

**THE ANALYSIS OF NATURAL SCIENCE LEARNING
MISCONCEPTIONS ON FORCE, MOTION, AND ENERGY
MATERIALS IN ELEMENTARY SCHOOLS**

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Abstract

This article discusses about the misconceptions occurred in elementary school, especially on force, motion, and energy. Misconceptions often occur in students due to a lack of the teacher's understanding of the material. However, teachers have to understand the material that will be delivered to students so that there are no misconceptions among students. In this article, the researchers took samples of elementary school teachers in the Jatipuro District. In this study, 55 respondents had filled out a questionnaire regarding force, motion, and energy. The results of the study showed, there were still teachers who still experience natural science learning misconceptions, especially on force, motion, and energy. Relating to force, motion, and energy, they experienced misconceptions that cause students to experience misconceptions about natural science learning. Thus, it needs to be followed up so that future generations can understand knowledge following the actual concept so that they can create results that can help their daily life. On the other hand, the role of various parties is needed so that mistakes in the natural science concept do not take place continuously. One of the efforts to stop misconceptions in natural science learning is to conduct research on these misconceptions and then repair them so that there will be changes that can change our lives in the future.

Keywords: Misconceptions; Natural Science; Force; Motion; Energy

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Introduction

Learning is a group of activities intended to promote the learning process. Teachers need to understand all the educational process components, the effectiveness, and the efficiency of continuing teaching. To find these answers, the teacher needs to run through an evaluation process. Based on the results of the evaluation, the teacher can focus their attention on students who lack the subject, and also identify the difficulties in gaining student experience (Nurfiyani et al., 2020).

Normally, students who learn from some subject material already have previous knowledge about the material they are studying. It also happens to students

who study natural science. Students already have some experience and natural knowledge. Knowledge is either theoretically true or false. The occurrence of previous knowledge produces intuitions and "student theories" about nature and the environment, however, they are not always theoretically correct. In some countries, teachers, especially natural science teachers, have begun to investigate misconceptions about natural science, because misconceptions are common. Most of the students have inadvertently misconceptions about natural science and kept abreast of scientific progress. Misconceptions arise from everyday experience and are difficult to correct. If

students are taught natural science without considering their misconceptions before experiencing the learning process at school, the teacher will not be able to teach correct scientific concepts. Therefore, to learn how to correct delusions, it must be expected consistently (Karomah et al., 2018).

When it occurs to scientific subjects, misconceptions often arise or occur. Natural science is one of the subjects closest to students' lives. Students often analyze and create scientific concepts that rely less on expert opinion. Elementary school students refuse to understand the correct scientific concept, which affects the subsequent learning process and causes a reduction in student achievement in natural science subjects (Uriyah et al., 2018).

One of the errors or mistakes caused in teaching elementary natural science is because children still need to learn abstract concepts at a certain stage of operation, teachers are less than optimal in teaching management, especially in learning to improve natural natural science research concepts. In natural science class, misconceptions come from the students (original teaching concepts, experiences, skills, and interests), from teachers who also have misconceptions, teaching errors, and old books (Biologi & Dasar, 2014).

From these explanations above, the researcher tries to find out the misconceptions that still occur in elementary school teachers, especially teachers in the Jatipuro sub-district. This research will focus on the material on force, motion, and energy which have begun to be explained to students in the fourth grade of elementary school.

Method

This research was conducted using a qualitative descriptive method to provide an explanation of the identification results

related to the misconceptions experienced by elementary school teachers in science learning materials. The source of the data was obtained based on the statement of 55 elementary school teachers in Jatipuro District, which was determined based on the purposive sampling technique. Furthermore, data collection techniques were carried out through interviews with the CRI (Certainly of Response Index) method. The data that has been obtained is then reduced, presented, and concluded and verified as in the process of qualitative research analysis (Sutopo, 2006).

Results And Discussion

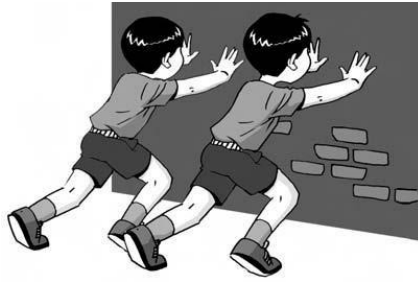
A. Result

Based on the questionnaire results given to teachers in elementary schools. There were several misconceptions about science learning, especially on the force, motion, and energy material. The researcher gave several questions about force, motion, and energy and then asked the informant to answer questions that had been prepared by the researcher. Some of the questions are as follows:

1. If an object is placed in a vacuum, what will happen to the object?
 - The objects will float
 - The objects will fall to the bottom
 - The object is still above



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The picture above shows Agung riding a horse, meanwhile Amar and Anton are pushing the wall. See the statement below. Which statement do you think is correct?

- Agung gets the force from the horse, while Amar and Anton get the force from the wall
- Agung gets the force from the horse, while Amar and Anton don't get the force from the wall
- Amar and Anton get the force from the wall, while the horse doesn't give force to Agung
- Mrs. Sonya tried to push the cupboard in the office, but the cupboard didn't move. Which statement is correct?
- The force created by Mrs. Sonya is smaller than the friction force produced by the cupboard
- The force created by Mrs. Sonya is greater than the frictional force produced by the cupboard
- The force created by Mrs. Sonya and the frictional force produced by the wardrobe has the same magnitude
- Defran lifted the cardboard containing his mother's Eid parcel from the floor to the table using 2 ways; lifting directly and the help of a sloping object. Which statement is correct?
- The effort/work for both methods is the same, however, Defran's force to push the cardboard parcel on a sloping object is less than the force of lifting directly
- Defran's force and work/effort to push the cardboard parcel on a sloping object is less than the force and effort of lifting directly
- Defran's work/effort to push the parcel boxes is greater than the effort to lift the parcel boxes directly, however, Defran's force to push the parcel boxes on lifting directly is less than the force to lift directly
- Alvin tried to lift a box of packaged drinks using two ways; by using his strength with lifting using his strength then he tried to lift it using a pulley. Which of the following statements is the most correct?
- The pulley still makes the force needed by Alvin is smaller than by lifting directly with his energy
- The pulley still makes the force needed by Alvin similar to using his energy directly, it makes Alvin easier to move the force
- The pulley makes the force needed by Alvin is greater than lifting it directly

From these five questions conducted by the researchers, the

following are the answers conducted by 55 respondents who came from

elementary school teachers :

Soal Nomor	A	B	C
1	40 respondents	10 respondents	5 respondents
2	3 respondents	28 respondents	24 respondents
3	16 respondents	33 respondents	6 respondents
4	16 respondents	14 respondents	25 respondents
5	44 respondents	3 respondents	8 respondents

From these five questions conducted by the researchers, the following are the answers conducted by 55 respondents who came from elementary school teachers:

Based on the data results obtained through the questionnaire by google formulir, it showed that, in question number one, 40 respondents answered A, 10 respondents answered B, and 5 respondents answered C. In question number two, 3 respondents answered A, 28 respondents answered B, and 24 respondents answered C. In question number three, 16 respondents answered A, 33 respondents answered B, and 6 respondents answered C. In question number four, 16 respondents answered A, 14 respondents answered B, 25 respondents answered C. Meanwhile, in question number five, 44 respondents answered A, 3 respondents answered B, and 8 respondents answered C.

B. Discussion

The concepts of motion, force, and energy are included in the basic concepts of natural science, however, students often misconceptions these concepts. These misconceptions usually begin from students' intuition and first-hand experiences, which differ from scientific beliefs. The results are represented by the motion, force, and energy of the event. In addition, students usually have experience with the movement, force,

and energy phenomena before entering the classroom. These early ideas and experiences often contrast with standard scientific concepts and make students' misconceptions.

Misconceptions or misconceptions in students cannot be separated from the teachers' role in providing lesson material. Several teachers are still incorrect in understanding the material or teaching materials given to their students. It can be seen through the questionnaire results that have been distributed by researchers to elementary school teachers through Google Form. For question number one from 55 respondents, only 10 respondents answered correctly. The problem on number one discusses the gravitational force of an object if it is in a vacuum. Several respondents experience misconceptions because they often watch television shows or news about outer space. Due to they often get information that astronauts float in a vacuum, teachers often associate gravity with a vacuum, thus they tend to answer A (40 respondents answered A). The answer is not correct because the lack of air in the tube does not mean they lack gravity, because the force of gravity is an attractive force between objects.

For question number two, only 3 respondents answered correctly. In these questions, the teacher tends to ask the type of force on the picture. The teacher will explain muscle force,

spring force, mechanical force, gravitational force, electric force, and magnetic force. However, it creates an understanding that objects that do not perform to the group cannot use force. Several teachers have misconceptions because of it. Thus, the teacher will assume, the wall cannot provide force because it is silent. Whereas, a stationary wall can use a force on a moving object so that the object will not experience a change if the force pushing the stationary object is less than the force possessed by the stationary object.

For question number 3 about objects at rest about the large friction force. 6 respondents answered correctly for this question. Due to the teacher's lack of understanding about this material, elementary students often experience misconceptions about this material. If the frictional force on the cupboard is not greater than the force generated by Mrs. Sonya, the cupboard will automatically move in Mrs. Sonya's direction. Meanwhile, if the friction force on the cupboard is greater, the cupboard will push Mrs. Sonya so that the cupboard does not move in Mrs. Sonya's direction. Because the cupboard and Mrs. Sonya are at rest, the friction between the cupboard and Mrs. Sonya is similar. Thus, the correct answer is C.

For question number four, 16 respondents answered correctly. This question discusses a simple machine to reduce the work/ effort. In this case, it shows that a simple machine is used to make work easier, not to give a smaller force due to the use of a simple machine. All of them still depend on the simple machine type used and its advantages.

For question number five, still discussing simple planes. Unfortunately, only 3 respondents

could answer correctly. Many teachers mistakenly assume the use of pulleys is to reduce the force. The use of pulleys still needs body muscles to assist in the use of the pulley process. In everyday life, pulleys are used to make it easier for someone to complete activities that require considerable energy. Thus, besides the pulley factor used, the energy used to move the pulley is a factor in the size of the force generated.

Conclusion

Based on the results of the research, it can be concluded, there are still several teachers who still experience misconceptions about natural science learning, especially on force, motion, and energy. On the questions about vacuum and the gravity force, only 10 respondents answered correctly. In the question about inanimate objects that do not move the force, only 3 respondents answered correctly. The question about objects at rest due to frictional forces is correct, only 6 respondents answered correctly. Lastly, the question about a simple plane, only 3 respondents answered correctly.

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