



Celebrating “worthiness of waste” to teach sustainability

Abstract

The production of waste, i.e. unnecessary or undesirable by-products, is an unavoidable consequence of most processes.

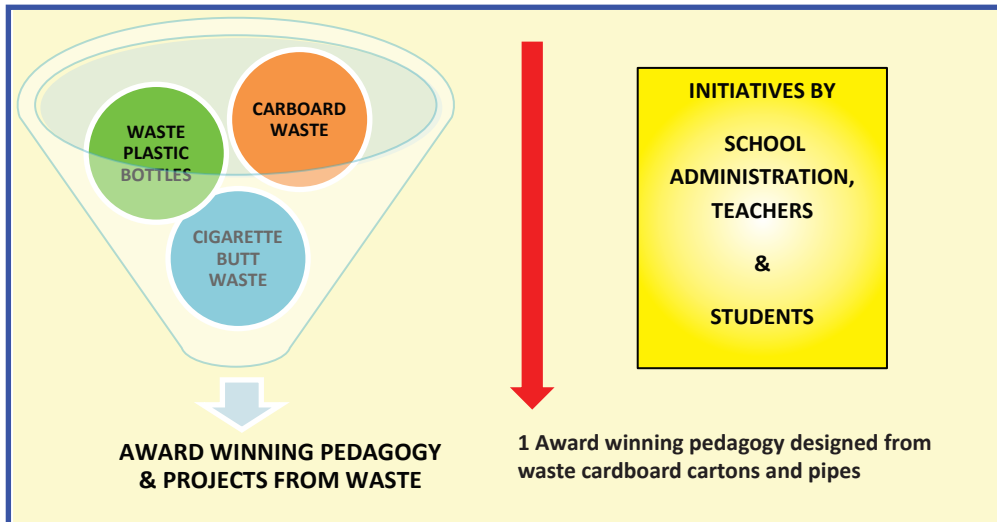
Globally, 7-9 billion tonnes of waste are produced yearly [1]. Whilst educating young people is often seen as a part of the solution to environmental problems, The school and teachers can play a critical role in helping them learn sustainable practices like waste management via educational activities and project designs. This article highlights the success stories of the initiatives taken by Salwan Public School, Rajendra Nagar in mentoring young minds to innovate unique ways of waste management to sow the seeds of sustainability in their minds.

Introduction

There are sufficient evidences showing

that societies are following unsustainable paths of resource use (World Resources Institute, 2000) and this trend stands as an obstacle towards a sustainable future. In United Nations Conference on Environment and Development (UNCED), named Agenda 21, emphasizes directly or indirectly the importance of waste management and measures that reduce the generation of waste (United Nations Environment Programme, 1992). Moving towards a circular economy, waste materials should re-enter production flows as material or embedded energy, through recycling, composting or waste-to-energy incineration [2,3] Ms. Priyanka Barara, Principal, Salwan Public School, Rajendra Nagar has supported multiple award winning projects and teaching pedagogy that aimed exclusively on reusing waste showcasing that waste can not only be managed but can be a treasure to teach.

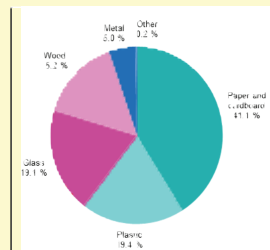




1. Innovative Pedagogy Designed From Waste Ranked 1st In Delhi by SCERT

Students usually do not enjoy learning long and intricate biological processes and if understood, it

1 Award winning pedagogy designed from waste cardboard cartons and pipes



is not retained lifelong hence learning through gaming was planned by Dr. Shilpa Raghuvanshi Chauhan, PGT Biotechnology. And according to BBC, India is world leader in paper waste (<https://www.bbc.com/news/world-asia-india-46641059>).

Not only in India, paper and cardboard (41.1 %) are the most common type of packaging waste in European Union (EU), Fig. 1 [4].

Figure 2: Packaging waste generated by packaging material, EU, 2020
Source: Eurostat (env_waspac)

With the objective to reuse the cardboard waste and help students enjoy learning and retaining long biological processes through affordable games, a STAPOO game was designed. Dr. Chauhan designed a STAPOO game that was correlated with the structure and functioning of the human heart. While the students are learning through STAPOO game, they are in groups and together learn the lessons, which they can revise easily too. Best part of the innovation was that even students who are introverted in classrooms come forward to play and learn. The game has two levels as shown in Fig 3:

Level 1 deals with the structure of human heart and

Level 2 deals with working of human heart

Celebrating the STAPOO game

This pedagogy was ranked No. 1 in State Delhi in Vidya Amrit Mahotsav which is an innovative pedagogy festival by SCERT, Delhi.

The link of the video of the whole game uploaded on Diksha app. is https://diksha.gov.in/play/collection/do_313727732140302336111485?contentId=do_31372358035470745618903

It was featured in the Times of India on 17th March 2023.

http://timesofindia.indiatimes.com/articleshow/98719544.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

https://epaper.timesgroup.com/article-share?article=17_03_2023_008_029_cap_TOI

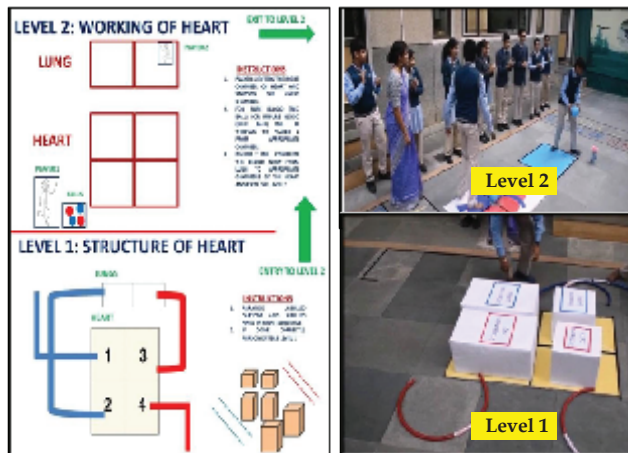


Figure 3: Game sketch parallel to Real glimpse of children playing the STAPOO game

2. National Award For Microscope Made From Waste Plastic Bottle

Our planet is choking on plastic. According to United Nations, we produce about 400 million tonnes of plastic waste every year. The estimated annual loss in the value of plastic packaging waste during sorting and processing alone is US\$ 80- 120 billion. The ubiquitous application of plastics has resulted in a massive amount of plastic waste released and accumulated in the bay ecosystem, posing significant ecological effects [5]. It is estimated that 75 to 199 million tonnes of plastic is currently in our oceans. Governments across the globe have started promoting innovation so the plastics we need are designed and brought into the economy in a way that allows for their reuse.

In alignment of this vision we have microscope designed from waste plastic bottle "Plastoscope"

Plastoscope is a cost-effective and easy to access and handle microscope made from waste plastic bottle that produces results as



Fig.4 Plastoscope

good as produced by compound microscope (Fig. 4). Plastic body of the waste bottle makes it light-weight, damage-proof, and cheap while contributing to the problem of plastic waste management. After several prototyping ventures, we have also installed a feature of dark field microscope that enables us to see living cells without staining which can be used by students to see cells like pollen grains, spores of ferns, bacterial and algae cells in water on school trips.

Alongside this, for educating a large group



Fig.5 Plastoscope integrated to the laptop

of students we have also designed a setup to connect the live phone camera to laptop/projector on Wi-Fi/USB which projects the microscope focusing and cell movement on a larger screen and also aids to online education which became so prevalent in times of pandemic (Fig. 6).

Not only for education, Plastoscope can be used for diagnosis of genetic diseases like Sickle-Cell Anemia, hence prevent its transmission, and malaria by detecting the malaria protozoa in blood sample or blood groups. This is because, though we have worked on reducing costs the principle, features like fine-tuning, coarse tuning, and replacing power of lenses remains the same, hence providing exactly the same or even better results.

Celebrating the plastoscope

Beside winning National Award from Inspire Manak the project was invited at the launch programme of Pradhan Mantri Innovative Learning Programme (PMILP)-"DHRUV" at ISRO, Bengaluru. Project "Plastoscope" mentored by Dr. Shilpa Raghuvanshi Chauhan was among top 9 science projects across the country that were selected for 14 days long ambitious program. The student was awarded by Honorable Vice President of the Country, Shri Venkaiah Naidu.

The project was not only showcased at IISc, Bangalore, IIT Delhi, ISRO but also got coverage on All In Radio (AIR) and various national newspapers and channels.

Coverage on DD news

<https://www.youtube.com/watch?v=O8GCshgfgxk>

Hindustan Times

<https://pressreader.com/article/281809990185037>

3.National award for Larvaecidal cakes made from waste cigarette butt.

The next project addresses two global problems: Cigarette butt pollution and mosquito borne illnesses. According to United Nation, Cigarette butts account for more than 766 million kilogrammes of toxic trash each year. They are also the most common plastic litter on beaches, making marine ecosystems more susceptible to microplastic leakages. When ingested, the hazardous chemicals in microplastics cause long-term mortality in marine life, including birds, fish, mammals, plants and reptiles. Yearly, 6 trillion cigarettes are smoked worldwide, and 4.5 trillion cigarettes are littered in the environment [6]. On the other hand, according to World Health Organization (WHO), 700

million people are affected from mosquito borne illnesses annually Over 1 million people die of mosquito-borne diseases each year

So, with the objective to manage and recycle the cigarette butt waste and to check mosquito borne illnesses, we have formulated larvaecidal cakes from nicotine extracted from waste cigarette butts, yeast, sugar and binding material (Fig. 7). Once the cakes are added to stagnant water that are breeding grounds of mosquito having hundreds of their larvae, Carbon dioxide and possibly additional volatiles produced by fermentation of sugar by yeast attract mosquitoes which can therefore be used as baits for the killing of mosquitoes.

Nicotine and other chemicals in cigarette butts are toxic to mosquito larvae and play a critical role in killing them thus preventing spreading of mosquito borne diseases.



Fig.6 Making of Larvaecidal cake from Waste Cigarette Butt

The product was tested in National Institute of Malarial Research, Indian Council of Medical Research (NIMR, ICMR) on it's lethal effect on Anopheles mosquitoes and it's larvae. Highlights the series of experiments and observation designed to check the effectiveness of the engineered cake made from waste cigarette butt.

Celebrating the Larvaecidal CakNational Award in ATL National Competition

Research based project published in Pradhan Mantri coffee table book by NITI AYO
https://aim.gov.in/pdf/Coffee_Table_Book_Final.pdf

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Conclusion

The "waste as a resource approach" will help young generation to visualize waste not as a problem or burden, but as a valuable resource, to innovate solutions for sustainable lifestyle. Waste can be re-engineered to design not only useful products but also channelizing rising quantity of unmanaged waste that threatens our ecosystem to boost economy. Schools can play a very critical role in reprogramming young minds to consider waste as an untapped opportunity for transformational change.



Priyanka Barara

Principal, Salwan
Public School,
Rajendra Nagar,



Shilpa Raghuvanshi

PGT Biotechnology,
Salwan Public School,
Rajendra Nagar

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