



# Science Experiment by Making a Simple Water Filter to Increase Students' Learning Motivation

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## ABSTRACT

Science experiment is a fun learning method and introduces the surrounding nature and seeks solutions to problems that occur. One way to do this is by experimenting with making simple water filters for elementary school students. This is an implementation of science learning which is sometimes considered difficult by students. The consideration of conducting science experiments must be safe, easy and in accordance with the applicable curriculum. This prompted a scientific experiment to make a simple water filter for fourth grade students at SDN Kalibanteng Kidul 02. The purpose of this training is to introduce and train the students of SDN Kalibanteng Kidul 02 how to get clean water by making a simple filter where the ingredients are easy to find. The method used in this research is to carry out the practice of making simple water filtration. This experiment will provide knowledge to students that clean water is one of the most important components in life that must exist under any conditions. Because the body cannot survive without water. Lack of water will certainly be fatal to health. The results obtained from this study, that science experiments affect the value of student completeness in learning and increase student motivation.

**Keywords:** *Science experiment, Student motivation, Water filters.*

## 1. INTRODUCTION

SDN Kalibanteng Kidul 02 is located at Jalan Taman Sri Rejeki Selatan III, Semarang City, Central Java Province. SDN Kalibanteng Kidul 02 consists of 6 (six) classrooms, 1 (one) teacher's room, 1 (one) principal's room, 6 (six) bathrooms, 1 (one) library room, prayer room, UKS room, warehouse, canteen, and 1 (one) Hall building on the 2nd floor. Science learning is included in the independent curriculum implemented at SDN Kalibanteng Kidul 02[1]. Science learning is provided with the aim that students have the following abilities: (1) gain faith in the greatness of God Almighty based on the existence, beauty and orderliness of His natural creation.(2) develop knowledge and understanding of science concepts that are useful and can be applied in everyday life(3) develop curiosity, positive attitude and awareness about the interplay between science,

environment, technology and community(4) develop process skills to investigate the natural environment, solve problems and make decisions(5) increase awareness to participate in maintaining, protecting and preserving the natural environment(6) increase awareness to respect nature and all its regularities as one of God's creations(7) acquire the provision of science knowledge, concepts and skills as a basis for continuing education to SMP/MTs [2]. Science learning objectives will not be achieved if students only passively listen to the teacher's explanation in the classroom. Learning will be more memorable and meaningful for students if they participate actively in solving problems or questions given by the teacher related to the material being studied [3]. To achieve these learning objectives, the teacher is directly responsible for class management and must provide motivation and carry out learning that is able to arouse students' enthusiasm for learning. The problems at SDN Kalibanteng Kidul 02 show that science learning outcomes are not optimal. In

fact, the science learning process applied in schools is less able to develop students' thinking skills.

Implementation of learning that takes place in the classroom is only directed at the ability of students to memorize information provided by the teacher without a deep understanding, so that the information tends not to last long in students' memories. Science learning is needed in everyday life to meet human needs through solving identifiable problems [4]. Therefore, learning science requires an emphasis on providing direct learning experiences through the use and development of process skills and scientific attitudes.

The natural science study in question relates to how to systematically find out about nature, so that natural science is not only the mastery of a collection of knowledge in the form of facts, concepts or principles but also a process of discovery [5]. The learning process emphasizes providing direct experience to develop competencies in order to explore and understand the natural surroundings scientifically. But the reality is very different. One reason is the use of inappropriate learning methods or approaches by teachers in teaching [6]. Teachers teach more material concepts through knowledge transfer and giving examples which tend to be rote material for students so as to create a monotonous learning atmosphere. process skills in the field of natural sciences are knowledge of concepts in principles that can be obtained by students if they have certain basic abilities, namely the science process skills needed to use science [7]. Learning is still dominated by the teacher, lack of facilities and media/visual aids needed in learning, lack of interest in student learning so that science process skills activities are not optimal, some students still do not make observations using the appropriate senses, use inappropriate tools and experimental materials with functions, less thorough in conducting experiments even though the teacher has explained at the beginning of learning, has not actively communicated the results of experiments and has not been able to draw conclusions according to the results obtained [8].

In the description of the partners' problems, a solution to increase science learning is recommended in the form of a science experiment making a simple water filter. Science learning does not only convey information and understanding of the material, but also must pay attention to the development of other abilities such as the ability to observe an object, use tools and materials, conduct experiments, the ability to communicate and the ability of students to conclude the results of observations or experiments [9]. One method that involves student

activity to improve science process skills is the experimental method. The application of the experimental method really helps students in their learning process because with this method students are given the opportunity to experience themselves or do it themselves in certain learning processes. The experimental method in learning is a way of presenting lesson material that allows students to conduct experiments to prove themselves a question or hypothesis being studied [10]. From this presentation it can be concluded that the experimental method involves direct student activity, students are given the opportunity to conduct experiments to find out for themselves the facts and concepts in learning.

## 2. METHOD

The methods and steps that will be carried out in this dedication include:

1. Conduct laboratory studies related to the physical, chemical and biological properties of water before and after filtration using a simple water filter. Laboratory studies were carried out at the UNNES Chemical Engineering Operations Laboratory.
2. Prepare tools and materials for testing in the laboratory, including: cotton, charcoal, gravel, sand and plastic bottles. The main filter material used is charcoal, where charcoal acts as an active carbon which can attract all the particles dispersed in water that cause dirty and smelly water. So that all of these particles will be attracted by the charcoal particles and bound by the activated carbon. Cotton which functions to hold sand and other particles from entering the container.
3. Design a simple water filtration device that is in accordance with the laboratory results shown in Figure 1.

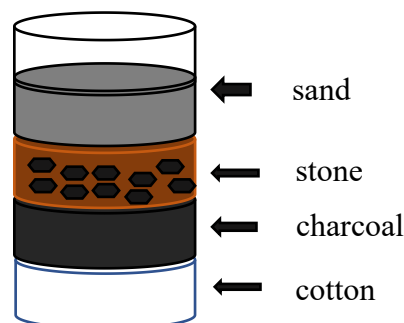


Figure 1. Design simple walter filter.

4. Conduct a preliminary study and location survey to obtain information about the condition of fourth grade students at SDN Kalibanteng Kidul 02.
5. Investigate partner problems.
6. Provide counseling/socialization to class IV students at SDN Kalibanteng Kidul 02 regarding the use of materials and water filter tools that will be made.
7. Demonstrate/practice making a simple water filter with the following stages:
  - a. Prepare all tools and materials.
  - b. Cut the bottom end of the mineral bottle.
  - c. Punch a hole in the bottle cap using a nail. This hole is intended for the flow of clean dirty water after passing through the filter.
  - d. The next step, put enough cotton on the inside of the bottle cap and please close the bottle using the bottle cap that has been perforated and added cotton.
  - e. Place the bottle with the hole and the cotton upside down in a glass or other container upside down (where the mouth of the bottle cap is facing down).
  - f. Grind the prepared charcoal so that it becomes like charcoal powder.
  - g. Add the gravel that has been prepared in the bottle to taste.
  - h. Add sand. In this way, a simple water filter is ready and ready to use.
  - i. Pour the dirty water through the previously cut hole in the bottle.
  - j. Wait until the water passes through the filter layer and enters the prepared container or glass.
  - k. After passing through the filter, the dirt in the water will be retained in the filter section of sand, fine charcoal and cotton. So all that's left is clean water.
8. Conduct discussions and questions and answers to further enhance understanding.

### 3. RESULT AND DISCUSSION

Water filtration carried out at SDN Kalibanteng Kidul 02 complies with the requirements of drinking water standards, both physics and chemistry.

#### 3.1. Physics requirements

- a. Turbidity, good water quality is clear, not cloudy. The water produced in the water filtration activities at SDN Kalibanteng Kidul 02 has met the limit recommended by the Minister of Health of the Republic of Indonesia Number 907 of 2002, namely 5 NTU scale where the maximum limit is 15 NTU. If

the water produced is cloudy, it means it is undrinkable or dangerous to health.

- b. Odorless and tasteless. The sense of smell can feel the smell and fresh taste of filtered water. Water with a foul odor cannot be consumed due to the decomposition of organic matter by microorganisms in the water. Foul odors can also occur if the water contains phenols.
- c. There are no floating solids. Water suitable for consumption does not contain floating solids that exceed the permissible threshold of 1000 mg/L. Solids floating in water are usually inorganic chemicals and dissolved gases. Water with a solids content exceeding the threshold will smell and taste bad and cause nausea.
- d. The water temperature reaches 8°C at room temperature. The normal limit for water temperature is 8°C, if the water temperature exceeds this normal limit, it indicates that there is a high amount of chemicals dissolved in the water and indicates the process of decomposition of organic matter by microorganisms. So if the temperature is not normal, the water is not suitable for consumption.

#### 3.2. Chemical requirements

The chemical standards for filtered water that are suitable for consumption include the degree of acidity, hardness, content of organic and inorganic chemicals. From the results of filtration at SDN Kalibanteng Kidul 02 it was found that:

- a. The degree of acidity (pH) of the water produced is 7. This is in accordance with the Minister of Health of the Republic of Indonesia Number 907 of 2022 that the pH limit for drinking water is 6.5-8.5, while for rainwater it is 5.5. Water with a low pH below 7 usually tastes sour and above 7 tastes bitter.
- b. The organic chemical analyzed in this activity is nitrate. The nitrate contained was 0.001 mg/L.
- c. Inorganic chemicals analyzed Fe. In this activity the Fe contained was 0.001 mg/L.
- d. The hardness level is 1 mg/L where the maximum threshold for water hardness is 500mg/L. Water hardness occurs due to the content of Ca and Mg ions. This cation can form scale when it reacts with soapy water.

#### 3.3. Effect of water filtration training on students' motivation at SDN Kalibanteng Kidul 02.

Learning motivation is the driving force from within students to carry out learning activities and add skills so that learning objectives can be achieved. In the science experiment of making a simple water filter, researchers created a fun learning atmosphere, giving prizes to students who were active either asking or answering the questions given. Praise is given to students who are active and understand science experiments. The equipment used is also creative and innovative with the aim of increasing student motivation. The following are the results of the control class and experimental class learning motivation.

**Table 1.** Value of motivation learning.

Student Number	Value	
	Control Class	Experiment Class
1	49	75
2	40	71
3	62	70
4	67	75
5	72	72
6	74	69
7	51	78
8	64	78
9	54	71
10	59	72
11	72	65
12	71	68
13	44	78
14	61	60
Total	840	1002

The total score of the criteria (if each item gets the highest score) is  $4 \times 20 \times 14 = 1120$  where 4= the highest score for each item distributed to students, 20= number of items, 14= number of respondents (students). The total score of data collection for the control class is 840, thus the learning motivation of the control class students is  $840 : 1120 \times 100\% = 75\%$  of the specified criteria.

The total score of the experimental class is 1002 so that the value of learning motivation is  $1002 : 1120 \times 100\% = 89.46\%$  of the specified criteria. From the results of the learning motivation of fourth grade students at SDN Kalibanteng Kidul 02, it was divided into the following categories: a score of 300, very poor category, 600 (poor), 900 (good enough) and 1120 (very good). The control class with a value of 840 is between less (600) and good enough (900). This is because in the control class the lecture method is used which is monotonous and makes students become listeners. This session explains the theory of making a simple water filter. Based on the results in the experimental class, it reached 1003 in the

sufficient (900) and very good (1120) intervals, but it was closer to good enough. This is because science experiments involve students actively in the learning process. Researchers distributed student worksheets before conducting science experiments. Both of these prove that the use of experimental science increases student motivation. Learning activities through science experiments in making simple water filters at SDN Kalibanteng Kidul 02 show high student learning motivation and are challenged to participate in class. Students enthusiastically follow the learning process and are directly involved in science practicum. Students have a desire to know more deeply about making water filters so that they have the ability to analyze and solve problems by exploring what the researcher explains. The existence of science experiments increases student learning conditions along with increased creativity and critical thinking skills. This is because students are given the opportunity to conduct experiments.

#### 4. CONCLUSION

Science experiments have been proven to increase students' learning motivation at SDN Kalibanteng Kidul 02 Semarang. The percentage of the experimental class reached 89.46% and 75% in the control class. Experiments on making simple water filters were carried out to instill curiosity and a positive attitude towards science and technology, develop students' skills to solve problems and make decisions, develop an understanding of scientific concepts that will be useful and can be applied in everyday life, participate in maintaining, protecting and preserving the natural environment, respecting the natural surroundings as God's creation.

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