



## **The Use of Project Based Learning to Improve Students' Concept Understanding on Elasticity and Hooke Law**

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### **ABSTRACT**

This study aims to determine the use of project-based learning models to improve students' conceptual understanding of elasticity and Hooke's law at SMA Negeri 1 Syamtalira Bayu. This research is a research quasi-experimental design. The sampling technique used is simple random sampling. The samples in this study were students of class XI IPA 4 as the control class with 27 students and class XI IPA 3 as the experimental class with 27 students. The results of the research data analysis showed that the N-Gain normalized obtained an average value of increasing understanding of the concepts of practical class students, namely 0.46 in the medium category, while the control class was 0.30 in the low sort. The test analysis results of the independent sample test for the experimental class and control class are  $0.03 < 0.05$ . It can conclude that using learning models, project-based learning can improve students' understanding of concepts on elasticity and Hooke's law at SMA Negeri 1 Syamtalira Bayu.

**Keywords:** Elasticity and Hooke's Law, Project Based Learning, Concept Understanding

### **INTRODUCTION**

Learning activities are educational processes that provide opportunities for students to develop their potential into increasing abilities. According to Permendikbud (2013) concerning Curriculum Implementation, it is stated that learning activities should be directed at empowering all potential students to become the expected competencies. But in reality the lack of quality facilities and infrastructure in the learning process. The main problem faced in education in Indonesia is the low learning outcomes of students in schools, especially the common understanding of concepts (Supardi, S. U., et. al., 2015).

Learning model Project Based Learning can improve students' understanding of concepts (Kristanti, Y., et. al., 2016). This is reinforced by the opinion (Bender, W.N., 2012), which states that project-based learning is a learning model based on asking students to face real-world problems and problems that they consider meaningful determine how to deal with them and then act collaboratively create problem solutions. This is following the standard of the educational process in the 2013 curriculum in Permendikbud (2013), which states that to

encourage students' ability to produce contextual work, both individually. In groups, it is highly recommended to use a learning approach that produces-based work Project Based Learning.

Model Project-based learning Based Learning is an instructional model that provides the opportunity for teachers to manage the classroom with a project that involves work (Hawari, A. D. M., & Noor, A. I. M., 2020). One of the advantages of Project Based Learning is that it can develop various skills, knowledge, and understanding (Larmer, J., et. al., 2015). This is supported by research (Lestari, N., 2019) that the effect of project-based learning models is one way to understand the material being studied easily and foster enthusiasm and active student involvement in learning is to apply the learning model Project Based Learning.

### **Problem of Research**

The teaching and learning process in class XI of SMA Negeri 1 SyamtaliraBayu has not been able to improve understanding of physics concepts, so students' knowledge of concepts is still low. This is supported by the results of interviews and observations with class XI physics teachers at SMA Negeri 1 SyamtaliraBayu. The teacher stated that students tend to memorize physics concepts, and students do not understand physics learning in the form of concepts and their applications. Problems were found during teaching and learning physics, where students still made many mistakes in determining equations without understanding the concept; practicum activities were also rarely carried out, which caused skills and application of understanding concepts to be underdeveloped.

This is also reinforced by the results of observations with some class XI students also showing the same thing. The students claimed to learn physics by memorizing physics concepts and formulas, so they tried to remember all the procedures they had learned. Students have difficulty in determining the formula that must be used to solve a problem. The solution that will be done to improve students' understanding of concepts is to apply the learning model Project Based Learning. Several previous studies related to research, namely the use of the model Project Based Learning have been carried out by (Lestari, N., 2019) which states that the effect of project-based learning models is one way so that students can easily understand the material being studied and can foster enthusiasm and active student involvement in learning. is to apply the learning model Project Based Learning. Project-based learning has great potential to make the learning experience more interesting and meaningful for students of SMA Negeri 1 SyamtaliraBayu in building conceptual understanding. Where the learning process can interact directly with learning objects that have only been taught theories but not direct practice.

### **Research Focus**

This study aims to determine the effect of implementing the model Project Based Learning on students' understanding of concepts after learning elasticity and Hooke's law at SMA Negeri 1 SyamtaliraBayu.

## **METHODOLOGY OF RESEARCH**

### **General Background of Research**

This research was conducted at SMA Negeri 1 Syamtalira Bayu. The sampling carried out in this study was probability sampling using simple random sampling (Ismail, H. F., 2018). The approach used is quantitative. This research is a quasi-experimental design research.

### **Subject of Research**

Population in this study were all students of class XI SMA Negeri 1 Syamtalira Bayu, totaling 120 students. The sample in this study amounted to 54 students. The researcher determines the class of the research sample by using simple random sampling. From the selected sample, class XI IPA 3 was selected as the experimental class and class XI IPA 4 was selected as the control class.

### **Instrument and Procedures**

Instrument used in the study was a concept understanding test. In general, the test is defined as a tool used to measure knowledge or mastery of measuring objects against a certain set of content or material (Sudaryono, 2017). The tests carried out in this study were pretest and posttest with the same questions in the form of multiple choices. This test was given to 54 students. The test given before learning (pretest) is intended to see the students' initial abilities and the test given after learning (posttest) is intended to see the effect of the model project-based learning on students' mastery of the material.

### **Data Analysis**

The stages of data analysis are: 1) normality test, to test the normality of the data used the Shapiro-Wilk test. To perform this normality test using the SPSS version 21.0 program. Normality test criteria if Sig. > 0.05 was declared normal, 2) homogeneity test, to test the homogeneity of the data, the test was used Lavene Statistic. To perform this homogeneity test using the SPSS version 21.0 program. Homogeneity test criteria if Sig. > 0.05 is declared homogeneous, 3) hypothesis testing, to test the hypothesis, an independent sample test is used using SPSS version 21. The t-test aims to determine whether or not there are differences in understanding of the concept given by the independent variable (X) to the dependent variable (Y), 4) n-gain test, used to determine whether there is an increase in understanding of concepts that have been applied to the model project based learning in the experimental class.

## **RESULTS AND DISCUSSION**

This study involved two classes, consisting of the experimental class and the control class. The experimental class is class XI IPA 3 which is given treatment using a model

project based learning and the control class is class XI IPA 4 as a comparison class that is not given any treatment and uses conventional learning that is usually applied in the school. The improvement of concept understanding in this study was seen from the presence or absence of significant differences between the experimental class and the control class based on the results posttest.

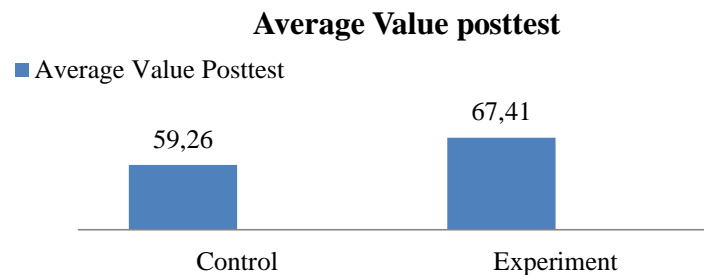
The results posttest obtained by the experimental and control class research results are:

**Table 1.** Test Results for Posttest Experimental and Control Classes

Descriptives	Statistics	
	Experimental Class	Control Class
Maximum		
Minimum	100	80
Average	45	30
Std. Deviation	67,41	59,26
	14,830	11,824

Table 1 shows that the minimum score for posttest the experimental class is 45 and the maximum value is 100, while the control class has a minimum score of 30 and a maximum score of 80. So it can be concluded that the model project based learning can improve students' understanding of concepts on elasticity and Hooke's law.

As for the effect of learning model project based learning to understanding the concept of student in the classroom control and experiment can be seen also in the graph below:



**Figure 1.** Graph Average Rating posttest

Figure 1 shows that the average difference in students' conceptual understanding in the posttest of the experimental and control classes. The mean posttest of students' conceptual understanding in the experimental class was 67.41 and in the control class was 59.26.

The t-test carried out must be preceded by a prerequisite analysis test. The results of the prerequisite test show that the data in the experimental class and control class are normally distributed and have the same variance. Test the normality of the data in this case using the equation saphiro-wilk.

The results of the normality test pretest showed that the significance value in the

experimental class was 0.065 and the control class was 0.065 and the posttest results for the experimental class were 0.305 and the control class was 0.244 greater than the 5% significance level (0.05). So it can be concluded that the data is normally distributed. Then the homogeneity test pretest in the experimental class and control class showed a significance value of  $1,000 > \text{sig. } 0.05$  and the posttest in the experimental class and control class showed a significance value of  $0.123 > 0.05$ . Based on the basis of decision making using a significant level of 0.05, it can be concluded that the class variance is homogeneous.

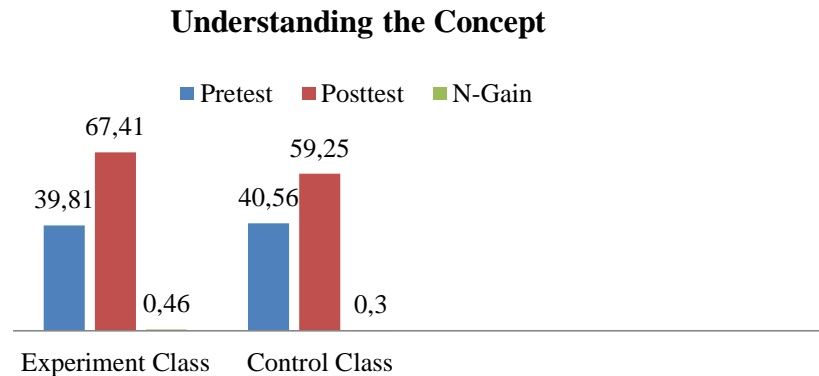
The results of the Independent Sample T Test Posttest for the experimental class and the control class are presented as follows:

**Table 2.** The Results of the Independent Sample T Test Posttest for the Experimental and Control Class

Posttest	T	Df	Sig. (2-tailed)
T test	2,232	52	0,030

Based on the data above shows that the value of Sig. (2-tailed) is 0.030. sig value. (2-tailed) 0.030 is smaller than the sig. 0.05. So it can be concluded that the use of the learning model Project Based Learning on students' conceptual understanding is significantly better than the learning model discovery or in other words there is an increase in students' conceptual understanding in the experimental class. This is in accordance with relevant research conducted by (Puspitasari, L., et al., 2020) which states that there is a significant increase in concept understanding after the model is implemented project based learning. Learning project based learning can improve the understanding of the concept because according to (Rosyadi, APP., 2018) that the understanding of the concept not only has the ability to capture notions like being able to disclose a material that is presented in a more understandable, but students are also able to apply. This is reinforced by the opinion (Insyasiska, D., et. al., 2017) that a concept can be formed through direct experience with objects or events in life, through meaningful images and words and the process is all visible in project based learning.

Then the increase in students' conceptual understanding was analyzed through the N-gain Meltzer formula. The test results for increasing students' conceptual understanding can be seen in Figure 2 below.



**Figure 2.** Graph of Values Pretest, Posttest, and N-Gain

Based on Figure 2 above, the average value of the obtained N-Gain Score on the understanding of concepts of experimental class students taught by the model project-based learning is 0.46 with moderate criteria and the N-Gain Score of understanding the control class concept is 0.30 with low category. So it can be concluded that the N-Gain Score experimentals  $0.46 > \text{N-Gain Score is Controlled } 0.30$  so that the method project based learning can improve students' understanding of the concept of elasticity and Hooke's law.

Based on the results of the test N-gain above, it shows that there is an increase in students' conceptual understanding after the model is applied project-based learning because project-based learning can make students in the learning process able to process elasticity and Hooke's law practicum tools directly into a product that has many benefits. Besides that, it allows students to find their own real learning concepts and how to organize and plan the learning process, so that students are interested and active in participating in lessons. Students learn independently, look for information and materials themselves through assigned activities, and group discussions. Through the model, Project Based Learning students raise interest in learning and students' boredom in participating in learning can be overcome. Student activities in Project Based Learning increase curiosity and provide opportunities for students to cooperate with each other by involving student activity means providing opportunities for students to think independently and collaboratively so that the knowledge gained can last a long time, is easier to remember and can affect students' mastery of concepts about the material presented so as to obtain the material to the maximum. This is supported by the statement (Terrón-López, M. J., et al., 2016) which states that the Project Based Learning model is a learning model that uses project as a first step in collecting and integrating new knowledge based on experience in real activities. Designed for use on complex problems that students need to investigate and understand. This model can also be seen as learning that can encourage students to build knowledge and skills through direct experience (Halmaida, et. al., 2020).

This is supported by previous researchers, namely research from (Sasmita, PR & Hartoyo, Z., 2020) explaining that the results of the study showed that the understanding of the test results (N-Gain) for understanding the concept was 0.52 which was in the medium category. In conclusion, the implementation of experiments using a model project based

learning can improve students' understanding of concepts. This is also reinforced by research (Fuadah, et al., 2016) which states that the model project-based learning can improve students' understanding of concepts seen from the understanding of the concept of the experimental class which is higher than the control class.

## CONCLUSIONS

The use of the learning model Project Based Learning can improve students' understanding of the concept on elasticity and hooke's law in 11<sup>th</sup> at Senior High School Syamlira Bayu Regency which was in the medium category. Addition, the response of students very well to learning, for the further study with the model Project Based Learning can be recommended for implementation in schools.

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