean up initiatives.

Discussion of Findings

The purpose of the study is to examine the Knowledge and Practices of Improper Solid Waste Disposal among Undergraduates in the University of Benin. Based on the data collected and analyzed, it was found out that majority of Undergraduates in the University of Benin have high knowledge of proper solid waste disposal. This is in corroboration with the findings if the study carried out by Ojodokun & Balogun (2019), who reported that university students in Southwestern Nigeria demonstrated high knowledge of waste management practices. Similarly, Alhassan et al. (2020) found that over 80% of undergraduates were aware of proper waste disposal methods, showing that students generally possess strong knowledge about waste handling across West African universities.

It was also found out that common solid waste disposal practices among undergraduates in the University of Benin include use of designated waste bins, separation of waste into categories, before disposal, and engagement in environmental friendly waste disposal practices such as recycling and reuse of plastics. This is in contrast with the findings of the study carried out by Abasimi et al. (2021), where despite high awareness, students still engaged in indiscriminate dumping due to lack of enforcement and infrastructure. Likewise, Ogochukwu & Nwachukwu

(2022) in Southeast Nigeria observed that although students claimed awareness of good practices, indiscriminate disposal in gutters and open spaces was still common.

Furthermore, it was found out that factors influencing improper solid waste disposal among undergraduates in the University of Benin includes: lack of waste bins, peer influence, poor maintenance of waste bins, and time constraints. This is in line with the findings of the study carried out by Adewumi et al. (2023), who identified inadequate waste bins, poor maintenance, peer influence, and time constraints as major determinants of poor disposal practices among Nigerian undergraduates. Similarly, Alemayehu & Melesse (2021) also reported that environmental infrastructure gaps and peer behavior strongly influence improper waste management among students.

Lastly, it was found out that measures that can improve solid waste disposal practices among undergraduates include awareness campaigns, provision of waste bins, incorporating waste management education into student orientation, punishing improper waste disposers and initiating student led clean up initiatives. This finding is in corroboration with the findings of the study carried out by Oloruntoba et al. (2020), who noted that awareness campaigns and adequate bin distribution improved waste management compliance among students in Ibadan. Likewise, Yusuff & Sonibare (2022) highlighted the effectiveness of environmental education and student-led initiatives in improving sustainable waste practices on Nigerian campuses.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter has to do with the summary, conclusion and recommendations based on the findings.

Summary

The purpose of the study is to examine the Knowledge and Practices of Improper Solid Waste Disposal among Undergraduates in the University of Benin. To achieve the purpose of the study, four (4) research questions were raised and important literature related solid waste disposal were clearly discussed. The descriptive research design was used for this study and the population consisted of undergraduates students in the University of Benin during the 2024/2025 academic session. With a total population of about forty three thousand, six hundred and seventy nine (43,679) undergraduate students. A total of two hundred and forty (240) students were selected to represent the population of the study. The instrument used for data collection was a well-structured close-ended questionnaire with twenty (20) items. The questionnaire was validated by the project supervisor and two other lecturers in the Department of Health, Safety and Environmental Education. The test retest reliability method was used to establish the reliability of the questionnaire. A total of two hundred and forty (240) questionnaires were administered to the sample and data collected was analyzed using frequency count, percentage mean, and standard deviation.

Findings

Based on the data collected and analyzed, the findings of the study revealed that:

- Majority of Undergraduates in the University of Benin have high knowledge of proper solid waste disposal.
- Common solid waste disposal practices among undergraduates in the University of Benin include use of designated waste bins, separation of waste into categories, before disposal, and engagement in environmental friendly waste disposal practices such as recycling and reuse of plastics.
- Factors influencing improper solid waste disposal among undergraduates in the University of Benin includes: lack of waste bins, peer influence, poor maintenance of waste bins, and time constraints.
- Measures that can improve solid waste disposal practices among undergraduates include awareness campaigns, provision of waste bins, incorporating waste management education into student orientation, punishing improper waste disposers and initiating student led clean up initiatives.

Conclusion

Based on the findings of this study, it can be concluded that undergraduates in the University of Benin possess a high level of knowledge regarding proper solid waste disposal, as the majority of respondents demonstrated awareness of correct disposal methods. However, while knowledge levels are commendable, the practices of solid waste disposal among the students revealed mixed

outcomes. Positive practices such as the use of designated bins, waste separation, and recycling were evident, yet instances of indiscriminate disposal were still reported, highlighting a knowledge–practice gap.

Furthermore, the study concluded that certain factors significantly influence improper waste disposal practices. These include inadequate provision and maintenance of waste bins, peer influence, and personal constraints such as lack of time and laziness. Finally, the findings affirmed that strategic measures such as awareness creation, provision of waste facilities, integration of waste management education, sanctions for improper disposal, and student-led initiatives are considered effective by undergraduates in improving solid waste disposal practices on campus.

Recommendations

Based on the findings from the data collected and analysed, the researcher makes the following recommendations

- Continuous environmental education programs and integration of waste management topics into the undergraduate curriculum should be prioritized to sustain and further improve students' knowledge levels.
- The university should establish structured waste separation and recycling systems on campus, ensuring that students' knowledge translates into consistent and practical sustainable behavior.

- The institution should address infrastructural gaps by providing and maintaining adequate waste bins in strategic locations while also discouraging negative peer influences through targeted behavior change campaigns.
- The university should actively implement awareness campaigns, support student-led clean-up drives, and enforce existing policies to encourage compliance and long-term commitment to proper waste disposal practices.

Suggestions for Further Studies

1. The Influence of Environmental Awareness Campaigns on Waste Disposal Practices among University of Benin Undergraduates.
2. A Comparative Study of Waste Disposal Practices between Undergraduate Hostels and Off-Campus Residences in the University of Benin.
3. The Role of Institutional Support in Promoting Sustainable Waste Management Practices among Undergraduates in the University of Benin

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**DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION
FACULTY OF EDUCATION
UNIVERSITY OF BENIN
QUESTIONNAIRE
ON**

**KNOWLEDGE AND PRACTICES OF IMPROPER SOLID WASTE DISPOSAL
AMONG UNDERGRADUATES IN THE UNIVERSITY OF BENIN**

Dear Respondent,

I am a final-year (400-level) student in the Department of Health, Safety and Environmental Education, University of Benin. This questionnaire is part of my academic research on the topic: “Knowledge and Practices of Improper Solid Waste Disposal Among Undergraduates in the University of Benin.”

The purpose of this study is to assess students level of awareness and understanding of proper waste disposal, their current waste management practices, and the challenges they face in maintaining a clean campus environment. Your honest and accurate responses will provide valuable insights and will be treated with strict confidentiality. All information gathered will be used solely for academic purposes.

Thank you for your time and participation.

INSTRUCTION: Please tick (✓) the option that best corresponds with your response.

SECTION A: DEMOGRAPHIC INFORMATION

1. Gender: Male Female
2. Age: 16-20 , 21-25 , 26-30
3. Faculty: _____
4. Department: _____
5. Level: 100 200 300 400 500 others

SECTION B: RESEARCH QUESTIONS

Research Question 1: What is the level of knowledge regarding proper solid waste disposal among undergraduates in the university of Benin?

1. Which of the following best describes solid waste?

- A. Materials that are liquid and cannot be used again
- B. Unwanted or discarded solid materials from human activities
- C. Only materials that can be recycled
- D. Gaseous emissions from industries

2. Which of these is an example of recyclable waste?

- A. Used plastic bottles
- B. Rotten food
- C. Medical syringes
- D. Broken ceramic plates

3. What is the primary environmental impact of improper solid waste disposal?

- A. Increase in rainfall
- B. Soil, water, and air pollution
- C. Growth of more plants
- D. Reduction in natural disasters

4. Which of the following is a proper waste disposal method?

- A. Open burning of plastics
- B. Throwing waste in rivers
- C. Composting organic waste

D. Dumping waste in open land

5. Which of these wastes should be disposed of in a hazardous waste bin?

A. Plastic bottles

B. Banana peels

C. Used batteries

D. Cardboard boxes

Research Question 2: What are the common practices of solid waste disposal among undergraduates in the University of Benin?

Instruction: Tick(✓) the most appropriate response

Key: SA (Strongly Agree), A (Agree), SD (Strongly disagree), D (Disagree)

| S/N | Statement | SA | A | SD | D |
|-----|--|----|---|----|---|
| 1 | I use designated waste bins to dispose of my trash on campus. | | | | |
| 2 | I dispose of food wrappers, plastic bottles, or other items in open spaces or gutters. | | | | |
| 3 | I separate waste into categories like paper, plastic, and organic before disposal. | | | | |
| 4 | I regularly engage in environmentally friendly waste practices such as recycling, reuse of plastics. | | | | |
| 5 | I sometimes throw waste into open spaces or bushes around the campus. | | | | |

Research Question 3: What factors influence improper solid waste disposal practices among undergraduates?

Instruction: Tick(✓) the most appropriate response

Key: SA (strongly Agree), A (Agree), SD (Strongly Disagree), D (Disagree)

| S/N | Statement | SA | A | SD | D |
|-----|--|----|---|----|---|
| 1 | The lack of waste bins in convenient locations makes proper disposal difficult. | | | | |
| 2 | I do not dispose of waste properly because I am not aware of the correct method. | | | | |
| 3 | Peer influence affects how I manage and dispose of my waste. | | | | |
| 4 | Poor maintenance of waste bins discourages proper waste disposal. | | | | |
| 5 | Time constraints or laziness can lead me to dispose of waste improperly. | | | | |

Research Question 4: What measures can improve proper solid waste disposal among undergraduates?

Instruction: Tick(✓) the most appropriate response

Key: SA (strongly Agree), A (Agree), SD (strongly disagree), D (disagree)

| S/N | Statement | Yes | No |
|-----|---|-----|----|
| 1 | Awareness campaigns would help increase proper waste disposal on campus. | | |
| 2 | Providing more waste bins across campus would encourage better disposal practices. | | |
| 3 | Incorporating waste management education into student orientation would be effective. | | |
| 4 | Punishing improper waste disposal can reduce poor practices. | | |
| 5 | Student-led clean-up initiatives would motivate me to manage waste properly. | | |