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Plastic waste product development: environment preservation efforts

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Abstract. Every human being takes responsible to the development of environmental preservation. An effort which can be applied in enhancing the environmental quality is to create an innovation dealing with waste processing as well as providing education to the society concerning environmental preservation. One of the dangerous waste products which can affect environmental preservation is plastic waste product. A team of researches developed plastic waste products into certain products which are eco-friendly and consist of economic value. Some training and education concerning the development of plastic waste management was held to teenagers aged 6-18 years in Suling Wetan Village. The number of participants of the study consisted of 30 teenagers. The finding suggests that during the training and education, teenagers tend to develop both of their soft skills and recreative value. Such training and education in waste product development can boost the society's productivity especially for teenagers and children which receive beneficial skills for them to create products that hold reduce, reuse and recycle principles.

1. Introduction

Plastic has become common product in our daily life which holds some advantages and disadvantages. People tend to select plastic over another products since it provides beneficial such as easy to use everywhere at any time we wish and it is quite affordable as well as comfortable to access [1]. The high frequency of using plastic products tend to bring bad impact to the environment. The plastic products will damage our environment so bad if it isn't properly controlled

To put this issue in our awareness, human being depends on the plastic usage unconsciously. This happens since plastic plays crucial role in solving human being's problematic. The advantage possessed by plastic takes place on its high frequency of durability. Moreover, no electricity is required in using plastic as well as any other natural resources. The advantage, which is very significant in plastic, lies on its price which is affordable compared to the other products [10]. In creating products, selecting the materials and its contents becomes the top priority point in determining the usage of it [11]. Such low erudition has caused the minimum of self awareness of environmental preservation.

Plastic becomes a consumer item which is made from organic polymer materials and it's used for daily purposes [8]. The substance consisted in plastic which is harmful to the environment is indicated in water pollution caused by it. Plastic waste produced by human being's exertion, whether intentionally or unintentionally, has devastated the water environment. There are many marine biota such as fish, marine mammals as well as sea plant living in the marine environment consume and eat plastic waste since they consider it as their food. It is very dangerous if there are some marine animals consume plastic waste. Whale and sea turtle, for example, often consider plastic bag as squid while birds sometimes consider plastic pellets as fish eggs. A study showed that over a half of sea turtle population as the sample have consumed marine waste which refers to plastic bag in this case [2].

Plastic which pollutes environment has become one of the crucial issues and it takes an appropriate solution. Such circumstance would affect the viability and it automatically endangers human being as well. The chemical substance of plastic is dangerous for marine organism. The plastic substance can also damage the chain food in marine ecosystem [3]. Not only marine ecosystem, but also human being will get the bad impact for their organs system if the seafood they consume frequently are affected by plastic substance.



Based on the factual situation and the problems mentioned above, an innovation to manage plastic waste is badly needed to prevent environmental pollution. The Plastic which is not well-recycled will potentially break down and release harmful chemicals substance contained in it. Pollutant contained in plastic such as cadmium, dioxin, lead and other chemical compounds, is extremely dangerous for body's health. This pollutant produces harmful poison and it directly pollutes the air, water and soil environment and human being's health will be damaged as well. Burning plastic can't be mentioned as an effective way to undo the harmful substance contained in it. Such method, burning plastic waste in incinerator, apparently produces another poisoned gas which will pollutes the sea, air and soil environment [1]

The innovation idea in a form of plastic waste product management turns out to be alternatives to solve this environmental pollution issue. This study takes in form of descriptive which analyze a program by providing training and educating related to the development of plastic waste product for teenagers and children aged 6-18 years old in Suling Wetan village, Cermee sub-district. The selected region is determined on the large amount of plastic waste in that region and at the same time, an initiative is emerged to develop the teenagers' skill in creating plastic waste products.

According to the data gained from administrative village affairs in 2015, the numbers of the population of Cermee Village are consisted of 2,323 households with a total of 5,953 people. The population, in detail, states that there are 2.928 men and 3.025 within productive range aged 20-49 years old. This phenomenon indicates an excellent potential for developing productivity and human resource development. Move over, Cermee village has the highest population compared to other villages in Bondowoso district.

The poverty in Cermee village is at high level. It is shown that based on the 2,323 households, 876 of them are categorized as pre-prosperous family; 716 are prosperous I; 386 are prosperous II; 237 are prosperous III; and only 108 households are recorded as prosperous III plus. It can be concluded that if households are categorized as pre-prosperous and prosperous family are categorized as poor family, it states that 70% of the households are in a poor financial scale.

The low frequency of education and economy sector in certain region affect the index of human resource development. The awareness of health, environmental preservation and the importance of education are the indicators of the quality of human resource in certain community. Cermee village's awareness of environmental preservation is still in low scale. This statement is supported by the large amount of waste littering that is not managed appropriately. Considering the circumstance and issue in this region, the research team invents a solution in the form of providing training and education on product development of a plastic creation to the teenagers generation as well as children.

Based on the social facts and also literature review concerning circumstance in the field of the study, the problems in this region can be identified as follows (1) People who live in krajan I suliwing wetan village consists of poor family in numerous numbers. According to the data, a solution is badly required to enhance the people's capability to gain skills needed to improve their needs; (2) There are only few amounts of home industries in krajan I suliwing wetan village. Certain skills or expertise in economic sectors and innovations of multifunctional goods owned by the surrounding community are also still very small; (3) Their self-awareness in developing skills needed are still low; (4) The productivity of the youth and teenagers in krajan I suliwing wetan villages is still in low; (5) People still less-care about environment; (6) Psychological factors awareness in term of education for the youth in this region are still very low. Based on the problem situation analyzed above, a training and education concerning plastic waste product management is invented by the research team as the problem solver.

Tabel 1. Analysis of solution concerning the community problems

Problems Identified	Solution Provided	Urgency of Plastic Waste Product Management
High frequency of poor family	Inventing their own occupation	Training and education of plastic waste product provides opportunity(es) to business development for the community

Problems Identified	Solution Provided	Urgency of Plastic Waste Product Management
Few amounts of home industries in community of krajan I suliwing wetan village	Inventing home industry through the existing potential	Training and education of plastic waste product is a waste littering processed which is potentially for home industry
Low frequency of skills and innovative product ideas	Providing guidance and training to foster innovation skills and ideas	Training and education of plastic waste product provides learning experience and skills for the youth
Self-awareness community concerning skills' development is still low	Providing guidance and training to foster innovation skills and ideas	Training and education of plastic waste product provides learning experience and skills for the youth
Low productivity of the youth	Providing guidance and training to foster innovation skills and ideas	Training and education of plastic waste product provides learning experience and skills for the youth
Low community awareness in environment	Inventing creative ideas dealing with abundant littering	Training and education of plastic waste product is an alternative way in dealing with plastic waste

The training and education of plastic waste product can stimulate the community's productivity, especially for the youth that initiates them to produce goods that has an excellent economic value as well as its function which will be graded as high class product. It is expected for them as stimulation to invent precious goods and to learn more about it. This problem solver is closely related to the low interest in learning and psychological factors come from the lack of self-confidence that the children in this community possess. Providing health education awareness is also required to overcome the existance problem. This solution aims to initiate the youth to live a healthy live.

2. Methods

A qualitative research is selected in this research in a form of case study in order to describe and explore more deeper concerning the process of particular activities, exertion, phenomenon, and also interaction objectively [4]. This research describes the phenomenon occured in training and education of plastic waste product management for the youth in Suling Wetan village, Cermeo Sub-district. The activities in this research will be held in two phases of training. These two activities consist of one agenda: developing plastic creations within various types. The plastic used in these activities comes from plastic waste in a form of plastic bottle which is also be mixed with some additional accessories.

The effectiveness of product development is also tested by assessing its effectiveness on environmental empowerment. This process is carried out by using descriptive statistics by looking at the mean value. The mean will be interpreted in the interpretation table of the mean value. The instrument used was in the form of a questionnaire using the lickert scale. This questionnaire contains the participants' responses to the effectiveness of the products developed and the implementation of product assistance. To get more information about the content of the questionnaire and the interpretation of the mean values, please refer to the table below.

Tabel 2. Product Effectiveness Instrument

No	Item soal	Deskripsi
1.	1-10	Efektivitas produk
2.	11-15	Efektivitas pelatihan pengembangan produk

Tabel 3. Mean score interpretation [14]

No	Mean Score	Interpretation
1.	1.00 - 1.80	Very Low
2.	1.81 - 2.60	Low
3.	2.61 - 3.20	Medium
4.	3.21 - 4.20	High
5.	4.21 - 5.00	Very High

3. Results and Discussion

3.1 Plastic Waste Product Development

Plastic can be classified into two categories which are thermoplastics and thermosetting plastics. Thermoplastic consists of linear or branch structure. The examples of this particular plastic are polyamide, polyethylene, Polyvinyl and so on. The thermoplastic can be recycled and be formed as desire. Thermoplastic, which exists in environment, can also be exploited to be a beneficial goods. Thermosetting plastics, on the other hand, possess 3D structure. The examples of thermosetting plastic are phenolic resins, polyester and so on. Thermoplastic, on the other hand, can't be recycled which is impossible to use it anymore. This plastic consists of hard structure which is unable to make it soft [1][8]

The high frequency of plastic usage in human activity is occurred due to its advantages. The dangerous substance contained in plastic isn't considered as crucial issue. In fact, plastic, indeed, provides plenty beneficials in human daily activities [9]. The main problem in consuming plastic lies in the littering waste of plastic which is considered as unable to recycle. In fact, human being will consciously do plastic littering since their self-awareness of managing and responding plastic littering is still at low level. Littering in long time period will cause an extreme damage toward environment [12].



Figure 1. Identification Types of Plastic

Plastic product developed in this study is focusing on plastic waste product which produces plastic creation invented by the youth generation in Krajan 1, Suling Wetan village. Such product creations is expected to have good price and at maximum utilization. The plastic waste product can be in a form of (1) Pencil Case; (2) Bookmarks; (3) Drinking Bottle; (4) piggy bank bottle; (5) Souvenirs; (6) Wall decoration; (7) Gallery and Costum. Besides developing some economic products as well as their fuctions, they are expected to use it in their daily activities. Futhermore, the youth generation is expected

to promote their creations and is able to dispose their product which will provide them entrepreneurship experience as early as possible. The training and education in innovative goods production is supposed to provide soft skills education and aesthetic values as well as amusement to the youth generation.

The development of plastic waste product can't be mentioned as a solution in recycling plastic waste. This type of development provides contribution in processing waste product into more beneficial goods. The recent modern and sophisticated plastic recycling method can be carried out by using Polyfloat technology proposed by SiCon. This technology is capable of separating plastic precision density from shredder residues. Recycling is the most important effort currently which is selected to reduce environment pollution caused by plastic waste. Recycling plastic also has several disadvantages in terms of effectiveness and economic value [13].

The preparation phase is the beginning phase in conducting this study. The preparation phase consists of several activities. The activities can be mentioned as follows:

- a. Focus Group Discussion (FGD) which aims to gain information required concerning job distribution from each team and what steps required in conducting the service program.
- b. Field observation and problem identification
- c. Acquiring authorization from the community so the service program will be safely proceed.

The next phase belongs to the consummation phase of the training and education program which aims the objective, in this context refers to the youth generation aged 6 to 18 years old. The referred ages is selected since at the age of 6 to 18 years belongs to the productive period in developing themselves and enhancing their skills in inventing innovative goods. This particular goods developed by the youth can be identified in a form of pencil case, piggy bank and flowerpot.

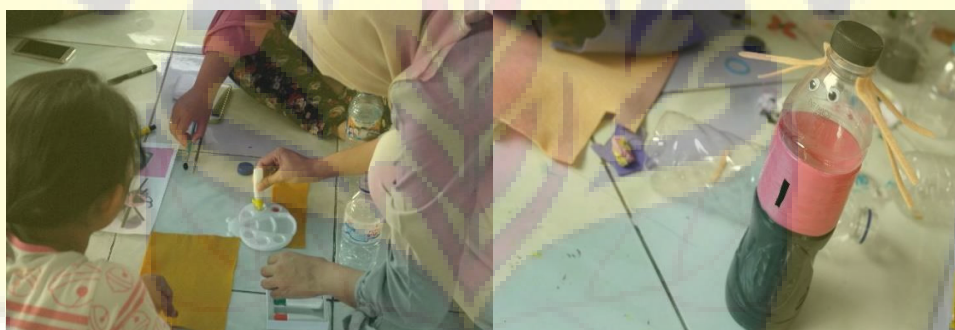


Figure 2. Training on developing plastic waste product provides debriefing for the youth in improving their skills and creativity.

Creativity and skills are closely related in development process of attitudem cognitive, education developing, humanistic and personological [5]. Developing attitude can be identified from the character development in cooperating on a team. The developing attitude occurred in certain person is able to be directed through training and education in a form of cooperation [7]. Managerial skill as well as cooperation has caused a potential point which will be emerged in this training. Cognitive skill, as mentioned above, is obtained by receiving a brand new knowledge in procedural cognition phase which is a knowledge dealing with producing goods [6].

The training and education towards plastic waste product development has plenty advantages such as applying a preservation towards environment through the plastic waste process. In addition, this activity is also capable of improving skills that the youth possess which initiates them to take role in more innovative ideas dealing with environment preservation by means of developing an eco-friendly products

There are several procedures to be put in consideration in decreasing the danger of plastic in environment[1]:

- a. Use paper or cloth bags instead of plastic bags.
- b. Use plastic bags over and over to decrease the consumption and restrain the plastic usage
- c. Take a glass container as an alternative over plastic
- d. Reduce the use of products wrapped in plastic.
- e. Avoid using plastic bottles for breastfeeding
- f. Keep plastic toys away from children. The harmful substance will give bad effects to them

- g. Keep away cutlery made of plastic
- h. Take the plastic product able to be recycled
- i. Avoid using plastic cups made of rigid polystyrene

3.2 Effectiveness of product development

The effectiveness of product development tests was carried out using descriptive data analysis. The number of participants involved in developing this product is 30 people. Sample is explained in the table below.

Tabel 4. Participant demographic

No	Variables	Number of participant	Frequency
1	<i>Gender</i>		
	Male	10	33.3 %
	Female	20	66.7 %
2	<i>Years</i>		
	6-10 years old	6	20.0 %
	11-14 years old	11	36.7 %
	15-18 years old	13	43.3 %

Tabel 5. Product effectiveness and accompaniment training

No	Variable	N	Min	Max	Mean	Sd	Interpretation
1.	Product effectiveness	30	4.00	4.90	4.40	0.25	Very high
2.	Training effectiveness	30	3.60	5.00	4.37	0.47	Very high

Based on the table above shows that the plastic development effectiveness score (Mean = 4.40, Sd = 0.25) is at a very high level. This also has similarities with the effectiveness of mentoring which is also at a high level (Mean = 4.37, Sd 0.47). This shows that the plastic products development can be one product that is able to contribute to environment preservation effort.

Tabel 6. Training effectiveness

No	Variables	N	Min	Max	Mean	Sd	Interpretation
1.	processing waste properly	30	3.00	5.00	4.33	0.60	Very high
2.	Availability of raw material	30	3.00	5.00	4.70	0.54	Very high
3.	Product processing techniques	30	3.00	5.00	4.30	0.75	Very high
4.	Product creativity	30	4.00	5.00	4.87	0.34	Very high
5.	Display view	30	3.00	5.00	4.60	0.56	Very high
6.	Product uniqueness	30	3.00	5.00	4.50	0.68	Very high
7.	Products can improve skills to participants	30	4.00	5.00	4.73	0.45	Very high
8.	Product packaging	30	2.00	5.00	3.20	0.76	Medium
9.	Product functional value	30	3.00	5.00	4.30	0.75	Very high
10.	Economic value of the product	30	3.00	5.00	4.43	0.67	Very high
11.	Clarity of training description	30	3.00	5.00	4.50	0.73	Very high
12.	Chronological explanation	30	1.00	5.00	4.20	1.30	High
13.	Languange	30	3.00	5.00	3.90	0.80	Medium
14.	Completeness Tools and material	30	3.00	5.00	4.43	0.62	Very high
15.	Mentoring intensity	30	4.00	5.00	4.80	0.47	Very high

Based on the table above, it can be concluded that the quality of products developed has very high quality. There are some weaknesses indicated by item number 8 Mean 3.20 (sd = 0.76). Product packaging is one of the disadvantages of this product. This is due to the participants have low knowledge in providing innovations for product packaging. Besides that the product is widely used to meet personal needs and not for consumption in the market. The advantages possessed by this product are in item number 4 (Mean 4.87 and sd 0.34), 7 (Mean 4.73 and sd = 0.45) and 2 (Mean 4.70 and sd 0.54). In succession the advantages of this product are the creativity of the product, the effectiveness of the product for the development of skills and the availability of raw materials. This is because plastic products are easy to obtain while being one of the products that have the potential to pollute the environment. Products developed also have various types such as pencil boxes, piggy banks, flower vases and others. The development of these plastic products also helps teenagers and children soft skills to be able to bring out their inspiration. It can also be an alternative for them to fill their leisure time for useful things.

As long as the overall mapping of this product has been done well. This is indicated by the mean score of the product effectiveness which is at the very high level. One disadvantage during the mentoring process is indicated by item number 13 (Mean 3.90 and up to 0.80). The language is one of the drawbacks in the mentoring of product development. This is because participants are still included in the category of children up to the secondary school stage. Detailed and simple communication is needed to create a good communication.

4. Conclusion

Training and education of plastic waste product development is believed to be one of the alternatives which is able to perform concerning environment preservation. It is concerned due to the negative impact produced by plastic waste. This training also gives an impact to the development of soft skills, cognitive abilities, and attitudes as well as artifice which the youth own. The participant, unconsciously, have contributed in preserving the environment

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References

- [1] Pavani P Rajeswari TR 2014 Impact of Plastics on Environmental Pollution. *J. Chemical and Pharmaceutical. Science.* 3 87
- [2] Bugoni L, Krause L, Petry MV 2001 *Marine. Pollution. Bulletin.* **42** 1330 [https://doi.org/10.1016/S0025-326X\(01\)00147-3](https://doi.org/10.1016/S0025-326X(01)00147-3)
- [3] Mato, Y et al 2001 *Environ. Sci. Technol.* 35 319 DOI:10.1021/es0010498
- [4] Creswell JW 2009 *Research Design: Qualitative, Quantitative and Mixed Methods Approaches.* Sage Publication
- [5] Runco MA 2010 Creativity. *Research. Journal.* **1** 2 <http://dx.doi.org/10.1080/10400418809534283>
- [6] Anderson LW and Krathwohl R 2000 A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives.
- [7] Rosales R, Stone K and Rehfeldt RA 2009 The Effects of Behavioural Skills Training on Implementation of the Picture Exchange Communication System. *Applied. Behaviour. Analysis.* **42** 541
- [8] Li N, Mahat D and Park S 2009 Reduce Reuse and Replace: A Study on Solutions to Plastic Wastes. Worcester Polytechnic Institute
- [9] Greenmuze staff 2008 Addicted to Plastics.
- [10] Science for Environment Policy 201 In- Depth Report Plastic Waste: Ecological and Human Health Impacts. DG Environment News Alert Service 1

- [11] Sicon Technology 2014 Polyfloat Improves the Precision of Density Plastic Separation. Miller L, Soulliere K, Bealieu SS, Tseng S and Tam E 2014 Challenges and Alternative to Plastics Recycling in the Automotive Sector. *Materials* **7** 5883-5902. doi:10.3390/ma7085883
- [12] Noda R, Komatsu M, Sumi E and Kasakura T 2001 Evaluation of Material Recycling for Plastics: Environmental aspects. *J Mater Cycles Waste Manag* **3** 118–125. Springer-Verlag
- [13] Hopewell J, Dvorak R and Kosior E 2009 Plastics Recycling: Challenges and Opprtunities. *Philosophical Transactions of The. Royal Society* **364** 2116. doi:10.1098/rstb.2008.0311
- [14] Moidunny, K. (2009). The Effectiveness of the National Professional Qualification for Educational Leaders (NPQEL). Unpublished Doctoral Dissertation, Bangi: The National University of Malaysia.

