

TOWARDS SUSTAINABLE APPROACH: ASSESS THE OPINION OF THE STUDENTS REGARDING DEVELOPMENT OF UTILITY AND DÉCOR ARTICLES FROM PLASTIC WASTE GENERATED IN SCHOOLS

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ABSTRACT

Plastic is a versatile material. Plastics take many decades to break down completely. Throughout the entire country, and particularly in urban areas, plastic bottles and sachets have become very common. Because the packaging revolt was not accompanied by an effective plastic waste management strategy, many Indian cities are now covered with plastic waste, which is harmful to the environment and poses severe health risks for the existing communities. Plastic recycling programs have been implemented in most developed nations due to rising environmental awareness and a shortage in landfill capacity. Yet, only 5 to 25 per cent of plastic waste is currently recycled in India. By recycling and reusing plastic raw materials and fashioning them into other products, consumers can effectively reduce plastic space taken up in landfills that can be used for biodegradable materials to save the environment. Plastic waste is a resource that is abundantly available and can be used either for material recycling or energy production, depending on the quality grade. The objectives of the present study were to prepare theme-based design and develop utility and décor articles from plastic waste generated in schools and assess the opinions of students and to prepare a catalogue with cost estimate for the designed utility and décor articles. The research design adopted for the study was descriptive in nature. The utility and décor articles were developed and displayed. The data was collected through an questionnaire to assess students' opinions regarding the extent of expediency of the developed utility and décor articles. From the data collected regarding the opinion of the students based on the existing parameters of the designed and developed utility and decor articles namely size, quality, durability, proportion, convenience of use, colour combination, and

aesthetic value for residential use from plastic waste, the findings of the study depicted that painting was the most liked article by the students with the weighted mean of 4.56. The colour combination of developed utility and décor articles was appreciated by the students.

Keywords: sustainable, utility and décor article, plastic waste

INTRODUCTION

“Plastic is a material produced from oil by a chemical process and used to make many objects. It is light in weight and does not break easily.”

- Collins Dictionary (1979)

Plastic waste is the accumulation of plastic objects. ‘The Earth’s environment that adversely affects wildlife, wildlife habitat, and humans’ (Chauhan, 2020).Plastics are a wide range of synthetic or semi-synthetic materials that use polymers as the main ingredient. Their plasticity makes it possible for plastics to be moulded, extruded, or pressed into solid objects of various shapes. This adaptability, plus a wide range of other properties, such as being lightweight, durable, and inexpensive to produce, has led to its widespread use. Plastics typically are made through human industrial systems. Most modern plastics are derived from fossil fuel-based chemicals like natural gas or petroleum; however, recent industrial methods use variants made from renewable materials, such as corn or cotton derivatives. ^[1]

The success and dominance of plastics started in the early 20th century that caused widespread environmental problems, due to their slow decomposition rate in natural ecosystems. Toward the end of the 20th century, the plastics industry promoted recycling in order to ease environmental concerns while continuing to produce virgin plastic and to push the responsibility of plastic pollution onto the consumer. Plastic collection and recycling are largely ineffective because of failures of contemporary complexity required in cleaning and sorting post-consumer plastics for effective reuse. Most plastic produced has not been reused, either being captured in landfills or persisting in the environment as plastic pollution. Plastic pollution can be found in the world's major water bodies, for example, creating garbage patches in all the world's oceans and contaminating terrestrial ecosystems. Of all the plastic discarded so far, 14% has been incinerated and less than 10% has been recycled. (Hopewell et al., 2014)

In developed economies, about a third of plastic is used in packaging and roughly the same in buildings in applications such as piping, plumbing or vinyl siding. Other uses include

automobiles (up to 20% plastic), furniture, and toys. In the developing world, the applications of plastic may differ; 42% of India's consumption is used in packaging. In the medical field, polymer implants and other medical devices are derived at least partially from plastic. Worldwide, about 50 kg of plastic is produced annually per person, with production doubling every ten years. (Chauhan et al., 2019)

Utility articles

Utility is a term in economics that refers to the total satisfaction received from consuming a good or service. Economic theories based on rational choice usually assume that consumers will strive to maximize their utility. Utility articles are items or equipment that are not usually essential, but which can be used with or added to something else in order to make it more efficient, useful, or decorative.

Décor articles

Décor comes from the French word *décorer*, meaning "to decorate." In its widest sense, 'decoration' refers to the process of making something more attractive. It can be referred to as 'interior decoration' or 'décor' and can be done by arranging and placing of décor articles that relate to the aesthetics of a space. In the construction industry, decoration refers to the 'dressing' of a room or interiorspace.

This study focused on the reuse of plastic waste generated in school. There were tons of easy and creative ways to reuse some of the plastic items. Reusing was the way toward transforming plastic waste into new and usable items. Many studies solved the problem of the accumulation of waste in the place of its origin. Usually, large amounts of this waste end up in dumps every day with the highest environmental impacts (Andrea et al., 2018). The reuse of plastic was not only beneficial for the climate but also, very helpful for the plastic industry. Through the reusing of plastic, many reused items were created which were harmless to the ecosystem. Reusing plastic helped to develop and save energy and reduce pollution.^[4]

This study generated theme-based designs for selected utility and décor articles all made from plastic waste generated in schools. This work may inspire designers and makers to reconsider the use of waste materials in their work, discover the beauty and utility of these materials, and create attractive products, raise awareness of material reuse, and have a positive impact on the environment through a structured design process using the guidelines.

Objectives of the study

1. To developed theme-based design of selected utility and décor articles from plastic waste generated in schools.
2. To assess opinions of students regarding the aesthetic and functional aspects of selected utility and décor articles developed from plastic waste.
3. To prepare a cost estimate and catalogue for the designed utility and décor articles developed from plastic waste.

METHODOLOGY

Purposive convenience sampling technique was used to select the schools from Vadodara city as only those high schools were selected who gave the consent to conduct the study and having co-education. Total 5 schools were selected. 250 students of grade 12th were selected from the 5 schools. Random sampling was used to select the students. Questionnaire method was used to collect the data from the students.

Selection, Construction and Description of the Tool

Selection of tool

For the present study, questionnaire was used.

Questionnaire: For the present study questionnaire was used to know the opinion of students regarding what they perceive about selected parameters namely size, quality, durability, proportion, the convenience of use, colour combination, and aesthetic value of the designed utility and décor articles as it gives the accurate data and it offers flexibility which increases the understanding between the students and the researcher.

Description and development of data collection tool

The questionnaire was constructed in compliance with the objectives of the study and statements were divided into 3 sections as follows:

Section I: Background information of the students

This section contained questions regarding the background information of the students like name, age, educational qualifications, email id.

Section II: Students' Opinion scale and pattern of response

To gather the information regarding students' opinions regarding the selected parameters namely size, quality, durability, proportion, convenience of use, colour combination, and aesthetic value of the designed utility and décor articles from plastic waste. 204 statements were

developed. Total 30 articles were designed for different spaces. The minimum and maximum scores under each aspect were obtained and a range of scores was developed based on the equal interval method to take the opinion of students for the developed utility and décor articles. The responses were measured on a five-point continuum, i.e., “strongly agree, agree, undecided, disagree and strongly disagree” and ascribed scores were 5 to 1. To obtain the category of opinion followed the weighted mean $(5 - 1)$ and the range of scores was divided at equal intervals.

Phases of Product Development

The product development was carried out in three phases during the study:

Phase 1: The researcher collected plastic waste from the 5 schools of Vadodara city.

Phase 2: The drawings of utility and décor articles were prepared using AutoCAD 2020 software by the researchers. The prepared drawings of the utility and décor articles were used for the development of the articles. To give value-addition to the developed utility and décor articles, the researcher hand-painted the articles. The products were displayed through an exhibition in the youth mela.

Phase 3: Cost estimation of the products was done based on material cost, labour cost and profit. A catalogue was prepared by mentioning the product description, namely product name, type of plastic used, size of the product, and costing of the developed utility and décor articles.

FINDINGS AND DISCUSSION

Finding and discussion is considered the most important chapter in dissertation as well as other types of research reports.

Part I

Designing and development of utility and décor articles from plastic waste generated in school.

This section describes the phases of designing and development of the utility and décor articles from plastic waste along with the cost estimation of the products.

Phase 1: Collection of plastic waste.

For collecting plastic waste, researcher collect the two months stored plastic waste, from the 5 schools of Vadodara. The plastic waste that was procured from the schools included waste like plastic bottles, paint buckets, containers, pipe, folders, stands etc.

Phase 2: Designing and development of utility and décor articles.

- A. Designing of utility and décor articles using AutoCAD 2020 software
- B. Development of utility and décor articles from plastic waste
- C. Value addition to the utility and décor articles

Designing of utility and décor articles using AutoCAD software

The researcher designed 30 utility and décor articles using the AutoCAD 2020 Software. All articles were developed from available plastic waste.

Utility article

- Dustbin
- Hanging light
- Wall light
- Table light
- Laundry basket
- Pen stand
- Bird house
- Newspaper holder
- Ottoman
- Key holder
- Side table
- Coaster
- Stationary organizer
- Wall shelf
- Toothbrush holder
- Wall mounted wine glass holder

Décor article

- Planter
- Hanging pots

- Artificial flower pot
- Chandelier
- Wall hanging
- Ornament
- Painting
- Candle Stand
- Vase
- Wall décor artifact
- Artificial sculpture
- Windchime
- Flowers
- Decorative mirror

B. Development of utility and décor articles from plastic waste

The drawings of the utility and décor articles were prepared using AutoCAD 2020 software and were used for the development of the articles.

General steps for the development of utility and décor articles

Step 1: The drawings of the articles were prepared in AutoCAD 2020 software and were used by the researcher for the development of the articles.

Step 2: Plastic waste was selected according to the article's measurements, size, and requirements.

Step 3: A cutting knife, a scissor, and a soldering iron machine were used to cut plastic products. The edges were smoothened with the help of sandpaper.

Step 4: Four to five coats of primer were first applied to the plastic surface to create a solid foundation for the acrylic paint to adhere to.

Step 5: One layer of black acrylic paint was used for the final coating, and to add aesthetic appeal, gold acrylic paint, gold-coloured foam sheets (0.2mm thick), and jute thread were also used.

Step 6: to join different pieces together hot glue gun, fevicol solution, nut bolt, and stapler pins were used.

C. Value addition to the utility and décor articles

To give value addition to the developed utility and décor articles, the researcher selected a Black and Gold theme, and according to the theme, hand painted the utility and décor articles with acrylic colours.

Phase 3: Preparation of catalogue and cost estimation of utility and décor articles

Cost estimation was done based on material costs, labour charges and profit for the developed utility and décor articles. A catalogue was prepared mentioning the product description namely product name, type of plastic used, size of the product and price of the developed utility and décor articles.

Table 1: Material costs and labour charges for the developed utility and décor articles for residential use from plastic waste

Sr. no.	Utility & Décor Article	Material cost & Labour Charges (in ₹)	Profit (in ₹)	Selling Price (in ₹)
1.	Dustbin	150	50	200
2.	Hanging light (Pendant)	270	100	370
3.	Wall light	330	100	430
4.	Table light	300	100	400
5.	Laundry basket	500	200	700
6.	Pen stand	30	20	50
7.	Bird house	150	50	200
8.	Newspaper holder	80	30	110
9.	Ottoman	1100	300	1400

S r. no.	Utility & Décor Article	Material cost & Labour Charges (in ₹)	Pr ofit (in ₹)	Sell ing Pri ce (in ₹)
10	Key holder	140	40	180
11	Side table	800	30 0	110 0
12	Coaster	290	60	350
13	Stationary organizer	110	50	160
14	Wall shelf	190	60	250
15	Toothbrush holder	30	20	50
16	Wall-mounted wine glass holder	250	15 0	400
17	Planter	70	30	100
18	Hanging pot A	60	20	80
19	Hanging pot B	60	20	80
20	Artificial flower pot	140	30	170
21	Himmeli chandelier	250	10 0	350
22	Himmeli wall hanging	40	10	50
23	Himmeli ornament	40	10	50
24	Painting	250	50	300
25	Candle Stand	20	10	30
26	Vase	120	50	170
27	Wall décor artifact	120	50	170
28	Sculpture	40	10	50
29	Windchime	70	40	110
30	Flowers	80	40	120

S r. no.	Utility & Décor Article	Material cost & Labour Charges (in ₹)	Pr ofit (in ₹)	Sell ing Pri ce (in ₹)
3	Decorative mirror	160	50	210
Total		6240	21 50	839 0
Note: • The material cost includes the cost of jute rope, Stapler pin, glue & adhesive, polish, primer, acrylic paints, and other materials used for the development of the utility and décor articles. • The profit was decided according to the making time and material cost was calculated based on prevailing market rate from November 2022 - December 2023. • Profit margin was calculated using given formula: $\frac{\text{Gross Profit}}{\text{Sale Rate}} \times 100$				

Part II

Section I: Background Information of the students

This section contained the background information of the students.

Section II: Opinion of students for the developed Utility and Décor Articles.

This section described the students' opinion regarding what they perceive about selected existing parameters namely "size", "quality", "durability", "proportion", "convenience of use", "colour combination" and "aesthetic value" of the developed utility and décor articles from plastic waste for residential spaces.

- 63.33 percent of the students strongly agreed that the dustbin was solving the purpose for what it was designed.
- 60 percent of the students strongly agreed that the light was solving the purpose for what it was designed.
- 53.33 percent of the students agreed that the finishing of the wall light was satisfactory.

- 58.33 percent of the students strongly agreed that the price of the table light was acceptable.
- 58.33 percent of the students strongly agreed that the basket size was appropriate for its use.
- 58.33 percent of the students agreed that the pen stand width was appropriate to hold pens.
- 65 percent of the students strongly agreed that the price of the bird house was acceptable.
- 58.33 percent of the students strongly agreed that the newspaper holder served the purpose for which it was designed.
- 78.33 percent of the students strongly agreed that the finishing of the ottoman was satisfactory.
- 60 percent of the students strongly agreed that the size of the key holder was appropriate.
- 68.33 percent of the students strongly agreed that the price of the side table was acceptable.
- 60 percent of the students strongly agreed that the size of the coaster was big enough for its use.
- 55 percent of the students strongly agreed that the stationary organizer served the purpose for which it was designed.
- 63.33 percent of the students strongly agreed that the design of the wall shelf reflected unity.
- 53.33 percent of the students agreed that the size of the toothbrush holder was big enough for its use and the overall quality was satisfactory.
- 58.33 percent of the students strongly agreed that the finishing of the wine glass holder was satisfactory and price was acceptable.
- 56.67 percent of the students strongly agreed that the finishing of the planter was satisfactory.
- 50 percent of the students strongly agreed that the size of the pot was appropriate for its use.
- 68.33 percent of the students strongly agreed that the overall quality of the flower pot was satisfactory.
- 51.67 percent of the students strongly agreed that the size of chandelier was big enough for its use and the colour combination was appropriate for residential use.
- 56.67 percent of the students agreed that the price of the wall hanging was acceptable.
- 53.33 percent of the students agreed that the overall quality of the ornament was satisfactory and the price was acceptable.

- 70 percent of the students strongly agreed that the finishing of the painting was satisfactory and it served the purpose for which it was designed.
- 50 percent of the students strongly agreed that the finishing of the candle stand was satisfactory and it added aesthetic value to the space.
- 65 percent of the students strongly agreed that the vase was sturdy enough for its use.
- 66.67 percent of the students strongly agreed that the finishing of the product was satisfactory.
- 51.67 percent of the students agreed that the sculpture added aesthetic value to the space.
- 65 percent of the students strongly agreed that the windchime added aesthetic value to the space while serving its purpose.
- 66.67 percent of the students strongly agreed that the finishing of the flower was satisfactory.
- 66.67 percent of the students strongly agreed that the finishing of the flower was satisfactory.

Table 2: Weighted mean score of the opinion of the students regarding utility and décor articles

Sr . No	Developed Utility and Décor Article	Weighted mean (5-1)
1.	Painting	4.56
2.	Side table	4.53
3.	Vase	4.49
4.	Windchime	4.49
5.	Artificial flower pot	4.47
6.	Wall décor artifact	4.44
7.	Dustbin	4.41
8.	Wall-mounted wine glass holder	4.41
9.	Newspaper holder	4.35
10.	Ottoman	4.34

11.	Hanging pot	4.34
12.	Laundry basket	4.33
13.	Stationary organizer	4.33
14.	Planter	4.31
15.	Decorative mirror	4.2
16.	Wall shelf	4.19
17.	Flowers	4.18
18.	Hanging light (Pendant)	4.17
19.	Wall light	4.16
20.	Coaster	4.16
21.	Chandelier	4.16
22.	Table light	4.15
23.	Bird house	4.15
24.	Pen stand	4.1
25.	Artificial sculpture	4.08
26.	Toothbrush holder	4.06
27.	Wall hanging	3.98
28.	Ornament	3.98
29.	Key holder	3.96
30.	Candle Stand	3.88

According to table, the highest weighted Mean score was 4.56 for the painting among the articles developed for the residential spaces.

Some Pictures of the Developed utility and décor articles.



Plate 65: Laundry basket



Plate 62: Hanging light (Pendant)



Plate 63: Wall light



Plate 64: Table light



Plate 77: Planter



Plate 73: Stationary organizer

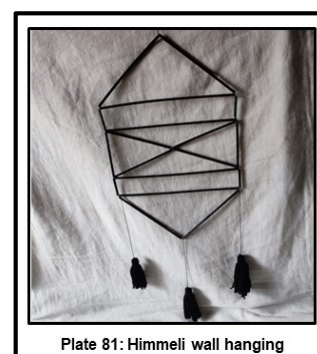


Plate 81: Himmeli wall hanging



Plate 74: Wall shelf



Plate 66: Pen stand



Plate 89: Flowers



Plate 67: Bird house



Plate 84: Candle stand

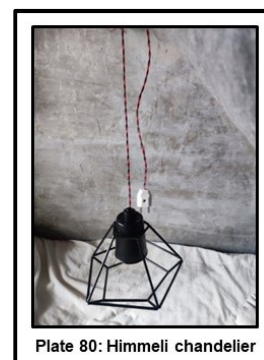
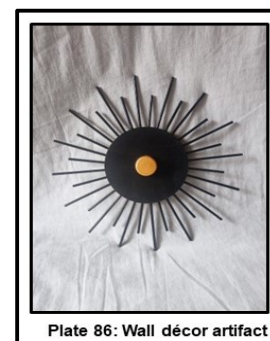
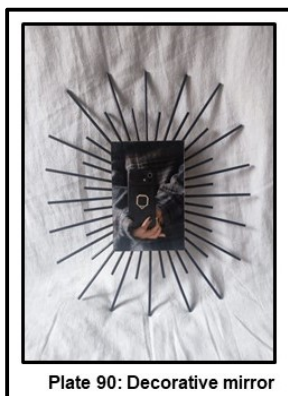




Plate 68: Newspaper holder



Plate 87: Artificial Sculpture



Plate 83: Painting



Plate 79: Artificial flower pot



Plate 69: Ottoman



Plate 61: Dustbin



Plate 75: Toothbrush holder

CONCLUSION

Plastic is a versatile material. Hence, plastic waste varies widely. Plastics take many decades to break down completely. It does not matter where the plastic is stored or kept; it will still take a long time to degrade. By recycling and reusing plastic raw materials and fashioning them into other products, consumers can effectively reduce plastic space taken up in landfills that can be used for biodegradable materials to save the environment. Plastic waste is a resource that is abundantly available and can be used either for material recycling or energy production, depending on the quality grade. By reusing plastic instead of manufacturing the same grade of material every time, plastic footprint can be reduced on dump sites across the globe which helps in reducing environmental pollution and creating wealth and employment and thereby, fostering economic development of the country. Reusing the plastic waste can also help in healing the environment by lessening the damage that is already done. It can also be of great use to hike up the economy of the plastic industry. Reducing and reusing plastics is a sure way to protect our natural resources. However, reusing plastics also means that there is lesser plastic in landfills, rivers, forests, and oceans across the earth. The findings of the study depicted that the painting was the most liked article by the students with the weighted mean of 4.56. The colour combination of the developed utility and décor articles was appreciated by the students.

IMPLICATIONS OF THE STUDY

For interior designers

The study will help interior designers to utilize the plastic waste from the construction and renovation sites and develop new products from it which can be used as décor or utility products for residential and commercial purposes.

For the manufacturer and retailers related to the plastic industry

The finding of the study would also be beneficial to the manufacturer and retailer of the plastic industry, as the design developed can be used as an example for reusing the maximum amount of plastic waste to create handicrafts, utility, and décor articles from plastic waste from their outlet.

RECOMMENDATIONS FOR FUTURE RESEARCH

- A similar kind of design project can be conducted on designing office articles, toys, and small furniture for Pre-Schools.
- A similar kind of design research can be conducted on other groups of students like architects, product designers, furniture designers, and manufacturers.
- A study can be undertaken on different industries that use plastic waste and can manufacture new products.
- A similar study can be conducted on using other household or commercial waste like glass, wood, cardboard, etc. to turn them into usable objects.

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