



Ecobrick is Reviewed as the Source of Learning, Creativity, and Environmental Care Attitude

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Abstract. The purpose of this study was to determine the use of ecobrick as a source of learning science, creativity and environmental care for students. Waste piles in Indonesia are increasing and it is projected that they will continue to increase as the population increases. Garbage is the residue of human activity that is no longer used but can be used. By learning how to process waste into ecobricks, you can reduce plastic waste and reduce environmental pollution. This research method uses an experimental method, namely by collecting pre-test and post-test data on creativity and environmental care attitudes before and after using ecobricks as a learning resource. The results of this study indicate that learning with ecobricks can increase creativity from the previous 67.45 to 89.64. Ecobricks can also increase the attitude of caring for the environment from 67.04 to 73.52.

Keywords: Creativity · Ecobrick · Environmental Care Attitude · Source of Learning

1 Introduction

The heaps of garbage in Indonesia increase day by day. The amount of waste accumulated in Indonesia reached 65.200.000 tons per year with a population of 261.115.456 people. Indonesia's population projection shows that the population keeps on growing and will definitely increase the heaps of garbage. The increasing number of residents every year becomes the reason for the increasing amount of wastes with both industrial and household waste. Waste as one of the factors the occurrence of puddles and floods in some areas that affect towards the degradation of environment condition.

The national economic survey report in CBS stated that only 1.2% of households carried out waste recycling activities. In addition to that, the number of households that burned waste reached 66.8%, whereas burning waste is the source of pollution that can cause respiratory diseases. The Government through Presidential Decree 97 of 2017 targets the reduction of household waste and waste that is similar to household waste by 30% and the handling of it by 70%, but there hasn't been any much change so far. The heaps of garbage are still piling up and they even increase in height. The volume of waste will keep on increasing every day if it is not managed properly. According to Jambeck, *et al.* [1] if there isn't any improvement in waste management, the cumulative

amount of plastic waste is expected to increase by the biggest order in 2025. This is also in line with the one stated by Poulain [2] which estimates that microplastic waste will keep on accumulating into the ocean mass that causes pollution to the ocean.

Garbage is the rest of human activities that are not used anymore, but can be utilized. The waste utilization, especially plastic, by using creativity can create products that are made up of wastes such as crafts in the form of bags, wallets, and other accessories. In fact, the activities in creating those products from plastic do not seem very effective, because they only use certain plastics, such as making plastic bags that are made up of coffee wrap so that not every plastic can be utilized. Today, from the information in online media and articles, it turns out that plastic can be processed into ecobrick, which is a kind of selecting dry plastic wastes and put into a bottle to be used as a seat, garden decoration, or house wall. Those wastes are changed into small pieces (bricks) and are put into a plastic bottle afterwards.

Plastic waste can be used as the student's source of learning at school. Plastic wastes are cut down into small pieces and put into the bottle and are made into many kinds of creativity. According to the research by Afifah & Rafiah [3], learning resources and media in form of utilizing plastic bottle waste recycling modules are very fun, that is seen from the participants' enthusiasm in learning because they are involved directly in the process of utilizing/recycling plastic bottle wastes.

Yunanto [4] in his book states that many learning sources are still not optimally utilized by most of the teachers in teaching and learning activities. B. J. Zimmerman and A. R. Moylan [5]. The right source of learning will make it easier for students to understand and apply their learning experiences well. According to Abdullah teaching staff and students at schools/educational institutions have a view that there are still limits of the availability in learning resources at schools/educational institutions, so that efforts are needed to add more of both quality and quantity. Zimmerman and A. R. Moylan, Learning resources must be able to stimulate creativity. Creativity is one of the characteristics learned in the 4.0 era and one of the skills that is needed in the 21st century aside from critical thinking, collaboration, and communication that are still being strived to pursue [6]. According to Sambada [7] the higher the creativity, the higher the ability to solve problems in physics lessons.)

Munandar [8] in his book states that creativity is the ability to make new combinations, based on the existing data, information, or some other elements. Fauzi, et [9] Creativity becomes one of the most important things to be implemented because creativity is considered as a solution to problem-solving, can provide satisfaction and is able to level up the quality of human life. Based on the activities results of Fauzi, et al. [9] that people are already able to make seats from eco bricks. Hapsari & Wahyuni [10] Students are able to make ecobrick and turn them into fascinating decorations in the school environment. Students can use eco bricks to be used as the school garden fences.

Student's creativity in utilizing waste can become the solution to reduce environmental pollution that comes from waste. That is supported by Andriastuti's research [11] that the potential value of eco bricks in reducing the household's plastic wastes in West Pontianak District which is 77% plastic wastes can be processed into eco bricks and 33% can not be processed into eco bricks. The potential of eco bricks that can be produced in 1 year is 2.481.940 pieces for the 600ml volume bottles or 1.119.177 pieces for 1500 ml

volume bottles. Nurhafizah, [12] that did the ecobrick research through the green pollution module said that the concept of ecobrick had a huge potential to be applied in environmental pollution lessons and ecobrick still not very popular among the wider community. Research [13] that to make students aware that plastic waste is hazardous for the environment and the right solution is to lock it inside the bottle (ecobricks).

The result activities from Trisniawati, [14] also said that through ecobrick could have insights about waste sorting and waste management. Suminto [15] Ecobrick is one of the creative efforts to encounter plastic wastes. The use is not to destroy plastic wastes, but instead is to extend the age of those plastics and process them into something useful that can be used for humanity in general. Palupi, [16] also stated that there was an increase in teachers' knowledge and skills in utilizing plastic wastes by using eco bricks as educational props. Teachers can share their experiences that have been obtained towards their children and parents.

The activities the residents of Tulung village, especially in 2nd hamlet, can practice making paving block and eco bricks that are made up of plastics. Rahmawati, [17] conducted a simulation on learning activities, namely in the cycle I the percentage obtained was included as less category, in the cycle II there was an increasing so that the percentage that was obtained was included as sufficient category. Then, in cycle III, there experienced a significant increase included as a good category. Therefore, this model-based learning model is feasible for students. Raut, [18] said that constructing plastic bottle based houses will be more effective compared to some other conventional building materials such as bricks, concrete, and ceramic blocks. The plastic bottles can be used in some parts of building construction such as walls, roof and etc. Reusing the plastic bottles as the building materials can have substantial effects on saving the building embodied energy by using them instead of bricks in walls and reducing the CO₂ emission in manufacturing the cement by reducing the percentage of cement used. It is counted as one of the foundation's green project and has caught the attention of the architecture and construction industry. Generally the bottle houses are bioclimatic in design, which means that when it is cold outside is warm inside and vice versa [19].

Based on the description presented above, the author designed a learning model of environmental pollution with eco bricks. Ecobricks are one of the alternative activities that has a potential to reduce plastic waste at the level of educational institutions and community, namely learning activities that involve students altogether to reduce plastic wastes by cutting down unused plastics into small pieces and then put them into bottles until solid, then make them into creations such as tables, chairs or decorations made up of plastic bottles that have been filled with plastic. Until now, the application of eco bricks in schools is still minimal.

2 Methodology of Research

This research is an experimental research using a one group pretest-posttest design on creativity and caring for the environment before and after using ecobricks as a learning resource. The population in this study was class VII SMP Nusa Bhakti Depok which consisted of two classes, namely class VII A and class VII B. The steps used in determining the percentage descriptive results are as follows:

1. Calculate the value of each indicator and recap its value.
2. Calculate the frequency for each category of answers that exist in each indicator
3. Calculate the percentage with the formula

$$NP = \frac{R}{SM} \times 100\%$$

Description

NP = Value in percent
 R = Raw score achieved
 SM = Ideal maximum score

3 Results of Research

In this section, the results of the research and wider discussion. The results can be presented in the form of graphic images and tables that make it easier for readers to understand. Discussion about ecobricks as a source of learning, creativity and increasing caring attitudes towards the environment (Figs. 1 and 2).

Table 1. Table of creativity.

No.	Indicator	Before	After
1	observe situation and problem that has never been noticed before	67.16	90.27
2	Connect ideas with experiences that has ever been gained from variety of different sources	67.65	90.27
3	Tend to show some alternatives towards certain subjects	72.30	92.36
4	Do not directly take things that previously happened and related to habits	64.71	84.72
5	Take advantage from his own potential, by exploring emotional power and mental as well as the hidden subconscious	56.62	90.10
6	Good at appreciating time and utilize it as best as possible to create, make idea, or to formulate down problems that are challenging	76.29	90.10

Table 2. Table environmental care attitude.

No	Indicator	Before	After
1	Burning garbage causes air pollution	58.98	70.83
2	Planting plants, air becomes fresh	79.69	82.29
3	The increase of carbon dioxide in atmosphere causes the temperature rises on Earth	72.66	77.08
4	Let the water flow when it is not being used potentially causes water wastage	64.06	76.04
5	Households need to provide water infiltration	33.59	31.25
6	Saving electricity means saving fuel	75.39	89.58

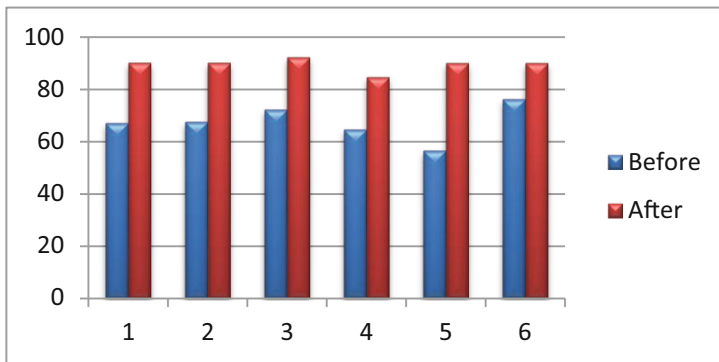


Fig. 1. Graph of creativity percentage

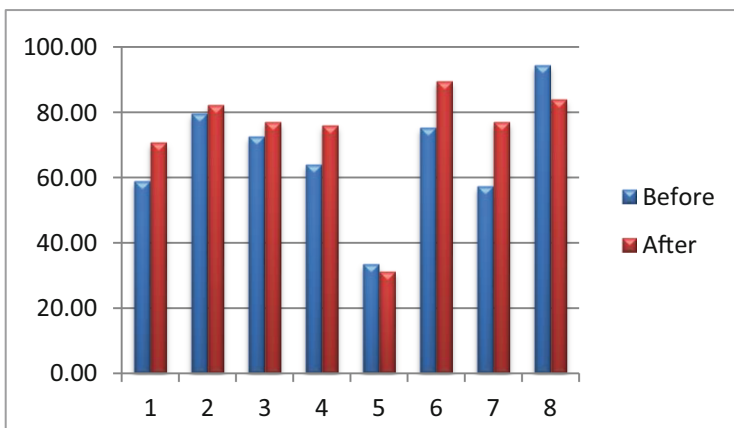


Fig. 2. Graph of the attitude of caring for the environment

4 Discussion

4.1 Ecobricks from Plastic Waste

Ecobrick comes from two words in English, namely “ecology” and “brick”. Ecology according to the Big Indonesian Dictionary (KBBI) is defined as the science of the reciprocal relationship between living things and the surrounding natural (conditions) (environment). The brick means brick, stone, red stone/wall, and can also mean a good person or a wall. These two words when combined into “ecobrick” which means environmentally friendly brick [20].

Ecobrick is a plastic waste management technique made from used plastic bottles in which various plastic wastes have been filled to the brim and then compacted until it becomes hard. After the bottles are full and hard, the bottles can be assembled with glue and assembled into tables, simple chairs, wall building materials, towers, small stages, and even has the potential to be assembled into fences and foundations for simple playgrounds and even Ecobrick History houses [20].

Historically, according to Maier, [21] Yogyakarta became the first city in the world to formally adopt ecobricking as a government strategy to overcome the problem of plastic waste in the city. This is as stated by one of the main leaders of the world’s ecobrick movement, Russel Maier. Russel, who is a regenerative designer from Canada, has been developing ecobrick technology since 2012 in the Philippines and Bali. His expertise is in triggering ecobricking into a community, city and country movement. Ecobrick is a system for managing and reusing plastic waste. The ecobrick program as a sustainable waste management system, in a simple way and with affordable materials, is expected to increase public participation in sustainable waste management.

How to Make Ecobricks Making ecobricks is quite easy. But it has to start right. It is a way of life and long term habit. Simple instructions for making the perfect ecobrick:

- a. Collect, separate, clean, prepare all kinds of plastic to make ecobricks [21].
- b. Choose the same brand and bottle size. What bottles have the most in your community
- c. Having ecobricks in the same bottle makes it easy and beautifies the results.
- d. Use a wooden stick to compact.
- e. Avoid metal, glass, which will damage the bottle. Avoid paper and food residue that will decompose.
- f. Insert colored soft plastic for the bottom of the bottle to make the ecobrick building construction colorful.
- g. It is very important to ensure the quality of the ecobricks. Weigh your ecobricks. Reject bad or non-standard ecobricks. Suggested minimal ecobrick weights 1500 ml = 500 g, 600 ml = 200 g. Minimum weight = bottle volume x 0.33 g/ml is the minimum density of a good ecobrick.
- h. Be sure to put a label on each ecobrick: name, date, weight, serial number.

When plastics are disposed of, burned or landfilled, they poison the earth, air and water. When we store, sort, and pack in bottles, we can make reusable ecobricks. Together we can build green areas that will enrich the environment and society. If you already have enough ecobricks, we are ready to build. Ecobricks can be arranged into modules/modular, for garden buildings, or also for several building constructions. Ecobrick

according to Cusido, aims to optimize some of these properties and thereby achieve important environmental benefits.

4.2 Ecobricks as a Science Learning Resource

Teaching and learning activities for science lessons in schools are carried out as usual, but as a simulation in learning environmental pollution it is a bit different, it looks like the science teacher is carrying several empty bottles, some unused plastic, scissors and wooden sticks. Some students before the lesson began to ask the object that the teacher brought. The learning begins with providing motivation and counseling on the importance of protecting and preserving the environment, followed by the provision of environmental pollution material and this learning is added with a demonstration method to demonstrate how to make ecobricks from materials brought to class. Students were also given the task of bringing as many materials as possible to make as exemplified by the teacher for making ecobricks the next day.

The efforts to manage waste using the ecobricks method can be a solution to reduce plastic waste by utilizing it into furniture (chairs, tables), planting space, walls, and even a whole building. Thus, this ecobricks method can reduce plastic pollution in the surrounding environment. Ecobricks can empower individuals to be responsible for their own waste owners from the source. The technique is simple and very easy, so it can spread quickly through social networks (communities, villages, schools, etc.) The results of the activities of Trisniawati [14], said that through ecobricks, you can have insight into waste sorting and waste management. Suminto [15] Ecobricks are one of the creative endeavors for handling plastic waste. Its function is not to destroy plastic waste, but to extend the life of these plastics and process them into something useful, which can be used for the benefit of humans in general.

Nurhafizah [12] who conducted research on ecobricks through the green pollution module explained that the concept of ecobricks has the potential to be applied in environmental pollution studies. Making ecobricks is still not very popular among the wider community. Most of the community. Still treating used plastics as household plastic waste, polluting the environment, rivers and polluting daily life without self-awareness. For this reason, more intensive socialization regarding the creative processing of plastic waste is needed.

Starting from household plastic waste. With a little effort, one important issue will be unraveled little by little. In science learning in the environmental pollution chapter, students are invited to make ecobricks from plastic waste according to Adinugraha [22] Biology learning media can be made from used goods (garbage). Used goods used are used paper, used cardboard, used iron/zinc objects, used wood and used electronic equipment. Biology learning media made from used goods such as plastic are suitable for use as learning media. In fact, some learning media are worthy of being produced for sale which are made of plastic. Motivation and learning outcomes of students who use tapioca waste learning resources are higher than students who use conventional learning resources [23]. Teachers who apply learning in schools based on ecology, especially coupled with entrepreneurial principles, will have a positive impact on students. Aryanto & Syaodih [24] the application of ecopreneurship-based learning will make you never give up, be able to turn challenges into opportunities, be independent, responsible, and behave

in an ecological manner that can manage, utilize, and maintain the surrounding natural environment. In this case, students processing plastic waste into Ecobricks will certainly reduce the scattered plastic waste. so the environment is clean.

Learning with ecobricks can be a source of learning because it is a product. The resulting product comes from plastic waste that is no longer used. This is supported by Asnawi & Usman that the topics chosen to function the environment as a learning resource or medium should meet the following requirements:

1. Must be in accordance with learning objectives
2. Can attract students' attention
3. Living and developing in the midst of society
4. Can develop children's skills to interact with the environment
5. Close relationship with the student environment
6. Can develop students' experience and knowledge

Plastics that are collected and made ecobricks into creative products will encourage students to collect a lot of discarded plastic because it can be arranged into other products that are more attractive and in accordance with the learning objectives, namely students can find out the problem of pollution sources and efforts to overcome them.

4.3 Creativity in Learning Through Ecobricks

Creativity is a novelty in something that is shown to be different from others that have more functional benefits. According to Munandar [8] creativity is the ability to create something new, as the ability to provide new ideas that can be applied in problem solving or as the ability to see new relationships between pre-existing elements. Learning environmental pollution through ecobricks can stimulate creativity because with ecobricks teachers can encourage students to be creative in making products or goods that can be used more than just plastic and can also reduce environmental pollution that comes from plastic.

The implementation of ecobricks activities at SMP Nusa Bhakti has been running but is still in the stage of collecting filled bottles. Only a few bottles were filled so that it could not be used into a functional form. While forming a functional item requires a lot of ecobrick bottles. Based on Table 1 of several indicators of creativity obtained, namely Observing situation and problem that has never been noticed before 67.16% and after 90.27%, Connect ideas with experiences that has ever been gained from variety of different sources before 67.65% and 90.27%, Tend to show some alternatives towards certain subjects before 72.30% and after 92.36%, Do not directly take things that previously happened and related to habits before 64.71% and after 84.72%, Take advantage from his own potential, by exploring emotional power and mental as well as the hidden subconscious before 56.62% and after 90.10%, Good at appreciating time and utilize it as best as possible to create, make idea, or to formulate down problems that are challenging before 76.29% and after 90.10%.

Ecobricks are one way of handling plastic waste by packing clean and dry plastic into plastic bottles. Ecobricks processing plastic waste into something useful in the long term is one of the keys to the success of the plastic waste recycling program. Based



Fig. 3. The activity of making ecobricks (source by: Aqil, 2022)



Fig. 4. The simple ecobrick chair products (source by: Aqil, 2022)

on the results of the activities, that the community has been able to make seats from ecobricks (Figs. 3 and 4).

4.4 Environmental Care Attitude

Based on Table 2 of several indicators of environmental care attitude obtained, namely Burning garbage causes air pollution Before 58.98% After 70.83%, Planting plants, air becomes fresh before 79.69% and after 82.29%, The increase of carbon dioxide in atmosphere causes the temperature rises on Earth before 72.66% and after 77.08%, Let the water flow when it is not being used potentially causes water wastage before 64.06% and after 76.04%, Households need to provide water infiltration before 33.59 and after 31.25 and Saving electricity means saving fuel before 75.39% and after 89.58%.

Masrurroh [25] Environmental education must be provided by all components of society. Environmental education needs to be taught from an early age in order to form awareness of caring for the environment. The results of research by Nurlaili, [26] showed that learning using waste recycling media resulted in students being more concerned about the surrounding environment and easier to understand the learning process in class. If students are involved in processing waste, their participation is quite active. That the level of student participation in school waste management is quite active. Similarly, the

level of knowledge of students in managing waste is in the sufficient category with scores of 15.6 (SMAN 12) and 14.8 (SMAN 13).

Rahmawati [17], in their research conducted experiments on students by using ecobricks through problem-based learning to increase ecoliteracy or awareness of the environment. According to Andriastuti [11] the potential value of ecobricks in reducing household plastic waste in West Pontianak District is 77% of plastic waste can be processed into ecobricks and 33% cannot be processed into ecobricks. The potential for ecobricks that can be produced in 1 year is 2,481,940 pieces for bottles with a volume of 600 ml or 1,119,177 pieces for bottles with a volume of 1500 ml.

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The results of the wastes weight from each waste composition are then converted to the waste economic value that is determined by Rosella Waste Bank, Pontianak City and the organic wastes that are processed into compost are based on the value of the compost price on Sei Landak Timur Perumnas 4 Street, Pontianak city. The total heaps of residential waste in Pontianak City is 126895.82 kg/day or 126.89 tons/day. The composition of Pontianak City residential waste which has the highest percentage of waste is organic waste with the other types of organic waste in a percentage of 63.44% and the highest inorganic waste with the other types of inorganic waste in a percentage of 20.43%. Percentage of organic waste with cardboard type is 1.21%, 0.54% newspaper, 0.81% white paper, and 3.12% leather paper. The percentage of inorganic waste with bottled types is 3.37%, 1.41% plastic cups, 1.11% cans, 2.25% bottles and colored plastics. The percentage of B3 is 2.31%. The potential economic value of Pontianak City residential waste is IDR 163.632.081/day. The potential economic value of waste in 2016 is IDR 59.725.709.457/year.

Jaya [27] did a research on the content of ecobrick innovation broadcasted on television, which stated that the program was able to increase the environmental care attitude up to 12 times from the beginning, because ecobrick innovation has an incentive value to motivate people in caring towards the environment. Concluded that eco bricks are the best way to utilize plastic wastes so that they will not harm biota and humans. Jaya [27] stated that eco bricks manufacture has got positive influence towards the students'

environmental care level in STIE-TN Dumai. That is reinforced by Khoirunnisa, et al. [35] research results at Pena Prima TPA Semarang, showing that environmental care characters can be grown in children aged 3–4 years through ecobrick. The environmental care characters, which are disposing garbage in its place, separating organic and inorganic wastes, using sufficient water, washing hands with soap, and washing hands after playing.

5 Conclusions

Based on this research shows that learning with ecobricks can increase creativity from previously 67.45 to 89.64. Ecobricks can also increase the attitude of caring for the environment from 67.04 to 73.52.

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