

Edible Cell Model For Cell Biology Learning For The Elementary School Students

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Abstract.

Learning cell biology in science subject is a challenging for elementary students in Indonesia. Not only it is implicitly taught in the science subject, but it also needs an intangible imagination to understand the cell's organelles and their function. Therefore, a recreating method to explain about the cells the cell's organelles and their function. In our program, the 5th and 6th of elementary students were explained about cells, organelles and their function in the first week class. Thus, they also were taught to observe cells under light microscope. Moreover, we developed the cells model by creating it from the edible materials such as cake, candies, messes, and biscuits; followed by fun game. While the cognitive ability of the students was evaluated with pre-and post-test. Our method increased the level of understanding of the students to learn cell biology. However, the standard deviation of student cognitive ability was highly varied in both classes.

Keywords: *edible, cell model, cell biology, elementary students*

I. INTRODUCTION

The subject necessary for proficiency at both the basic and advanced levels of school is science which focus study on living beings and their environment [1]. Science is meant to provide a tool for students to learn about themselves and their natural environment, as well as their application in addressing issues that may arise in everyday life [2]. Indonesia, science subject, especially biology has been taught at the junior high school level. Thus, it brings the gap information when elementary students learn about the human tissue hierarchy and the tissue function of our body. Therefore, science must be taught in a such an entertaining and fun way. Through science subject, students can understand and hopefully apply science concepts to solve daily life problems [3]. Students can develop their scientific interest through studying science since the primary school level. Cell is one of the topics in biology as a part of science subject that must be studied. The cell is the smallest unit of life that able to divide, multiply, grow and respond to stimuli from the environment. It is a tiny area surrounded by membranes and filled with a concentrated liquid which has structural integrity, functionality, and genetic characteristics. The cell regulates and performs all tasks; for instance, red blood cells carry oxygen across the body. Each cell has a particular function [4] As one of the fundamental concepts to study about the cells is the cell concept which led us to understand the function of our body [5]. However, understanding the concept of cell can be tough for student.

Based on the research done by Hadipriyatno, *et al.* (2019) the concepts about cell structure and its function were the second most difficult science topics for 11th grade students in Lombok [6]. Additionally, according to Sari and colleagues (2019), some obstacles in learning the cell concept were difficulties in imagine the cell and organelles, insufficient learning media, and unfamiliar term written in Latin language [7]. Earlier studies found that 3D models can help student mastering concepts and principles in biology better than 2D diagrams and microscopic slides [5]. Therefore, using 3D models learning media in study cell concept could help student in mastering the concept of cell. Our program, involving the engineered cell replicas out of edible ingredients, is aimed at students in the fifth and sixth grades. Since this program intended to introduce the cell concept to students in primary school, the learning activity ought to be fun. During the first week, students was provided with the handout information relevant to cells and their organelles and their organelle, followed by a question-and-answer session. Students were also allowed to observe plant cell under a microscope. In the second week, students were separated into 4 groups and given a

set of edible materials to construct the animal cell model. Candy, cookies, cakes, and a variety of other kid-favorite delicacies are utilized as the components to construct it. The most creative and well-arranged organelle with the correct label would be awarded. The measurement instrument to evaluate this method effectivity to cell biology knowledge were pre-tests and post-tests on day-1 and day-2 activities. To sum up, this hands-on science learning in grades V and VI by studying cells under a microscope and building edible cell replicas has been shown to increase students' understanding of biological cell principles.

II. METHODS

This community service was initially started with the basic biology class to the students of Grade V and VI in a private elementary school in Sleman, Yogyakarta, Indonesia. This activity implemented the Classroom Action Research Method [8], followed by Progressive differentiation and Integrative Recognition Method [9]. This method employed action to the studied subject, then further evaluated of the level of understanding before and after the actions. This community service activities were included in three steps

First step: Preparation Steps

The team of the community service have good backgrounds in Cell Biology knowledge consisting of four Pharmacy students, a Chemistry Education lecturer and Molecular Cell Biology lecturer. In this preparation steps, the team met and discussed with the school principal and class teachers about the designed of the activities. In this step, the hands out of the basic cell biology, pre-and post-test were being prepared as well. The team also prepared the plant cells sample to be observed by the students in day-1 class and the cake, cookies, jellies, messes, and candy for the activity in class of day-2.

Implementation Steps

This community service was divided into 2 classes each grade and conducted regarding strict health protocols to prevent COVID-19. In the first class on July 13, 2022, the students learned about the cellular biology consisting of cell definition, type of cells, the cell organelles, and the functions, as well as the tool to observe the cells named light microscope. In the end of the class, there was a hand on activity for observing the plant cells using microscope. Furthermore, in the second class on July 27, 2022, the students were divided into 4 groups each grade and one of which were given a set of edible materials as mentioned previously. The team exhibited some of possible cells model made by edible materials and by using the student's creativity, they had to make the cell model engineered from the given materials. After the cells being finished, the students had to correctly labelled the name of the organelles. The best cell model and labelled correctly got the chance for winning the reward.

Evaluation Steps

Before and after the classes, students were given pre-and post-test to evaluate the effectivity of this class in increasing the cognitive ability of the students.

III. RESULT AND DISCUSSION

Table 1.The Participating Students

Students	Day-1 (n=75)		Day-2 (n= 77)	
	Female	Male	Female	Male
Grade V	25 (71.43%)	10 (28.57%)	26 (68.42%)	12 (31.58%)
Grade VI	18 (46.15%)	21 (53.85 %)	17 (44.74 %)	21 (55.26 %)

Cell Biology, basic and fundamental knowledge of science subject, had never been embedded in science subject in elementary school. However, almost all the elementary students heard about cells and there are abundant media information such as National and International television program and books discussing about the concept of the cells. To bring this concept closer to the children, our community program addressed to introduce the concept of cell biology through the fun and practical method by directly hands on to engineer the cells model as mentioned in previous reference [4]. There were 75 students participated in this program consisted of 48 students in Grade V and 37 students in Grade VI. This groups were included 26 and 18 female students: as well as in 12 and 21 male students Grade V and VI (Table 1).

This community service was a two-day program consisting general information, concept, and plant observation at day-1 (Figure 1a); followed by hands-on activity to construct the cell model from edible materials (Figure 1b). In the first week, we distribute the hand printout materials about cells in definition, types, and the organelles, including explaining the role and function of each organelle. This activity was followed by simple experimental activity to observe the plant cells from *Hibiscus sabdarifa* (Rosella petal tissue), *Curcuma xanthorrhiza* (rhizome tissue) and *Andrographis paniculata* (leaf) under the light microscope. Then, the students drew the plant cells on those tissue on the paper. This objective of the first day is to understand the cells concept in our body.



Fig 1. Classroom Activities: a. Observing Plants Cell under the Microscope on Day-1, b. Constructing Edible Cell Model on Day-2

Furthermore, the second day of this program was the continuation of what have been done in the first day. In particular, every class was divided into 4 groups, then each of them got the set of edible materials consists of cake, cookies, messes, gummies and candies to engineer their own animal cell models detailed with the organelle's label. This models were created based on some previous references [10-12]. Moreover, we selected two among those group of each class as the closest model of the real cells. The selected animal cells models were the most biomimicking cells decorated with the correct label of the organelles from Grade V (Figure 2a, 2b) and Grade VI (Figure 2c, 2d).



Figure 2. The rewarded team of the most biomimicking cells.
a. The teams of Grade VI
b. The teams of Grade V

This community service applied Progressive differentiation and Integrative Recognition Method by giving the pre-and post-test in every class activity. At the first class activity, the grade V's pre-test score was 60.86 ± 12.22 , then increasing to 78.29 ± 17.23 in post-test. Having higher score than grade VI student's pre-test score was calculated at 63.08 ± 11.78 increasing to 86.67 ± 14.54 (**Figure 3a**). It indicated the first activity elevated the student cognitive ability and recognition in especially cell biology concept. Furthermore, the pre-test score of grade V and VI in the second class activity were 49.84 ± 23.74 and 73.47 ± 31.75 . These values were improved to 94.11 ± 11.71 and 80.21 ± 23.14 in the post-test, respectively (**Figure 3b**). Even though the score were higher in Grade VI than that of Grade V, there was no significant different between both. There is no significant difference between the score of pre-and post-test since the standard deviation of each data was highly vary. To sum up, our community service successfully levels up the understanding of elementary students to the science subject, particularly cell biology.

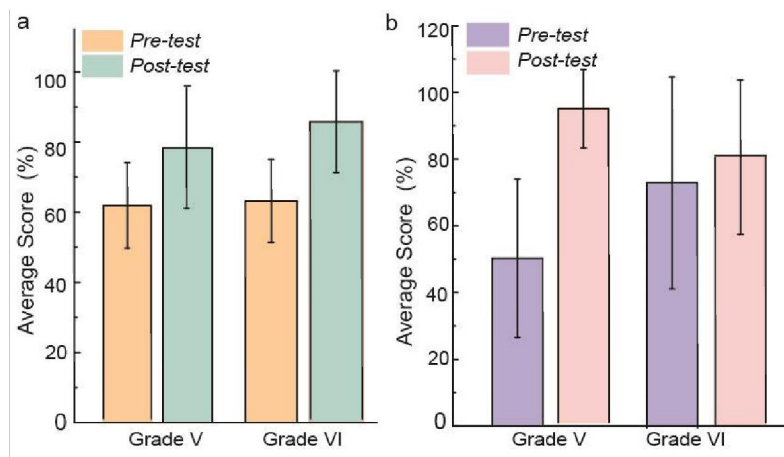


Fig 3. The Average Score of Pre- and Post-test in the:
1. First Class and Second-Class Grade V and IV

IV. CONCLUSION

Since cell Biology had never been embedded in science subject in elementary school, to deliver the basic of the concept of cell biology is needed. By enjoyable teaching method through the construction of edible cell model, the level of cognitive and recognition ability of elementary students was rising. Thus, this method can be adapted to improve the understanding of science for the children.

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