IJRIE 1 (1) (2020)
International Journal of Research Innovation and Entrepreneurship
https://journal.unnes.ac.id/sju/index.php/ijrie

The Improvement of Energy Concept Understanding of Students with Deaf in Special Needs Junior High Schools Using Energy Change Props

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DOI: https://doi.org/10.15294/ijrie.v1i1

Accepted: Feb 20, 2020**. Approved:** June 01, 2020**. Published:** July 30, 2020

ABSTRACT

The learning process of deaf students requires more time than that of normal students. This also occurred in physics topics of natural science subject. In order to support the deaf students' concept understanding, learning media such as teaching props, are needed. This support would help them to maximize their senses of sight and touch. This study aims to determine the effectiveness of energy change props in enhancing energy concept understanding for deaf students. This research was a quasi-experimental study with a single subject research design. The subjects of the study were five deaf students of grade VII in a junior school for special-needs students in Central Java, Indonesia. The effectiveness of learning has been shown from the improvement of conceptualization from base-line condition to intervention. An effect size technique was used in the data analysis. The result showed that the obtained average effect size in this study was 1.32 with a high category. This study indicated that the props for energy change were effective for enhancing energy concept understanding for deaf students.

Keywords: props; energy; concept understanding; deaf students.

1. INTRODUCTION

Education plays an important role in determining the development and manifestation of an individual that affects the development of the country (Rusilowati, 2009). Efforts to educate the nation's life can be done through the implementation of qualified education, regardless of his/her physical condition, gender, or age. This shows that children with special needs (CSN) are also entitled to a qualified education.

Education with a qualified learning for children with special needs is specific, according to the needs of each type of students (Zakia et al., 2016). Children with hearing impairment experience an inhibition of verbal communication, in terms of expressive (speaking) and receptive (understanding the conversation of others) (Purwaningsih & Sulisworo, 2015). It would cause delays in the students' learning process. Therefore, an appropriate learning media which

can help the students with hearing impairment in the learning process is crucial.

The use of visual media in a learning process for deaf students was more effective than that without using media (Surawati et al., 2014). The interviews involving natural science teachers of a junior high school for special-needs students in Central Java Indonesia revealed that the availability of science learning media especially for physics topics was very limited. Even, there was no physics learning media for children with hearing impairment.

Students of grade VII of junior high schools for special-needs students will learn about energy in the second theme entitled "Always Save Energy". Based on the fore-mentioned interviews, the students with hearing impairment have difficulties in understanding the topic of energy. These interviews also indicated that a learning media for energy topic is very crucial for the students with hearing impairment to support their concept understanding. Teaching aids for deaf students were designed so that can be used through the sense of sight and touch. The effectiveness of the use of energy change props in enhancing the understanding of **energy** concepts for students with hearing impairment in special-needs junior high school would be described in detail in this paper.

2. METHODS

This research was a quasi-experimental study, with a single subject research design. The subjects of the study were five deaf students of grade VII a special-need junior high school in Central Java, Indonesia. The effectiveness of learning was justified from the increase in the concept mastery from the base-line condition to the intervention. A written test was used as the instrument in this study. The data was analysed using an effect size technique. The correlation index number between the baseline and the intervention was calculated prior to get the effect size value. The correlation range that was used to determine the effect size equation is according to Sugiyono (2014) and presented in **Table 1**. The Cohen's effect size criterion (Dunst & Hamby, 2012) is depicted in **Table 2**.

Table 1. Correlation coefficient scale.

Interval	Note
0,00-0,40	Weak
0,41-1,00	Strong

Table 2. Criteria of effect size value.

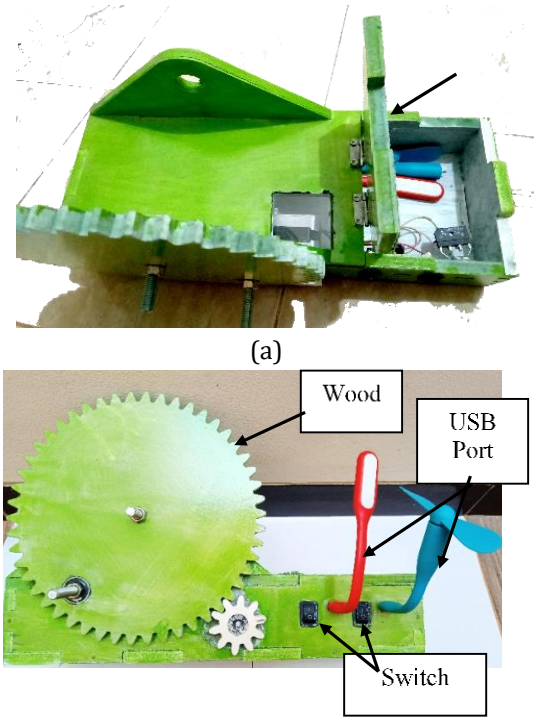
Range of percentage	Criteria
$d \leq 0,2$	Low
$0,2 < d \leq 0,8$	Middle
$d > 0,8$	High

3. RESULTS AND DISCUSSION

Energy change props for deaf students used in this study is presented in **Figure 1**. The effectiveness of props was justified from the cognitive learning outcomes in the form of concept understanding by the five students of grade VII of the special-needs junior high school. The analysis of the props effectiveness was conducted by using an effect size technique. The effect size was a measure of the magnitude of the correlation or effect of a variable on other variables (Santoso, 2010). A learning using energy props was an intervention that would affect the students' concept understanding. The data collection method used was the single subject method proposed by Sunanto (2005), with a baseline data collection and each intervention that was carried out three times. The correlation summary (r) and the increase in the students' concept understanding from other base stages and interventions (effect size) are presented in **Table 3**.

Table 3. Correlation summary and improvement of the students' concept understanding.

No.	Student Code	Correlation (r)	Effect Size (d)
1.	S-01	0.92	1.97
2.	S-02	0,99	0.42
3.	S-03	0.61	1.84
4.	S-04	0,82	1.75
5.	S-05	0.91	0.61
Effect Size average			1.32
Criteria			High



(a)

(b)

Figure 1. Arrangement of energy change props: (a) top and (b) front view.

The results were also illustrated in a linear graph of the conditions of each student as are shown in **Figures 2**. The analysis result using the effect size technique obtained an average value of 1.32 with a high criterion. It indicated that the learning using the energy change props in this study could improve the students' concept understanding for energy topic. The use of props in learning was highly recommended due to its suitability with the topic being studied (Hamdani et al., 2012). Moreover, this kind of props could be demonstrated directly and tried by the students resulting in a more effective learning.

The indicators on the baseline of intervention consisted of seven verbs from the cognitive level of C1 to C3 which include: (1) mentioning, (2) identifying, (3) estimating, (4) expressing, (5) concluding, (6) determining and (7) sorting. After collecting the database of intervention from all students, a simple analysis was done by calculating the difference in the number of baseline score and intervention. The increase in the percentage of the students' concept understanding in each of the problem indicators is shown in **Table 4**.

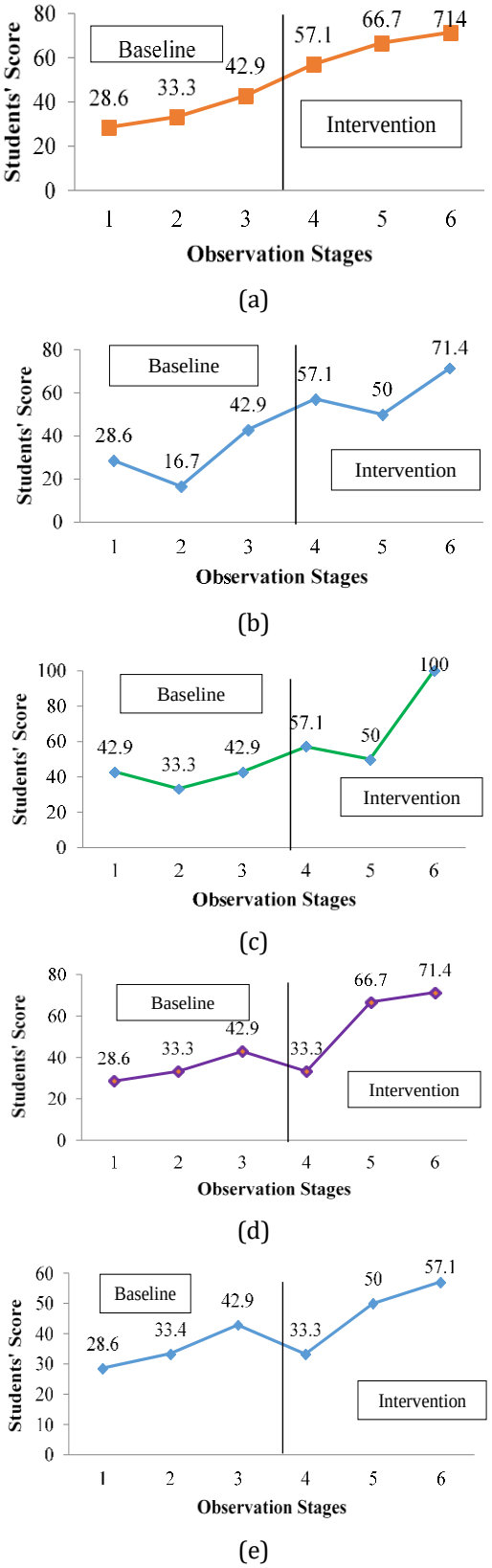


Figure 2. Length of baseline conditions and intervention capabilities of (a) S-01, (b) S-02, (c) S-03, (d) S-04, and (e) S-05 in understanding energy change concept.

Table 4. Percentage of concept understanding improvement of each problem indicator.

Indicator	Improvement percentage (%)
Mentioning	60.0
Identifying	84.6
Estimating	75.0
Expressing	71.4
Concluding	100.0
Determining	50.0
Sorting	60.0

The data in **Table 4** indicated that the improvement of understanding of determining indicator (cognitive level C3) was still low with an improvement percentage of 50%. This became an evaluation to improve the learning process that could support the students' cognitive abilities at the applying level (C3). The use of props can be used to improve students' cognitive abilities in the C3 realm. Props are visual aids or tools used by the teachers in a learning that can help the topic delivery process to the students. As a result, the learning process would be more effective. The props used as a learning media played an important role in creating an effective teaching and learning process (Sudjana, 2014). The use of energy props was proven to improve the students' concepts understanding on energy topic. Energy itself is difficult to define; it cannot be seen or measured. However, changes in the energy system can be seen and measured (Lancor, 2012). Understanding the concept is a part of a learning process to correctly understand a certain design or abstract ideas, so that someone can classify an object or event (Elisa et al., 2017).

4. CONCLUSIONS

An energy change prop was developed to facilitate the learning of deaf students in understanding the concept of energy change. The props of energy change were effective in improving the students' concept understanding, evidenced by the effect size value of 1.32 in a high category.

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