

# Waste Management in Educational Institutes

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Waste Management,  
Recycling,  
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Educational Institution.

## Abstract

Effective waste management in educational institutions is crucial for fostering sustainable practices and environmental stewardship. Higher Education Institutions (HEIs) are increasingly recognized as mini-cities with significant daily populations, necessitating comprehensive waste management strategies. These institutions play a pivotal role in sustainability by educating future professionals and serving as living laboratories for environmental management practices [1]. A systematic review of waste management in HEIs suggests that the most effective practices include the engagement of the academic community through teaching, research, and outreach [1]. Additionally, the management of organic waste is gaining attention, with practices like composting and the implementation of food waste prevention programs in cafeterias being highlighted. These efforts are complemented by the identification of sustainability indicators that assist in decision-making and the continuous improvement of campus sustainability. The integration of environmental management systems can further enhance these initiatives, as demonstrated by case studies in universities like TERI University in New Delhi, which showcase the benefits of such systems in educational settings. Overall, the development of sustainable waste management in educational institutes is not only about compliance with environmental regulations but also about building a culture of sustainability that resonates with all stakeholders involved. This paper will work to define this through literature review, then mention the proposal which applied in university of Canada-New capital- in Egypt, and finally Making an international online survey for universities users to gain the results which lead to know the knowledge of this categories of users about waste management and the necessary of Applying it. although on the other hand the results of several studies shows that at least 87% of the waste generated on building may be recycled [2]. To ensure sustainable solid waste management and reliable recycling program, a university must run fixed program to be operated.

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## 1. Introduction

Educational institutions, while being minor direct contributors to environmental degradation, play a significant role in influencing environmental quality through resource consumption and the generation of externalities [3]. The scale of their impact is determined by various factors including the number of students and staff [4], the technical specifications of campus facilities, and the effectiveness of institutional management [5,6,7,8]. A critical environmental consideration for these

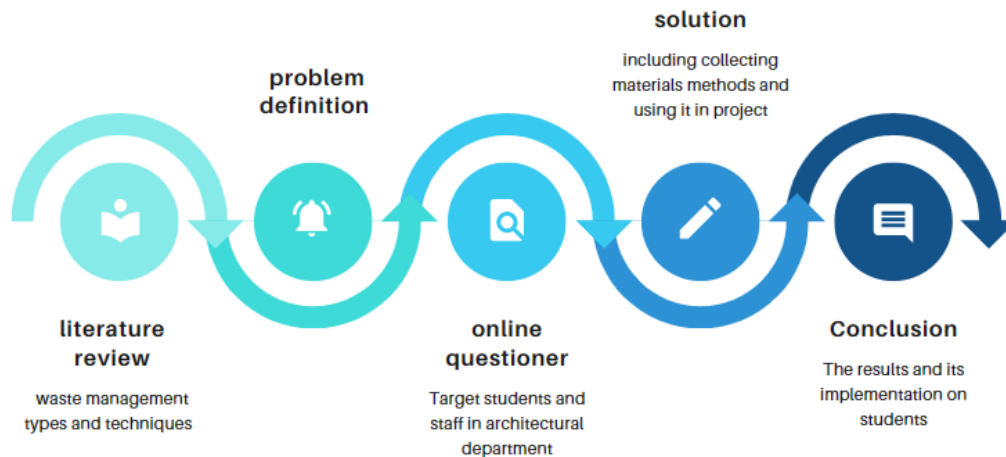
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institutions is the implementation of efficient waste management systems [9]. The challenge intensifies at the higher education level, where the development of an integrated approach to waste management is paramount [10,11]. Additionally, the integration of waste education programs can significantly enhance recycling efforts and boost awareness regarding municipal waste, thereby fostering a more environmentally conscious campus community [12,13]. The objective moving forward is to establish a sustainable framework that not only addresses waste management but also instills a culture of environmental responsibility among all stakeholders within educational settings [14].

## 2. Methods and tools

The methodology will go through many phases; 1<sup>st</sup> the literature review about waste management types and techniques, 2<sup>nd</sup> defining the problem in the case of education institutes, 3<sup>rd</sup> making an online questioner target the users of universities although it is designed to capture a diverse and comprehensive range of perspectives on the waste management in educational institutes matter. Then mention the actions that had been taken in university of Canada- new capital - and finally recommendations and conclusion for this study. (Fig. 1)



**Fig. 1: Research Methodology.**  
(by the author)

## 3. Types of wastes

There are two types of wastes; solid waste and liquid waste; 1<sup>st</sup> Solid wastes: domestic, commercial and industrial wastes especially common as co-disposal of wastes. Examples: plastics, Styrofoam containers, bottles, cans, papers, scrap iron, and other trash.

2<sup>nd</sup> Liquid Wastes: wastes in liquid form. Examples: domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources.

### 3.1. Classification of Wastes according to their properties

- a. Degradable wastes; From plant or animal sources Broken down by other living organisms, Example: municipal waste green waste, food waste paper waste and bio degradable plastics Also include human waste, manure sewage.
- b. Non degradable wastes; Cannot be broken down by other living organisms, not capable of degradation or decomposition, Example; plastics, metal and glass. Also include dangerous chemicals, toxins as are plastic grocery bags [14].

### **3.2. Classification of Wastes according to their Effects on Human Health and the Environment**

- a. Hazardous wastes; Substances unsafe to use commercially, industrially, agriculturally, or economically that are shipped, transported to or brought from the country of origin for dumping or disposal in.
- b. Non-hazardous wastes; Substances safe to use commercially, industrially, agriculturally, or economically that are shipped, transported to or brought from the country of origin for dumping or disposal in [14].

### **4. Sources of wastes in educational institute**

Educational institutions contribute significantly to municipal solid waste, generating a variety of waste types including food waste, packaging materials, paper, plastics, and more [15]. Proper waste management is crucial, involving practices like segregation at the source and cooperation among all stakeholders for sustainability [16]. Challenges include the cost of disposal, clogging of drains, and soil contamination, highlighting the importance of responsible waste treatment and reduction strategies [1].

On the other hand, it could categorize as; Domestic wastes such as; paper, plastic, glass, Biomedical Wastes such as; expired drugs, plastic syringes, surgical dressings, Construction Wastes such as; metal rods, bricks, cement, concrete, roofing materials- digging activities E.g.) telephone, electricity, drainage. And finally, E-Waste- electronics disposed such as; Secondary computers, electronics.[17]

### **5. Methods of waste management**

There are several methods for waste management such as; collection, source separation, storage, transportation, transfer, processing, treatment and disposal of waste.

However recent research on waste management in educational institutes has highlighted the importance of sustainable practices and the role of higher education institutions (HEIs) as agents of change. A study comparing solid waste management within HEIs in developed and developing countries found that while recycling rates are low in emerging realities like La Paz, Bolivia, there is a significant portion of students actively engaged in waste separation at home [18]. Another research conducted a systematic review of waste management in HEIs, emphasizing the potential of the academic community to engage in improvement through teaching, research, and outreach, thereby transforming campuses into living laboratories for sustainability [1]. Moreover, case studies from institutions like Anna University in Chennai, India, demonstrate the implementation of sustainable waste management practices and their impact on the environment and society [19]. These studies collectively suggest that while challenges remain, there is a growing awareness and implementation of sustainable waste management practices in educational settings, paving the way for a more environmentally conscious future.

#### **5.1. Waste Management Recycling**

When the people use the term management, it simply indicates the process of managing things in such a manner so that it will provide them with a desired result. However, when it comes to waste management recycling, it simply refers to the process of managing various types of waste materials for reusing them to make new products. Waste management recycling has become a very popular way of utilizing potentials of the waste materials. Practicing waste management recycling process in home is possible, as it is a very easy process. In order to get the best result in this regard, people need to follow certain very basic but essential steps. [20] (Figure 2)



**Fig.2: wastes classifications.**  
(Department of Civil Engineering - University of Patras, 2024)

**a- Collect the Waste Materials:**

In order to recycle the waste materials at educational institutes, first users have to collect the waste materials by putting them in the right classification bin. Then the educational institute itself has to deal with collecting factory to come and collect the separated wastes.

However, in this point EPA is nowadays in the process of reviewing the waste hierarchy to determine if potential changes should be made based on the latest available data and information.



**Fig.3: waste management hierarchy**  
( <https://www.epa.gov>, 2024)

**b- Make Categories of Waste Materials:**

The second step of waste management recycling process which is sorting out various waste materials, such as old metal, paper, wood, or plastic. The educational institute has to make sure that they properly categorize the waste materials by encourage students and other users to deal right with the recycling bins.[20]

**c- Sell them to Manufacturer:**

After all the above functions are performed properly, now the educational institute can sell the waste materials to the manufacturer who will make the products out of these waste materials. Going for a local known manufacturer will be good idea here. [21]

**d- Products are Ready:**

in this step everything is done. Products are manufactured and ready to come to the market.

By seeing the recycled products, no one can even guess about it. While buying anything of that sort, the customers have to be aware of the fact that they are buying the recycled products. [21]

**6. The importance of people awareness:**

To improve waste management even further, the government should take a community-based approach to the problem. The citizen should be a part of the project, seeing it as their responsibility and a way to improve their standard of living. They should also be educated on the importance of recycling and reusing. This will improve waste disposal. The role of environmental education is to influence people's attitudes toward waste management in a positive way. Without environmental education, more time and resources will be spent in vain on waste management. Future research and studies will look into ways to convert waste into energy for societal benefit and use. More awareness is needed in this regard [22,23].

**7. Online questioner “Solid wastes management in educational institute”:**

1<sup>st</sup> step was that the online questioner had been sent to large number of universities users through sending them the questioner by research gate and personal emails.

The total response was 58 experts from several cities around the world; (Egypt 13 expert, India 2 expert, Nigeria 3 expert, Brazil 2 expert, Jordan 1 expert, Sri Lanka 3 experts, Bangladesh 2 experts, United Kingdom 12 expert, Australia 2 experts, united states of America 1 expert, Iraq 1 expert, Tanzania 1 expert, Switzerland 1 expert, Kenya 1 expert, Indonesia 1 expert, turkey 1 expert, Italy 1 expert and Malaysia 1 expert”



**Fig. 4: the response countries in the online questioner (Question pro.)**

**8. Results of the online questioner:**

**Table 1: Results of the online questioner:**

Questions	Answer	Count	Percent
Gender	Female	31	53.45%
	Male	27	46.55%
Age group	16-25	12	20.69%
	26-35	27	46.55%

	36-45	14	24.14%
	more than 45	5	8.62%
Student, staff, employee or visitor	student	20	34.48%
	staff	28	48.28%
	employee	8	13.79%
	visitor	2	3.45%
Have you ever heard about waste management?	Yes	46	79.31%
	No	12	20.69%
if yes, in what way you know about it?	TV	12	23.08%
	School	11	21.15%
	university	32	61.54%
	public meeting	13	25.00%
	others	19	36.54%
Mention your educational institute name	<ul style="list-style-type: none"> <li>• Graphic Era Hill University Dehradun India</li> <li>• University of Nigeria Nsukka</li> <li>• UNIVERSITY OF NIGERIA</li> <li>• Federal University of Santa Catarina (Universiade Federal de Santa Catarina - UFSC) – Brazil</li> <li>• University of Michigan, Ann Arbor</li> <li>• Central Environmental Authority</li> <li>• University of Chittagong, Bangladesh</li> <li>• AASTMT</li> <li>• University of Manchester</li> <li>• Alnahrain university</li> <li>• University of Ruhuna</li> <li>• University of Vermont</li> <li>• Bangladesh University of Professionals</li> <li>• Kirkuk university Iraq</li> <li>• Catholic university of Eastern Africa</li> <li>• Hochschule Luzern</li> <li>• University of Technology Sydney</li> <li>• University of Liverpool</li> <li>• Pancasila University</li> <li>• University of Nigeria Nsukka</li> </ul>		

	<ul style="list-style-type: none"> <li>• Specialized Dental Clinic in Ain Shams University</li> <li>• CEFET/RJ</li> <li>• Cairo university</li> <li>• Jayoti Vidyapeeth Women's University Jaipur Rajasthan India</li> <li>• Cukurova University</li> <li>• Future university</li> <li>• Faculty of dentistry, MTI university</li> <li>• Alazhar University</li> <li>• British university in Egypt</li> <li>• Pharos university in Alexandria</li> <li>• German university in Cairo</li> <li>• Faculty of commerce English section Cairo University</li> <li>• University Tunku</li> <li>• CIC</li> </ul>		
are you satisfied with waste management in your educational institute?	Yes	24	42.86%
	No	32	57.14%
Do you use the recycling pins in your educational institute correctly?	Yes	34	58.62%
	No	24	41.38%
Have you ever heard the importance of recycling and reuse?	Yes	57	98.28%
	No	1	1.72%
In your opinion what is the most solid wastes in your educational institute?	cartoon	5	8.62%
	plastics	22	37.93%
	glass	1	1.72%
	metal	1	1.72%
	paper	27	46.55%
In your opinion your institute solid waste management should be reuse or recycled?	reuse	17	29.31%
	recycled	41	70.69%
Do you have an announced recycling program in your institute?	Yes	25	43.10%
	No	33	56.90%
If you don't have this program, would you be willing to separate bags for collection purpose if your institute announce a recycling program?	yes	46	82.14%
	no	3	5.36%
	maybe	7	12.50%
If the recycling program settled what is your recommended action, you prefer to encourage you to be part of it?	to apply the wastes in subject's projects	28	50.00%

	to take marks according to your participation	13	23.21%
	to take money according to the quantity	17	30.36%
	Other	9	16.07%

79.1% of university users know about the concept of waste management, however most of them knows the concept from the university, 57% of them don't satisfy with waste management in their educational institutes. Most of them agreed that the most wastes gained from the educational institutes was papers and plastics and that's means that most of educational institutes wastes directed to be recycled not reused. Most of them are willing to be involved in any recycling program if it will be announced in their institute, however they would like to be applying in subjects' projects more than other options.

### 9. Analytical example “university of Canada in Egypt”:

The Universities of Canada in Egypt represents a significant collaboration between Canadian and Egyptian higher education sectors. Established in 2018, it serves as the first International Branch Campus in Egypt's New Administrative Capital (Fig.5), hosting the University of Prince Edward Island (UPEI). The campus offers a range of programs including Business Administration, Mathematical and Computational Sciences, and Sustainable Design Engineering [24].

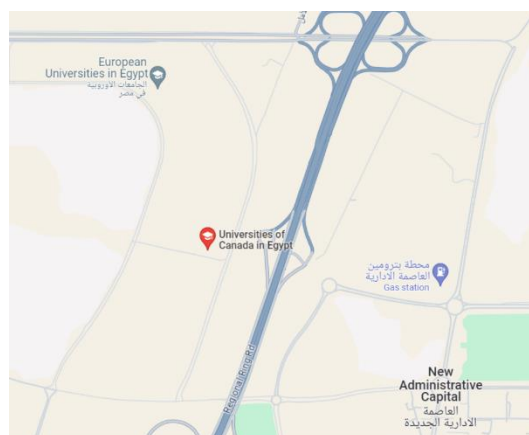


Fig. 5 : location of university of Canada

( google maps, 2024 )

The University of Canada in Egypt is committed to sustainability and environmental stewardship, which includes implementing effective waste management strategies. These strategies are designed to minimize waste, promote recycling, and manage waste disposal in an environmentally responsible manner. The university's approach aligns with the broader waste management policies in Egypt, which are increasingly focusing on waste-to-energy projects and integrated waste management systems to address the country's waste challenges. While specific details of the university's waste management practices are not publicly detailed, such initiatives typically involve segregation of recyclable materials, safe disposal of hazardous waste, and efforts to reduce the overall environmental



impact of waste. These practices not only contribute to a cleaner and safer campus but also serve as an educational tool for students, preparing them to be environmentally conscious leaders of the future.[25]

university of Canada had been decided to use the waste management strategies all over the university indoor and outdoor. (Fig.6)



**Fig. 6: wastes containers in university of Canada - New capital- Egypt.**

**(The author, 2023)**

Through the personal interview with eng. Mohamed abd-elsalam the safety manager in the university the researcher know that They deal with waste management through collecting company “Arab company for transporting medical and industrial wastes” the company by default come to collect the medical and industrial wastes from the campus every 3 to 6 months or by call. the wastes divided into two categories “FSD and GPI” this collecting from chemistry lap which is fabric or old oil. [25]

The medical wastes were in range 1K per 6 months however the industrial wastes were 4k during the six months. This company have a private area to compact these wastes on it in the zone of EL-AYAT, Banya swif. On the other hand, the university take the part of paying the transportation fees for the company. [25]

## **10. Discussion/Conclusion**

waste management is a critical issue for educational institutions since they generate huge amounts of waste and must promote sustainability among their students and staff. However, Recycling is a very useful process of waste management. It helps in preventing waste of potentially useful materials. Moreover, by separating the knowledge of recycling that’s increase the awareness and the ability of students and however used the institute to help in the process then it will be an attitude in all places during their day.

Educational institutions looking to enhance their waste management systems can adopt several best practices. Firstly, conducting a waste audit is crucial to understand the types and quantities of waste generated. This data can inform targeted strategies for waste reduction and recycling. Secondly, institutions should engage the entire campus community in waste reduction efforts through education and clear communication about waste policies. Thirdly, implementing a comprehensive recycling program, including the separation of recyclables and organic waste, is essential. Additionally, institutions can explore partnerships with local waste management services and other organizations

to find innovative solutions for waste diversion and reduction. Lastly, campuses can serve as living laboratories for sustainability, integrating waste management practices into the curriculum and research projects, fostering a culture of environmental responsibility among students and staff [26, 27]. These steps not only contribute to a more sustainable campus but also prepare students to be environmentally conscious citizens.

Finally, after the questioner it was so clear that the people awareness was clear and most of them are willing to be part of this step since they have noted about it and be involved in the cycle.

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