

RESEARCH ARTICLE

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Innovative Utilization of Upcycled Waste Materials in the Construction of Useful and Attractive Household Articles

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Abstract

The study was carried out to examine the innovative utilization of upcycled waste materials in the construction of useful and attractive household articles. The research design adopted for the study are experimental and survey research. The experimental design dealt with the steps involved in the construction of the articles while the survey design encompasses the assessment of the respondents on the acceptability of the articles produced. Two articles produced using upcycling method are foot-stool and storage box pouf. An open-ended questionnaire was designed by the researcher for assessing the acceptability of the articles produced. The questionnaire was administered on 30 respondents which comprised of academic staff, non-academic staff and students within the Tai Solarin University of Education which was the study area. Data collected were analysed using frequency counts, percentages, mean and standard deviation while the quality assessment of the two articles produced was based on colour, appearance, and cost. Among the major findings are that majority of the respondents adjudged both the footstool pouf and storage box produced of been of high quality in terms of Colour (56.7%, 53.3%), appearance (50%, 60.0%) and cost (60%, 60.0%%) respectively; the produced footstool and storage box are confirmed to be durable and affordable; the use of upcycled waste materials were adjudged to go a long way to encourage the patronage of locally made fabric materials and would also create new market opportunities for traditional textile designers. The study's findings led to the following suggestions. Upcycling information should be more specific on what, when, and where to recycle; To maximise material use, clothing and textiles should be upcycled at several levels; Government and other stake holders should focus on waste management in textiles using upcycling techniques much equal to inventing new products and technologies.

Keywords: Upcycling, Innovation, Waste Materials, Household Articles

INTRODUCTION

People currently consume a vast amount of raw resources, resulting in massive waste. Waste is any product or material that has no further use or value for the owner and is discarded (Johnny, 2013). The amount of garbage generated is an issue for governments, industry, and the society for numerous reasons. According to Ainsworth

(2011), waste disposal can impair human and environmental health; landfill space is increasingly scarce as councils strive for zero waste; and landfill replacement prices are rising. In addition Barot & Sinha (2015) opines that some people perceive waste generation as a moral issue, a sign of excessive and unwanted overconsumption.

Natural resource depletion and waste creation are connected to unsustainable human attitudes and behaviours (Nodoushani, et al., 2016; Fletcher, 2018). Understanding the thinking processes and activities that lead to trash formation may offer new views on how to promote waste reduction and resource conservation without drastically altering human behaviour and lifestyle. Perrin & Barton (2011) note that waste creation is a complicated issue for local, national, and worldwide governments, requiring multi-disciplinary approaches to management and understanding. Due to the huge and growing environmental, social, and economic difficulties posed by garbage, people should take actions to control, collect, and manage waste, clean up streams and land, and upcycle or recycle. Studies nowadays should focus on upcycling and remanufacturing waste items to assist society economically (Akanksha, 2016); Plattner, Meinel & Weinberg, 2019).

Choi et al. (2014) define upcycling as the process of transforming waste materials, worthless, or undesirable items into new materials or products of greater quality, such as artistic or environmental value. According to Seo (2017), upcycling is the process of repurposing an object without causing damage to the substance. On his own part LeBlanc (2019) define upcycling as the process of reusing or recycling abandoned or waste materials in order to give them a new life or purpose without having to purchase new ones. Martin (2014) and Helen (2018) argue that upcycling makes old things fresh. They added that upcycling not only improves life quality, but also increases the environmental value of the created products by boosting their aesthetic value.

The idiom “One man’s trash is another man’s treasure” could not be more true than in upcycling, which symbolizes the premise that what one person considers worthless, another considers as useful. Many artistic genres have always found significance in society’s waste. Artists, and by extension designers, are talented at valuing what others

devalue. The use of machinery is no longer a constraint for designers, and they can relate to earlier approaches and inspirations from around the world. According to Cupit (2016). Designers get ideas first through sketches or mock-ups, then understanding the nature of each waste item, and ultimately how to use each material.

Designers today should use their imagination to create a new product with least expense and materials. Due to the current emphasis on environmental issues and material reuse and reinvention, upcycling will drive designers to be more ethical in their design practises (Huang, Bird, and Heidrich, 2015). This should be a positive challenge for these designers to create new items while also raising public awareness of the importance of upcycling. According to Bosscher (2017), upcycling gives fresh life to waste materials. Platt & Doug (2012) explain the distinction between upcycling and recycling. Unlike recycling, which involves breaking down the original material and repurposing it, upcycling saves energy and promotes nature and the environment while reducing pollution.

Sustainability is the technique of generating something new with little long-term environmental impact (Caulfield, 2019). Reusing old wood, metal, paper, furniture, cans, bottles, and even industry waste helps to live more sustainably. Waste is recycled to extend the life and productivity of resources. In this new normal, people should focus about acquiring high level skills, especially critical thinking, creativity, and self-efficacy (Teli et al., 2015; Hvass, 2016). As observed by Verganti (2008) there is need to develop people’s cognitive and affective skills, as well as their analytical and questioning thinking abilities, in order to communicate easily and keep up with the age’s innovations.

Instead of throwing waste away or burning it to pollute the environment, the researchers believe waste materials can be recycled to create useful educational resources for teaching and learning, giving meaning to the

global call to “reduce, reuse, and recycle as the only acceptable ways of disposing trash, where this can only be done through waste explorations and education by focusing on waste recycling to ensure the protection of human health” (Vani, 2009; Plattner, Meinel & Weinberg, 2019).

Statement of the Problem

Today's society and government face enormous waste disposal issues. When consumers buy and use products, a lot of waste is generated. Waste disposal has become a major concern due to rising consumer demand and garbage production. More output leads to increased waste, which creates environmental concerns. A cost-effective solution to this issue should include recycling and reducing the burden on the nation's landfills by reducing waste, air and water pollution, and greenhouse gas emissions, upcycling is crucial in this new normal age. There is little documentation available on novel techniques to reuse waste materials to produce useful or appealing products for other researchers and academics. In addition, many people are unaware of the benefits of upcycling waste materials. It is well known that greater output leads to increased waste, which increases environmental concerns. A financially sustainable solution to this problem should reduce the burden on the nation's landfills and utilise waste resources in new products.

Upcycling technique is important because it would conserve natural resources, minimise waste, cleans the air and water, and reduces greenhouse gas emissions. Thus, the goal of this study therefore is to assess the creative use of upcycled waste materials in the construction of useful and attractive household goods.

Purpose of the Study

The main purpose of this study is to make use of upcycled waste materials in the construction of useful and attractive household articles. The motive behind the study is to utilize variety of techniques to transform materials that may have been sent

to the garbage dump or landfill into useful or attractive items. Specifically, the study intends to:

- i) Select the appropriate waste material (plastic bottles, cardboard, paper cartons) to be used for the making of household articles (foot-stool, storage box pouf)
- ii) Construct the waste materials into the various household articles
- iii) Determine the level of acceptance of the household made articles

MATERIALS AND METHODS

Research Design

The study employs both experimental and survey research design. The experimental design deals with the steps involved in the construction and production of the articles while the survey design encompasses the various steps involved in the assessment of the respondents' perception on the acceptability of the articles produced.

Materials for Making Household Articles

The following materials were utilized in the construction of the household articles:

- i. For the construction of Footstool pouf, the waste materials used are cardboard, empty Plastic bottles, Dowels, Gum, Scissors, 1 inch foam, Stapler and pins, cutting knife and Storage box.
- ii. For the construction of Storage box pouf, the materials used are Cardboard, Sticks, Dowels, Gum, Scissors, 1 inch foam, Ruler, Stapler and pins, cutting knife.

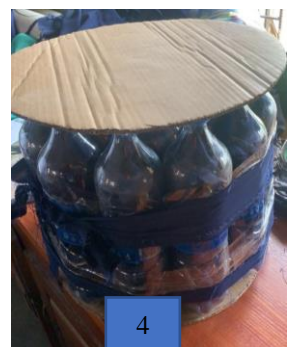
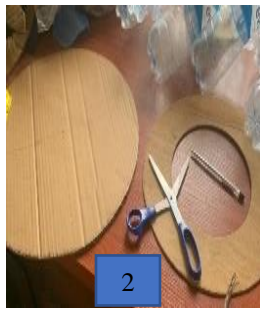
Methods

- i. Selection and collection of waste materials
- ii. Construction of the waste materials into various household articles
- iii. Display in a classroom
- iv. Assess acceptability of the articles using some respondents selected using convenient sampling technique

Construction of the Footstool Pouf

Steps involved in the making of footstool Pouf using cardboard and plastic Bottles

1. Step 1 – Cut 16×16 Boards From ¾” cardboard
2. Step 2. Take ¾” cardboard and cut two 16”x16” pieces board using a scissors
3. Step 3. Measure 7 1/2” from the center of the cross and draw a circle. The diameter of the circle is 15”.
4. Step 4. Using a scissors, Cut 15” Round Discs out from the cardboard
5. Step 5. Collect appropriate and equal sizes of plastic bottles and arrange them on the cardboard with wood glue
6. Step 6. Use rope to tie round the plastic bottles in order to provide strength to the bottles
7. Step 7. Then attach the upper cardboard disc with wood glue to frame both ends of the footstool.
8. Step 8. Work on the sides of the footstool: get a ½ inch foam and punch holes on it. The size of the foam should be the same as that of the surrounding cardboard
9. Step 9. use the cloth to cover the entire piece using stapler to hold it onto place. Also staple the cloth covering the base of the footstool.



Plates 1 to 4: The construction stages of the footstool pouf.



Plate 5: The finished view of the footstool pouf.

Construction of the Storage Box

Steps in the construction of storage box using cardboard and sticks

1. Step 1. Cut a cardboard with width 16 inches and length 50 inches length
2. Step 2. Cut the cardboard in about 3 inches width intervals so that it can be flexible to curve and make into circles
3. Step 3. Cut the base of the storage using cardboard and Use gum to glue the sides to round the base
4. Step 4. Add sticks round the surrounding of the cardboard using dowel to support the surroundings of the box
5. Step 5. Work on the sides of the storage box: get a ½ inch foam and punch holes on it. The size of the foam should be the same as that of the surrounding cardboard
6. Step 6. After punching and making holes on the foam, use gum to secure or attach the foam on the surrounding round the storage box
7. Step 7. use the cloth to cover the entire piece using stapler to hold it onto place. Also staple the cloth covering the base of the storage box.
8. Step 8. Line up the entire space inside the storage box with ½ inch foam
9. Step 9. Work on the cover of the storage box by using 1inch foam on top of the cardboard.

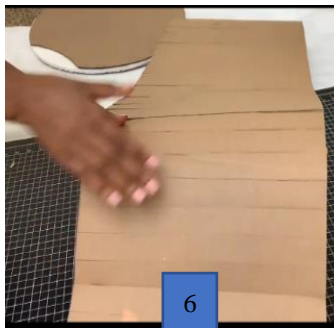




Plate 6 to 11: The construction stages of the storage box pouf.



Plate 12: The finished view of the storage box.

Test for Acceptability of Articles Produced

The survey aspect of the study was conducted among the respondents within the College of Vocational and Technology Education, Tai Solarin University of Education, Ijagun, Ijebu-Ode, Ogun State, Nigeria which comprised of academic staff, non-academic staff and students.

Population of the Study

The study population consist of 30 participants which comprised of academic staff, non-academic staff and students within the Tai Solarin University of Education which was the study area. The selected population were required to inspect the articles produced and evaluate them based on colour, appearance, its uses, cost and general quality and also to express their responses on upcycling as a technique for waste management.

Research Instrument

The instrument used in gathering data from the respondents is a self-designed Product Acceptability Questionnaire. The questionnaire are divided into two (2) sections (A and B). Section A involved the demographic information of the respondents such as gender, age range and occupation while section B comprised of acceptability parameters for assessment of quality on the articles produced.

Method of Data Collection

The two articles produced namely Footstool Pouf and Storage Box were displayed in one of the classrooms in the campus and the questionnaire was given to the respondents to administered. The respondents respond to the questionnaire after inspecting the various articles displayed by ticking their responses on the questionnaire.

Method of Data Analysis

The data gathered through the questionnaire were analysed using descriptive statistics (frequency counts, percentage, mean and standard deviation). The analysis was based on colour, appearance, cost and general acceptability of the two articles produced.

RESULTS

In an attempt to answer research objective three of this study, this aspect of the study presents the results gotten from the survey, which sought to find out the level of acceptability of the household articles

produced (foot-stool and storage box pouf) using the waste materials (plastic bottles, cardboard, paper cartons) and also emphasizes the quality and cost of materials used in the process of the production of the articles using the waste materials.

Demographic Characteristics of Respondents

The demographic characteristics of the respondents were coded and analysed. The results were as presented in the Tables 1 below.

Table 1: Demographic characteristics of the respondents

Characteristics	Frequency	Percentage (%)
Gender		
Male	8	26.7%
Female	22	73.3%
Age group		
Under 25	6	20%
26 to 35	19	63.3%
36 and over	5	16.7%
Occupation		
Academic	12	40%
Non-Academic	5	16.7%
Students	13	43.3%
Department		
Agric Science	5	16.7
Home Economics	12	40%
Technical Education	3	10
Creative Arts	10	33.4

Key: n=30

Table 1 revealed the demographic characteristics of the respondents. The result of respondents on gender showed that there were more female participants in the study than male in that 8 (23%) of the respondents were male while 22 (73.7%) of the respondents were females. The result showed that 6 (20%) of the respondents fall within the age bracket of below 30 years, 19 (63.3%) fall within the age bracket of 30 to 49 yrs and 5 (16.70%) of the respondents

were between 50 years and above. The result of respondents' on the types of occupations revealed that 12 (40%) of the respondents were academic staff (lecturers), 5 (16.7%) of the respondents were non-academic while 13 (43.3%) of the respondents were students. The result indicates that most of the respondents were from Home-Economics and Creative arts discipline areas 40% and 26.7%, respectively.

Analysis of Colour, Cost, and Appearance of Footstool Pouf and Storage Box Produced

Analysis of the Cost of Production of Footstool Pouf and Storage Box

Table 2: Cost of materials for footstool pouf and storage box

Materials for the making of Footstool pouf	Production Cost for Footstool Pouf	Materials for the making of Storage Box	Production Cost for Storage Box
Plastic bottles(Empty)	350.00	Cardboard	400.00
Cardboard	200.00	Sticks	700.00
Dowels	450.00	Dowels	450.00
Gum	450.00	Gum	450.00
Scissors	500.00	1 inch foam	800.00
1 inch foam	850.00	½ inch foam	500.00
Stapler and pins	650.00	Ruler	100.00
Ruler	100.00	Stapler and pins	650.00
		Scissors	100.00
TOTAL	3,550.00		4,150.00

Table 2 presents the breakdown of the cost of producing both the footstool pouf and storage box. The total cost of producing the footstool pouf and storage box was 3,550.00 and 4,150, respectively. With this low cost of

production, young entrepreneurs may easily venture into upcycling production of these items using different trash and waste materials as it requires less capital for start-up.

Analysis of Respondents' Responses on the Quality Assessment of Footstool Pouf and Storage Box Produced

Table 3: Respondents' responses on the quality assessment of footstool pouf and storage box produced

Parameter	Quality Assessment on Footstool Pouf				Quality Assessment on Storage Box			
	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor
Colour	13(43.3%)	17(56.7%)	-	-	16(53.3%)	14(46.7%)	-	-
Appearance	15(50%)	14(46.7%)	1(3.3)	-	18(60.0%)	12(40.0%)	-	-
Cost	12(40%)	18(60%)	-	-	12(40%)	18(60%)	-	-

Table 3 present the responses from the acceptability test conducted on the produced articles. The result showed that majority 17 (56.7%) of the respondents indicated "good" as their responses to the colour of the footstool pouf. Majority 15 (50%) of the respondents indicated "excellent" as their response to the appearance of the footstool pouf while majority 18 (60%) of the respondents indicated "good" as their response to the cost of footstool pouf.

On the other hand, respondents responses on the acceptability test conducted on the

produced storage box showed that majority 16 (53.3%) of the respondents indicated "excellent" as their responses to the colour, 18 (60.0%) of the respondents indicated "excellent" as their response to the appearance while majority 18 (60.0%) of the respondents indicated "good" as their response to the cost of the storage box while none of the respondent had a contrary view. This implies that the colour, appearance, and cost of the designed storage box are accepted to be generally good.

Assessment of the Respondents on Upcycled Made Products

Table 4: Mean response of respondent on upcycled made products

S/N	How much do you agree or disagree with the following sentences?	Mean	SD
1	What is your understanding of upcycling?. For me upcycling means: Upcycling is to make an A product into an A+ product. recycling of waste materials to other products	3.85 6.16	1.39 0.83
	I have never heard of up-cycling or encountered relevant media about it	3.14	1.88
2	My attitude towards upcycling is Unpleasant–Pleasant Bad–Good Worthless–Worthwhile Harmful–Beneficial Unenjoyable–Enjoyable	5.75 5.96 5.79 5.85 5.96	1.14 1.13 1.25 1.18 1.05
3	After seeing these articles produced, they would feel guilty if they were not upcycling, especially when used materials are available	5.06	1.36
4	After seeing these articles produced, it would be unacceptable to them not to upcycle, especially when used materials are available and would become waste otherwise	5.98	0.81
5	Upcycling will from now reflects my principles about using recourses responsibly	5.43	1.44
6	Having seen the results of these upcycled waste materials, what is your opinion on the practice of selection of upcycled waste product for sustainable clothing and environment?	5.70	0.96
7	Having seen the results of these upcycled waste materials, can you purchase upcycled products for use	5.68	1.16

Table 4 revealed the mean response of respondent on the acceptability of the upcycled produced articles. The study revealed that most of the respondents were not familiar with the term upcycling, as they perceived the term upcycling to mean recycling of waste materials to other products while majority of the respondents agree that they have never heard of up-cycling or encountered relevant media about it. (Mean = 3.85, 6.16–3.14, SD = 1.39. 0.83–1.88). Respondents described they could now tell up-cycling from recycling after viewing the process. Most respondents (Mean = 5.75–5.96, SD = 1.05–1.25) favoured upcycling.

The study revealed respondents were of the view that it would be unacceptable not to upcycle after seeing the two manufactured products, especially when used materials are accessible and would otherwise be a means

of generating funds to people (Mean = 4.63, SD = 1.77). Most respondents said upcycling today meets their values of resource management (Mean = 5.43, SD = 1.44).

The result showed that majority of the participants responded that they will be interested in practicing upcycling of most of their unused clothing materials for sustainable fashion products (Mean = 5.70, SD = 0.96). Majority of the respondents equally stated that they will be willing to buying upcycled sustainable products (5.58, SD = 1.16). They were all in agreement that upcycled products will be eco-friendly products, that is articles exhibiting social responsibility, environmental sustainability and products that would be durable for long-time uses.

DISCUSSION

A total of 30 respondents from Tai Solarin University of Education, Ijebu-Ode took part in the assessment of acceptability of the produced footstool pouf and storage box made from upcycled waste materials. The respondents were from three category of people that were found within an academic environment namely: Academic staff (Lecturers), Non- Academic staff and Students took part in the study. The vast majority of respondents (43.3%) were instructors or students. The majority of responders were aged 26 to 35, and a similar proportion were from the creative arts (33.4%) and home economics (40%) disciplines, respectively (Table 1).

The result reveals that majority of the respondents adjudged both the footstool pouf and storage box produced of been of high quality in areas of Colour (56.7%, 53.3%), appearance (50%, 60.0%) and cost (60%, 60.0%), respectively. (Table3). With this low cost of production, young entrepreneurs may easily venture into upcycling production of these items using different trash and waste materials as it requires less capital for start-up (Table 2). Affaq et al. (2020) investigated the recycling of plastic into household items and found that pet plastics were successfully recovered from plastic trash, making the process easier and more cost effective. Nxumalo et al. (2020) found that all households recycled domestic plastic garbage. A household reuses plastic containers to store cooking oil, tea bags, salt, and soup. Plastic bags are frequently reused in rural areas for storage of dry goods, school bags for children, and food storage in refrigerators and freezers. Plastic bottles are commonly used to store liquids like cooking oil, water, and liquid soap. Some homes utilise plastic garbage to manufacture carpets and toys.

The study found that upcycling is one technique for sustainable apparel in families and the environment. Aspects of upcycling include new commercialization of used goods or changing their usages, as well as

increasing the value and quality of used goods. They believe upcycling made products will benefits families by creating job that would generate income as well as saved amount of trash that will bring about environmental sustainability. Participants said they could tell up-cycling from recycling since they saw the process. They were particularly drawn to up-cycling after listening to the researcher explaining the various up-cycling strategies and their outcomes. According to Africa news (2021), a Rwandan business recycles used tyres into household objects. One of the carpenters reported that he can create approximately 15 lounge sets per week, consisting of five seats and a table, which sell for between \$150 and \$200 US Dollars each, while a pair of shoes sells for between \$1 and \$6 US Dollars.

The acceptability poll found that, most respondents agreed that they cannot but accept upcycling technique, especially when used materials are available and would otherwise generate income (Mean = 4.63, SD = 1.77). Furthermore, Oliveira Neto & Correia (2019) study reveals that in 2016, the purchase of recycled solid blocks resulted in a profit of over US\$ 45,000 for one company, and another company earned approximately US\$ 250,000 in the same year by recycling solid waste from manufacturing blocks and selling iron, wood, paper, and plastics. Banga (2011) reported that recycled products are from metal (charcoal stoves), candles (tadooba), building equipment, and domestic utensils (such as ladles and saucepans), old tyres (ropes and sandals) and straws (mats and bags). Households reported that the recycled products from metal were very useful to them but expressed fear about the re-use of the plastic bottles. Afrin et al. (2021) reported that worn out car tires can be used in roadside barriers, parks and playgrounds, structures, channels, artificial reefs, and biogas drainage. Most respondents said that upcycling today meets their values of resource conservation (Mean = 5.43, SD = 1.44). Also, most participants (Mean = 5.70, SD =0.96) agreed they would be willing to

upcycled most of their unused garment materials for sustainable fashion goods (5.58, SD =1.16). They all agreed that upcycled items are eco-friendly, socially responsible, and long-lasting. According to Leal et al. (2019), reusing and recycling textiles has several socio-economic benefits in addition to environmental and ecological benefits. According to Patel (2000), plastic waste management can help reduce environmental impacts. Furthermore, Oliveira Neto & Correia (2019) study reveals that using reverse logistics for solid waste treatment and recycling has economic and environmental benefits.

CONCLUSION

Upcycling is an understudied yet promising environmentally sustainable behaviour that can help reduce trash and greenhouse gas emissions. This study was therefore based on the practical experiments done by the researcher to address this knowledge gap. All the samples produced showed that the use of upcycled trash and waste materials is not limited to just fashion alone, but rather can also be used for other purposes as it is highly attractive. The produced articles: footstool pouf and storage box are confirmed to be durable and affordable as it can take just as low as three thousand, five hundred and fifty-five naira (3,550.00) and four thousand, one hundred and fifty naira (4,150.00) respectively to produce each of them. The study goes to show that upcycling can also be applied for other purposes outside of fashion because of its versatility.

Less expensive but more valuable upcycling items that arose from this method, encouraging both environmental and social benefits as seen in the two prototypes, designers can lessen the environmental impact of textile waste by upcycling rather than dumping waste and trash in landfill. Upcycling apparel clearly leverages textile waste to make things with a higher market value than standard recycled goods.

This study has also revealed that people would in no future time embrace the use of upcycled trash and waste materials in the production of household articles used for interior design. The use of upcycling in the turning of trash and waste materials for the production of footstool pouf and storage box and other household items could be better developed using modern technology compared to the traditional method which might be cumbersome especially when producing at commercial scales. The appreciation of the quality of the upcycled waste materials made footstool and storage box products showed that the product has potentially high level of acceptability amongst respondents and would attract high market demand if mass produced. Respondents believed that they might practice environmental sustainability by minimizing trash, as they do up-cycling with waste in homes.

RECOMMENDATIONS

The following recommendations were given in context of the study's findings:

1. Information intended to increase upcycling participation should be more explicit on what, when, and where to recycle, as well as how to recycle.
2. Clothing and textile materials should be upcycled on a variety of levels to ensure the most efficient use of commodities.
3. The government as well as other stakeholders should prioritize textile waste management through upcycling processes.

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