

DEVELOPMENT AND EVALUATION OF THE ACCEPTABILITY OF THE GREEN CHARGING STATION ACTIVATED BY EMPTY PLASTIC BOTTLES

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ABSTRACT. Plastic bottle segregation and high electricity usage are two main issues at Mindanao State University's Maigo School of Arts and Trades (MSU-MSAT). The first concern is that students use the campus to charge their devices, and the second is the absence of garbage cans designated solely for plastic bottles. Because many students charge their phones on campus, MSU-MSAT sees an increase in electricity consumption. This research aimed to develop a sustainable energy source that would enable students to gather plastic bottles while also providing free phone charging efficiently. This study used a mixed-method research design. According to the study's results, the innovative device was built using the RDI Model and was assessed using a Likert scale for quantitative data in terms of its (a) Functionality, (b) Convenience, (c) Sustainability, and (d) Eco-friendliness, yielding a result of Highly Acceptable. Thematic analysis using open-ended questions was used to analyze the qualitative data in terms of features that are liked most by the respondents, which yielded two (3) key themes: (a) Environmentally friendly and (b) Convenient Design. The Green Gadget Charging Station Activated by Empty Plastic Bottles is an excellent device for MSU-MSAT and its students.

Key Words: Renewable energy, Functionality, Sustainability, Convenience, Eco-friendliness, Solar Energy

1. INTRODUCTION

One of the alternative energy sources that can be employed to add competition and a non-polluting energy source is solar energy[1]. Concentrated solar technology's potential for generating electricity is bright due to its high capacity, efficiency, and capacity for energy storage[2]. There is

expenditure.

The study aimed to evaluate the level of acceptability of the Green Charging Station Activated by Empty Plastic Bottles.

1. What do Empty Plastic Bottles activate the level of acceptability of the Green Charging Station in terms of (a) Functionality, (b) Convenience, (c) Sustainability, and (d) Eco-friendliness.

2. Determine the most liked features of the Green Charging Station Activated by Empty Plastic Bottles.

Conceptual Framework

This section of the research paper discusses the direction of the study. Figure 2 shows the conceptual framework of the study. It determines the four (4) factors of the level of acceptability upon evaluating the study's dependent variable. These factors include functionality, convenience, sustainability, and eco-friendliness. In addition, thematic analysis was also used to determine the features of the said innovation that the respondents liked. Figure 2 presents the flow of the study.

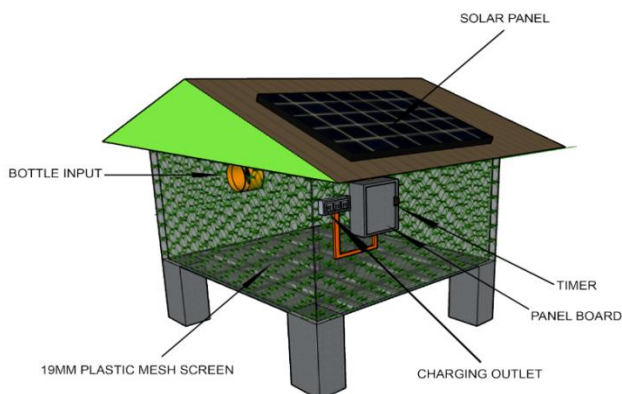


Figure 1. Parts of the Green Charging Station Activated by Empty Plastic Bottles

growing awareness about the occurrence of plastic bottle pollution, which has led to more observations and surveillance in the global environment [3]. At schools and universities, both during class and in free time, the use of cell phones and tablets is increasing daily[4]. It causes the students to charge their gadgets inside the campus premises, which leads to high electricity consumption, with the high demand and increasing price of electricity[5]. The university is looking for a renewable alternative energy source that could benefit both the administration and the students by offering student gadget charging stations that use solar panels as an alternative source and to support the university's efforts to save the earth by triggering it by dropping empty plastic bottles. The Green Charging Station Activated by Plastic Bottle is an invention that collects used plastic bottles efficiently while lowering the university's electricity

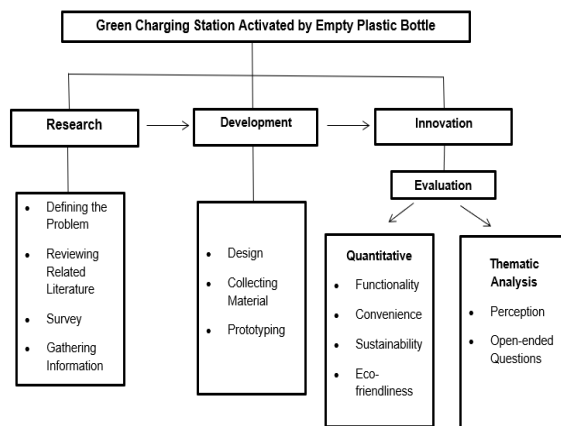


Figure 2. Process flow of the research project

2. METHODOLOGY

Data for this study were gathered both quantitatively and qualitatively using a mixed-methods approach.

Mixed methods research combines quantitative and qualitative components to address the research questions [6]. The research questionnaire was created based on a recent study by Benito and Capilitan (2022) titled "Developing and Evaluating The Innovated Portable Working-Drawing Desk As An Instructional Tool For Industrial Technology Students Of Mindanao State University- Maigo School Of Arts And Trades (MSU-MSAT)"[7]

Table 1. Likert Scale for evaluating the functionality, convenience, sustainability, and eco-friendliness of the respondents on the Green Charging Station Activated by Empty Plastic Bottles

Weight	Scale	Verbal Interpretation	Descriptive Rating
4	3.26 – 4.00	Extremely Satisfied	Highly Acceptable
3	2.51 – 3.25	Very Satisfied	Very Acceptable
2	1.76 – 2.50	Slightly Satisfied	Not Acceptable
1	1.00 – 1.75	Not at all Satisfied	Highly Not Acceptable

The research questionnaire was then validated by two expert faculty members from the same universities. To collect quantitative data, the researcher used a Likert scale to rate the Green Charging Station Activated by Plastic Bottle on a scale of (a) Functionality, (b) Convenience, (c) Sustainability, and (d) Eco-friendliness. Respondents must select using the four-point scale. The scoring criteria for the four variables of the Likert scale are shown in Table 1 for reference.

Thematic analysis through open-ended questions was also deployed to determine the best features of the said innovative charging station. The researcher installed the Green Charging Station on Campus Tambayan, where most of the students spend their vacant time doing their school work, eating their snacks or meals, or/waiting for their next class. Meanwhile, the researcher observed and explained to the respondents the ethical considerations in data collection that they are taking part in the research, the objective of the study (without identifying the primary research question), the research methods, the voluntary nature of research involvement, and the measures utilized to maintain anonymity[8].

The respondents were allowed to voluntarily utilize the Green Charging Station during their stay on Campus Tambayan. The respondents were given enough time to charge their gadgets using the innovative charging station. After testing and charging, they were then given the validated research instrument to evaluate the level of acceptability of the innovative product in terms of its (a) Functionality, (b) Convenience, (c) Sustainability, and (d) Eco-friendliness. Included in the questionnaire were open-ended questions in which the researcher interviewed and asked the respondents about the features of the Green Charging Station Activated by Empty Plastic Bottles that they liked the most.

The study participants were students who were enrolled for the second semester of the 2022- 2023 academic year at MSU-MSAT. Due to the large population, the researcher limited the conduct of the data gathering to one month, with a total of 310 students who participated in answering the survey questionnaire.

3. RESULTS AND DISCUSSION The acceptability of the Innovative Drawing Table

Table 2. Level of acceptability of the innovated portable- drawing desk in terms of usability, flexibility, durability, and cost-effectivity

Benchmark Statement	Mean Score	SD	Verbal Interpretation	Description Rating
Functionality	3.68	0.792	Extremely Satisfied	Highly Acceptable
Convenience	3.62	1.083	Extremely Satisfied	Highly Acceptable
Sustainability	3.50	1.212	Extremely Satisfied	Highly Acceptable
Eco-friendliness	3.49	0.835	Extremely Satisfied	Highly Acceptable
Overall	3.573	0.981	Extremely Satisfied	Highly Acceptable

Table 2 shows the level of acceptability of the charging station activated by the plastic bottle in terms of functionality, convenience, usability, sustainability, and eco-friendliness. It shows that the functionality (m=3.68, sd=0.792), convenience (m=3.62, sd=1.083), sustainability (m=3.5, sd=1.212), and eco-friendliness (m=3.49, sd=0.835) are highly acceptable to the respondents. The standard deviation also shows how dispersed the data is concerning the mean, and it shows close to zero, which means that data points are close to the mean.

Understanding functionality is crucial in a wide range of design-related activities, including the generation and modification of designs, as designs exist to satisfy some purpose or function [9]. Mainly, the function of the Green

Charging Station is for students to have an alternative source of electricity where they can charge their respective gadgets without adding expenses to the electrical consumption of the campus. Product sustainability focuses on the benefits that products can provide companies, including financial advantages and the same benefits to the environment and society. With sustainability being considered in creating this innovation, it ensures that the campus will benefit from this in the long run. The temporal orientation of individuals varies, including their perception of time scarcity, how much they value time, and how sensitive they are to time-related issues [10]. Hence, the reason for convenience is very important in the design process of the Green Charging Station. The last thing that the researchers took into

consideration in creating this product is cost-effectiveness. Given the significant impact of technology, a better understanding of the relationship between innovation and cost-effectiveness analysis is crucial.

Table 3. Themes that emerged from the personal interview data on the features of the innovative drawing table

Code	Categories	Themes
The students can charge their gadgets without a regular electric outlet.	Useful to students	Usefulness
It collects exclusive plastic bottles.	Waste segregation	Eco-friendly
Strategically located beside the canteen and campus convergences.	Easy access	Convenience
Free to charge the gadgets	Costless	

Features of the Green Charging Station Activated by Empty Plastic Bottles

The findings presented in this section sought to present the qualitative part of the study: What features of the Green Charging Station Activated by Empty Plastic Bottles desk were liked most by the respondents? Personal interviews were done to collect the data to provide an in-depth understanding of the innovative portable drawing-desk features. A directed content analysis approach was employed in the thematic analysis of the data from 337 personal interviews conducted. Following the direct content analysis approach, three main themes emerged in the data analysis. These three main themes are labeled (a) Usefulness, (b) Eco-friendly, and (c) Convenience. Presented in Table 3 are the codes, categories, and themes.

Usefulness

The Usefulness theme has two categories: the *useful to students* and *waste segregation* and is further supported by 310 statements. During the personal interviews, respondents shared that using the Green Charging Station can help charge the gadgets of the students, especially when they are waiting for their classes. It can also be used during a power interruption where there is no electricity on the campus. It can also charge other gadgets such as laptops and tablet computers.

The Green Charging Station is very useful in terms of collecting empty plastic bottles, and it also serves as a segregation bin. According to respondent number 7, "I like the Green Charging Station because I am not worried anymore where to charge my phone in case it gets battery low and also it is free because I only need to drop empty plastic bottle and I can already charge my phone." This was also confirmed by respondent number 67, "I like the most is it can charge three cellphones with just one drop of the plastic bottle, making it very useful for us students who are waiting for our next classes." Respondent number 223 said, "It is handy to us students because we don't need to go to

classrooms to seek a charging outlet for our phone to charge." Also, respondent number 271 reiterated, "I like it because it is beneficial for the students to charge our gadgets, especially if there is brownout."

Eco-friendly

The Green Charging Station lives with its name as a green innovation that promotes proper plastic waste disposal on the campus. This innovation collects empty plastic bottles in exchange for charging the students' gadgets for a few minutes. The waste collected is already segregated as "plastic bottle only," making it easier for garbage collectors. This also helps reduce the littering problem on campus because the students now keep their empty plastic bottles so they can use them when they need to charge their gadgets in an emergency. This can help reduce the campus' electricity consumption. Altruism, helpfulness, compassion, generosity, solidarity, sharing, and caring for others are just a few examples of the social perspective on ethical behavior[11], making this innovation an effective device in helping save the environment[12] which is also supported by the statement of respondent number 241 "I like it because it helps in making the waste segregated especially here where students just throw their plastic bottles anywhere." It is backed up by respondent number 112: "It helps in disciplining the students to throw their plastic bottles in the designated bin for the plastic bottle only." Plastic bottle segregation plays a major role in helping the campus to promote proper waste segregation and disposal. Respondent number 305 stated, "Now that there is an innovation that helps segregate the plastic bottles, it will be easier for the garbage collectors to collect the plastic waste of the campus." Respondent number 209 added, "It is amazing to see that the trash bin for Green Charging Station easily gets full even after two to three days, which means that there are many students that throw their plastic bottles properly."

Convenience

The convenience theme has two categories: (1) easy access and (2) costless. Of the 310 total respondents, 298 supported this claim. During the interviews, respondents shared their thoughts that the said innovation can be easily accessed because it is strategically located where students take their snacks while waiting for their classes, which gives a visible presence to the end-users.

According to respondent number 52, "The green charging station was put in place where it is easier to be seen by students who wish to throw their plastic bottles." This was also confirmed by respondent number 113, "It is effortless to see and locate because it is big and it is beside the campus canteen where students buy and consume their snacks." Furthermore, respondent number 14 said, "The device is straightforward to see because it is located where students wait and do their assignments."

According to respondent number 302, "What I like about this innovation is that it is free every time we use it; we just need to find an empty plastic bottle and drop it in the green charging station to charge our cellphones." Respondent number 88 added, "I am amazed because now I can freely charge my phone without paying any amount of money compared to the convenience store where you pay money just

to charge your cellphone.”

The most crucial aspect of successful innovation is the creation of value[13]. It accomplishes this by enhancing current things, processes, or services or establishing valuable goods, procedures, or services that did not exist [16].

4. CONCLUSION AND RECOMMENDATIONS

According to the data gathered, respondents rated the Green Charging Station activated by Empty Plastic Bottles as acceptable regarding Functionality, Convenience, Sustainability, and Eco-friendliness. It can also help reduce the monthly electricity consumption of MSU-MSAT. Furthermore, the students are now disciplined enough to keep their plastic bottles because they can use them to charge their gadgets through this innovation. Due to the convenience it offers to the students, they are now helping to practice proper plastic waste segregation since it is a significant problem on campus. In terms of its sustainability, the Green Charging Station can last for a long time because it only gathers its power through the sun's rays and stores the collected energy in the batteries responsible for charging the end users' gadgets.

The Green Charging Station is a product of careful study and thorough research that aims to reduce the campus's electricity cost and contribute to saving the environment. The Green Charging Station has excellent potential to be used in the local community due to the frequent power interruptions that often occur in Lanao del Norte. Thus, it can help people charge their gadgets even without electricity.

The device is convenient because it doesn't involve any complicated operations and will also help the local community collect plastic bottles efficiently. The collected plastic bottles can then be recycled to create another product, or they can also be sold in junk shops.

Limitations of the Study

This study is limited only to the students of MSU- MSAT. The researcher highly suggested conducting this study with other Universities and Local Communities to help save the environment through proper plastic bottle waste segregation and reducing electricity consumption. The Green Charging Station also can't determine the type of plastic that has been dropped in the been. Thus, it entirely relies on the self-discipline of the MSU-MSAT students.

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