

Magnets and electric: Improving elementary students' understanding on the concept of energy and force

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Abstract: COVID-19 has brought a wide impact on the world including education. It comes with the difficulties of conducting the teaching-learning process and achieving the students' comprehension and understanding of the subjects, especially science. It is worsened by the thematic learning model, where students are required to understand more than one learning concept in one learning sub-theme. The offline teaching, which is scheduled in the first semester of the 2021/2022 academic year is a momentum to reshape the thinking concept of elementary school students. One of the concerns is physics. Physics is very important in the development of student knowledge, because of its continuous application in everyday life. In addition, the use of natural science in secondary schools is wide. Another important point is that students have less ability to understand new knowledge. Therefore, practice is needed to support the learning of theories. Considering this problem, the team of community service of Engineering Faculty Universitas Muhammadiyah Malang used magnetic and electric kits to explain the concept of energy and force to students. These topics are difficult for students, and they need to learn them with direct practice. Learning using the physics kits, magnet and electric, made students can understand better the basic concepts of magnetism and electricity. Moreover, students can practice their motoric skills using the kits. Students can also develop their creativity and innovation by varying the experiments with the kits. Lots of practice with magnets and electric kits helped teachers to evaluate students' ability and absorption of the materials. With this learning media, the learning provided by the teacher can be more interesting and fun for students. Therefore, students can improve their knowledge and skills in understanding concepts and their knowledge of physics.

Keywords: electricity, kits, magnets, science, physics

1. Introduction

In 2016, The Regulation of Ministry of Education and Culture had determined the Basic Competencies and Core Competencies of students referring to the 2013 Curriculum [1]. For basic competencies, students are required to have the ability and minimum learning materials achieved for a subject in each educational unit which refers to core competencies. Meanwhile, in core competencies, students are required to have the ability to achieve graduate competency standards at the class level. Therefore, every teacher has the responsibility to convey teaching materials and knowledge appropriately so that the competence of students can be achieved. In addition, it is expected that all teachers have skills in preparing innovative and creative teaching materials [2]–[4] so that they can improve the students' competence based on the curriculum, the development of student needs, and the development of information technology [5], [6].

Students' understanding of thematic subjects is still low and requires guidance from teachers [7], [8]. This is because many students experience confusion when required to understand more than 1 concept in one theme or sub-theme. The thematic learning process with a combination of several subjects requires teachers to be able to synchronize understanding between materials so that students get new experiences in learning and apply the learning concepts in everyday life. Thus, creative and innovative learning media are needed from teachers in order to create an interactive learning process.

Learning media is a means to communicate learning material to students with the aim of achieving educational goals and as a teaching method [9]. In the teaching and learning process, the use of learning methods can provide a new learning atmosphere so that students are motivated to learn [10], [11]. In addition, learning media can make students better understand the concepts of the subjects presented. With these benefits, the learning process can be clearer, more interesting, and interactive and can improve the quality of student learning outcomes.

The use of learning media in the classroom is a means for teachers and students to carry out the teaching and learning process. These learning media can be in the form of textbooks, student worksheets, audio or audiovisual teaching materials, models or mockups, or interactive teaching materials that can increase student activity and communication between students and teachers [9]. The development of learning media is a manifestation of the creativity and innovative thinking of teachers in providing appropriate, good, and fun learning for students in the classroom [12].

However, a phenomenon that is still widely encountered in the learning process is that there are still many teachers who use conventional learning media in the form of textbooks or textbooks and Student Worksheets. The use of this learning media still provides an understanding of "routines" for students [13]. Students are only taught to read the text or reading that is already in the book which is then continued by answering the questions in the next section. Thus, students are only required to understand from reading without seeing the real form of what they have read. The understanding that students receive and read from textbooks, not the understanding they receive from the experience. Thus, teaching materials are still contextual and monotonous so they cannot meet the teaching needs of students. The pandemic presents obstacles for teaching and learning activities for elementary school students. Children's understanding of the teaching material provided by the teacher does not run optimally. One of the subjects that experience obstacles in fulfilling students' basic competencies is in the field of science. Science is an important subject because of its application in everyday life and scientific disciplines that continue to be used until high school [14].

However, in its application in the field, teachers often have difficulty introducing science concepts, especially physics, to elementary school children. This is not without reason, because elementary school children tend to find it difficult to imagine without a concrete/real form. So, it is more difficult for children to absorb the material given by the teacher. In contrast to the concept of mathematics or the Indonesian language whose implementation is always applied to everyday life.

In thematic learning, especially in physics, students sometimes still find it difficult to recognize magnetic and electric fields [15]–[17]. The application of the

concept of electricity and magnetism in everyday life is very much, but it cannot be seen by the eye, but only follows the rules of the applicable laws of physics. So that learning media is needed that can clarify the teacher's presentation of the concept. One example of learning media that can be used in the learning process is electrical teaching aids and electrical circuit boards [18]. This learning media is a learning media innovation that can be used to explain the form of electrical energy, magnetic force, and the amount of power needed to turn on lights and the like. So, by using this media, the learning process can be carried out in a fun way and students can directly practice the science concepts of physics [19]. This learning media is expected to motivate students to recognize and learn one of the science physics concepts in a fun way.

Surya Buana Islamic Elementary School is one of the private Islamic-based elementary schools in Malang City that is accredited A. At each grade level, this school has 4 parallel classes where each class contains 20-30 students. This school has 36 teachers and educators who carry out teaching and learning activities on active school days. This school is located on Jl. Simpang Gajayana 610-F, Dinoyo, Lowokwaru District, Malang City.



Figure 1. Surya Buana Islamic Elementary School Malang

Although this school is a private school, this school has made many achievements in the religious field shown by the students of this school. This of course needs to be accompanied by student academic competence. Thus, teachers are required to be more creative in creating an active and interactive teaching and learning atmosphere. The learning process must be well prepared by the teacher by planning, preparing and compiling their teaching materials and learning media. Good teaching materials and learning media will be able to help students understand the concepts of subjects presented by the teacher in class. Of course, teachers need to be supported by good learning media so that the results of delivering the material are more effective and maximal.

Based on the analysis of the situation described above, the existing problems related to the teaching and learning process are:

1. Class teachers still deliver physics science subject matter in contextual thematic learning based on books and student worksheets (LKS), so the learning methods used cannot provide maximum learning outcomes or achievements.

2. Teachers are not yet skilled in the use of thematic physics science learning media during the teaching and learning process in class.
3. Teachers cannot yet be creative in choosing, designing, and making learning aids needed to convey material to students.

2. Method

This community service program is aimed to teachers and 4th grade students of Surya Buana Islamic Elementary School Malang. As a solution to these problems, methods are made so that the objectives of this activity can run well.

The method used to increase understanding of the use of this teaching aid is by way of practice and discussion. The initial practice will be carried out by the implementing team to the teacher, so that it can be directly imitated and put into practice to students. Furthermore, the implementing team assists teachers during the teaching and learning process in the classroom using teaching aids. If then there are students who ask critical questions in such a way that the teacher cannot answer, then the implementation team will help. All difficulties or problems can be discussed directly, so that students can immediately know and practice the difficulties experienced.



Figure 2. Examples of socialization of teaching aids to elementary school students

The steps in this activity are:

1. The presenter explains this teaching aid.
2. The presenters provide practice in using teaching aids.
3. A question-and-answer session is given to find out the difficulties that may be faced by the teacher participants.
4. Teachers are allowed to try the available tools.
5. The presenters help teachers who still find it difficult.
6. The teacher practices the use of teaching aids to the students, while the teacher assists.
7. Discussion can be done during practice or after.

3. Result and Discussion

The use of learning media in the form of electric teaching aids at Surya Buana Islamic Elementary School Malang has been carried out. The Service Team first

carried out the procession of handing over the teaching aids to the Head of Surya Buana Islamic Elementary School, as shown in Figure 3.



Figure 3. Giving the props to the Head of Surya Buana Islamic Elementary School Malang

This activity gave great enthusiasm to grade 6 students who had previously received material on the concept of electricity. The teaching aids show a variety of series and parallel electrical circuit experiments as well as motion test equipment. Students are first given a review of the theory that has been taught by elementary school teachers, then start the set-up of teaching aids. Some of the obstacles faced were that the scheme contained in the theory needed to be understood before installing the circuit, as shown in Figure 4. The main difficulty for students was the installation of branched cables which were previously described simply in the circuit schematic. The process of delivering material is also accompanied by class teachers as a means of tutorials or practice as well as documenting activities.



Figure 4. Presentation of initial material according to the concepts that have been explained

After the process of making the circuit, students are given an understanding of the reasons for the various forms of lamp flames according to the theory that has been described previously. Students are also given critical questions so they can hone their troubleshooting skills.



Figure 5. Instructor demonstration as well as hands-on experiments by students

Students are also asked to directly conduct experiments, thereby improving their skills. This experiment is expected to be able to give a better picture to elementary school students who are still new to the concept of electricity in everyday life.

4. Conclusion

Community service program carried out by the service team from UMM provides benefits for teachers and students at SD Islam Surya Buana Malang. For teacher, this service provides new knowledge about the development of creativity to create learning media using direct demonstration technology. As for schools, this raises the spirit to initiate special laboratories so that students can more easily understand the material being taught directly, as well as improve their psychomotor skills.

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