



The Effect of the Project Based Learning Model on Student Science Learning Outcomes

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Abstract

To determine the effect of the PjBL model on the learning outcomes of grade VII students of SMP Negeri 2 Barombong, Gowa Regency. This research uses quasi-experimental methods. The place of research is carried out at SMP Negeri 2 Barombong, Jl. Poros Kanjilo No. 11, Kanjilo Village, Barombong District, Gowa Regency. The results showed that the students' abilities were in the medium category. This research indicates a significant influence of the application of the project-based learning model on student learning outcomes. The project-based learning model is able to provide a more interactive and immersive learning experience, which in turn has a positive impact on student academic achievement.

Introduction

Education cannot be separated from a learning process. This is because in education there is an understanding of *Life Long Education* or education as a lifelong process. This lifelong education is proof of the continuous learning process that occurs without knowing the limits of age and time. Education contains a process of developing potential such as personality, intelligence, skills and learning outcomes. This is in accordance with the definition of education contained in Law Number 20 of 2003 concerning the National Education System (Mukti & Tentama, 2019).

The purpose of national education is to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, critical, creative, independent and become democratic and responsible citizens. The purpose of this national education is expected to be able to produce Human Resources who have the ability to communicate, the ability to collaborate, have the ability to work productively, have life skills to determine work priorities, evaluate themselves, manage time and think critically in solving problems in accordance with the needs of skills in the 21st century.

National Education of the 21st century aims to realize the ideals of the nation. Education should be able to create a golden generation that is able to compete in the global society. The demands of an increasingly competitive era make society have to be productive. Advances in information communication technology also change people's lifestyles, both in working, studying and socializing in the environment. One of the ways the government advances the world of education is to make curriculum changes, which are being intensively carried out, namely the implementation of an independent curriculum.

An independent curriculum requires teachers to change teaching habits. Learning that is usually teacher-centered must change its pattern to be learner-centered. According to Permendikbud No. 22 of 2016 states that the learning process is interactive, inspiring, fun, challenging,

motivates students to participate actively and provides space to develop student creativity. The learning carried out should be able to prepare students to face the 21st century, with the skills that must be possessed, known as the 4Cs, namely *critical thinking*, *creativity*, *collaboration*, *communication*, (Anggreni et al., 2019).

Good skills and skills can be demonstrated by always asking questions about something he learns and always finding out something to know and showing logical answers using a procedure systematically. One subject that is still a scourge that is considered difficult for students is the subject of Natural Sciences. The negative stigma against science subjects arises by itself, so that students have characters that are unable to master science subjects (Nasrah et al., 2021). In fact, science is not just a collection of Latin terms and scientific names that must be memorized, but a science that can make a huge contribution to the process of building knowledge through sensing, adaptation and abstraction. Artimya through science lessons-built knowledge and how that knowledge was obtained (Adnan, 2015).

Mastery of science subjects is very important in junior high school, because science studies what is related to oneself and the environment. In the process of learning science will make someone able to analyze the chain of reasoning and rules owned in studying the environment. In addition, it is also able to build models or instruments from scientific symptoms after observations. This means that through science lessons, a learner is expected to have abilities and skills or proficiency as a result of learning (Nasrah et al., 2021).

Efforts to improve the learning outcomes of science students continue to be carried out such as complete facilities, the ability of teachers to manage the learning process, it will not be meaningful if students are not serious in their learning activities. The sincerity of students in learning is largely determined by various factors. As explained by Slameto (2015) there are many types of factors that affect learning, but can be classified into two groups only, namely external factors and internal factors. External factors are factors that exist outside the individual, such as family, school, and community. While internal factors are factors that exist in individuals who are learning, such as intelligence, attention, interest, talent, motivation, emotional intelligence, critical thinking skills and creative thinking skills (Nasrah et al., 2021).

Critical thinking skills are skills that need habituation, trained gradually and continuously. Critical thinking habituation can be done by conditioning students to find problems and find solutions to these problems. The problems taken are real from everyday life, so that students can actively participate both individually and in groups to solve these problems. Critical thinking skills can be achieved by learners if teachers use learning strategies that build knowledge or concepts. According to Ahlam and Scrooge, learning critical thinking makes students intervene to increase their curiosity. Critical thinking can be trained by exposing students to problems and then conducting scientific research through projects or practicums to find solutions to these problems, until finally students reach conclusions with the right concepts (Anggreni et al., 2019).

Creative thinking skills are also very important because this thinking process can produce innovative solutions to a problem and produce products as a result of new thinking (Hani, 2019). The future of humanity depends on the ability to reconstitute and put creativity and innovation at the forefront of educator systems. Such skills include the ability to solve new problems, come up with fresh ways of thinking, come up with new ideas and solutions, ask unusual questions, and arrive at unpredictable answers and better creativity. The ability of learners to propose creative ideas should be developed by asking them to think of ideas or opinions that are different from those proposed by their friends (Sani & Siow, 2014).

In reality, students' critical and creative thinking skills have not been developed optimally. Many students are unable to express opinions to solve a problem, there are some students when discussions cannot cooperate with their group mates. Students are often given the opportunity to ask questions, but very few are enthusiastic about asking questions, this is because students are still afraid or confused about what will be asked. In addition, students are less trained in developing their ideas in solving problems. Students only see references provided by the teacher. Many students are still passive, unable to think critically and have not dared to express their opinions in the learning process (Utami, et al., 2019). In reality seen in schools, the learning process in the classroom becomes ineffective because teachers are often too active and more dominant in the learning process (Ningsih et al., 2017).

The learning needed today is learning that involves students actively in developing their ideas but still under the guidance of the teacher. The learning model needed is an active, innovative, creative, effective and fun learning model. The selection of learning models must be in accordance with the material to be discussed so as to attract the attention of students to actively learn and try to optimize all the abilities they have to achieve the expected learning goals and help students develop critical thinking skills in solving problems. The learning model that is considered quite influential on the ability to think critically and creatively of students is the *Project Based Learning* (PjBL) model.

The *project-based learning* model is an innovative learning centered on learners' activities in designing, planning, and implementing projects, and producing projects that are published or presented to solve real-world problems. The hallmark of project-based learning is project-centered. During the problem-solving process, learners go through the questioning stage and refine questions, debate ideas, make predictions, collect and analyze data, draw conclusions, and communicate findings with other groups. Throughout the project, teachers should also continually assess learners' progress, provide feedback and reward achievements and successes. It is very important to recognize and encourage learners' creative thinking and critical thinking skills both individually and in groups (Saenab et al., 2018). If the learning process using the PjBL model can take place well and critical thinking skills and creative thinking continue to be trained gradually and continuously, it will certainly have a good effect on learning outcomes.

Various studies on the influence of the PjBL model on critical and creative thinking skills have been conducted in various regions. One of the results of research conducted by Nafisah (2018) in Bandar Lampung, shows that there is an influence of the PjBL model through making bioplastic preserves on the creative thinking skills of grade VII students on the material of diversity of living things with an average value of experimental class of 64.19 in the medium category and a control class of 44.85 in the low category. Thus, the PjBL model through the manufacture of bioplastic preserves can be used by teachers in schools as an alternative learning to develop students' creative thinking skills.

Research conducted by Fauziah et al. (2018), with the results of the calculation of the one-way Anova test obtained $f_{\text{calculate}} = 210.64 < f_{\text{tabel}} = 3.09$ then h_0 (null hypothesis) rejected and h_a (alternative hypothesis) accepted, showing that there is a significant influence on the *Project Based Learning model* on the learning outcomes of living things classification material in making dicotoms classification charts and determination keys. Then for the results of the assessment of the students' project in making a dicotom-classification chart and the key to determination, a high average score was obtained by experimental class 1 with a value of 79 and experimental class 2 with a value of 82. This shows that the results of the scores from experimental class 1 and experimental class 2 meet the KKM using the *Project Based Learning model*.

The PjBL learning model is very effectively applied. One conventional method that is not appropriate to be used in the learning process is the lecture method, because the lecture method will only make students fixated on the teacher's explanation and books without being able to develop their thinking. Therefore, it is very difficult for students to develop critical and creative thinking skills which will affect learning outcomes. Not infrequently also found in some schools, teachers rarely apply the PjBL learning model. One of them is at SMP Negeri 2 Barombong, Jalan Poros Kanjilo Number 11, Kanjilo Village, Barombong District, Gowa Regency. Thus, researchers need to conduct research at the school, specifically on grade VII students who have used an independent curriculum, on Classification of Living Things and Symbiosis.

The material for classification of living things studied aims to enable students to be able to group living things based on the principles of classification, grouping dicotoms and making keys to determination and being able to understand about the five kingdoms system. In the material for classification of living things, there are many students who have difficulty classifying dichotomies and keys to determination in living things. In addition, learners also have difficulty in remembering Latin names in living things. Previously in this learning, teachers often used a direct learning model where the understanding of concepts and skills of students here was not honed. So that the ability of students to classify living things can increase and the ability of students to group living things and make the key to determination can easily be done by finding solutions to learning problems. The solution or effort to this problem is to apply the *Project Based Learning model* by creating a dichotomy classification chart and determination keys.

Methods

The type of research used in this study is quasi-experiment. This study aims to compare an effect with the treatment of certain groups. The place of research is carried out at SMP Negeri 2 Barombong, Jl. Poros Kanjilo No. 11, Kanjilo Village, Barombong District, Gowa Regency. In this study, the population was all grade VII students of SMP Negeri 2 Barombong, Gowa Regency, totaling 340 students spread across 10 study groups. In this study using random sampling technique. The classes sampled are: classes VII.B, VII.C and VII.D. Data collection techniques used using test techniques and documentation techniques.

Results and Discussion

Learning outcomes learned using the *Project Based Learning learning model*

The results of descriptive analysis of student learning outcomes before and after the learning process using the PJBL model of the PJBL experimental class PJBL 1 can be seen in table 1.

Table 1. Descriptive analysis of learning outcomes before and after learning using PJBL experimental class PJBL 1

Description	PJBL 1	
	<i>Pre-test</i>	<i>Post-test</i>
Number of samples	35	35
Average	52.80	76.23
Median	52.00	76.00
Standard deviation	5.42	4.33
Variance	29.45	18.77
Range	20	14
Minimum	40	70
Maximum	60	84

Based on table 1, it is known that the *pre-test* results of learning outcomes obtained an average value of 52.80 ± 5.42 and a median of 52.00. The variance is 29.45 and the range is 20. The Minimum value is 40 and the maximum is 60. While the *post-test* results obtained an average value of 76.23 ± 4.33 and a median of 76.00, a variance of 18.77, a range of 14, a minimum value of 70 and a maximum value of 84.

The frequency distribution and value categories of learning outcomes in the PJBL 1 experimental class are presented in table 2.

Table 2. Distribution of frequency and value categories of student learning outcomes taught using the PJBL model of PJBL experimental class 1

Interval	Category	Frequency		Percentage (%)	
		Pretest	Posttes	Pretest	Posttest
90 – 100	Very high	0	0	0	0
80 – 89	Tall	0	10	0	28.6
66 – 79	Currently	0	25	0	71.4
55 – 65	Low	14	0	40.0	0
0 – 54	Very low	21	0	60.0	0
Total		35	35	100	100

Based on table 2, it can be stated that the number of students whose learning outcomes scores on the *pre-test* in the very low category were 21 people (60.0%) and the low category was 14 people (40.0%). While the *post-test* results of learning outcomes for the medium category were 25 people (71.4%) and the high category as many as 10 people (28.6%), thus it can be said that the application of the *Project-based learning model* improves the learning outcomes of students in the PJBL 1 experimental class

The results of descriptive analysis of student learning outcomes before and after the learning process using the PJBL model of the PJBL experimental class PJBL 2 can be seen in table 3.

Table 3. Descriptive analysis of learning outcomes before and after learning using PJBL experimental class PJBL 2

Description	PJBL 2	
	<i>Pre-test</i>	<i>Post-test</i>
Number of samples	35	35
Average	52.69	71.57
Median	52.00	70.00
Standard deviation	5.33	5.25
Variance	28.45	27.60
Range	20	18
Minimum	40	62
Maximum	60	80

Based on table 3, it is known that the *pre-test* learning outcomes obtained an average value of 52.69 ± 5.33 and a median of 52.00. The variance is 28.45 and the range is 20. The Minimum value is 40 and the maximum is 60. While the *post-test* results obtained an average value of 71.57 ± 5.25 and a median of 70.00. Variance is 27.60, range is 18, minimum value is 62 and maximum value is 80.

The frequency distribution and value categories of learning outcomes in the PJBL 2 experimental class are presented in table 4.

Table 4. Distribution of frequency and value categories of student learning outcomes taught using the PjBL model of the PjBL experimental class PjBL 2

Interval	Category	Frequency		Percentage (%)	
		Pretest	Posttest	Pretest	Posttest
90 – 100	Very high	0	0	0	0
80 – 89	Tall	0	5	0	14.3
66 – 79	Currently	0	27	0	77.1
55 – 65	Low	13	3	37.1	8.6
0 – 54	Very low	22	0	62.9	0
Total		35	35	100	100

Based on table 3.12, it is known that the number of students whose learning outcomes scores on the *pre-test* in the very low category were 22 people (62.9%) and the low category was 13 people (37.1%). While the *post-test* results of learning outcomes for the low category were 3 people (8.6), the medium category was 27 people (77.1%) and the high category was 5 people (14.3%), thus it can be said that the application of the *Project-based learning* learning model improves student learning outcomes in the PJBL 2 experimental class.

Project Based Learning Model on Learning Outcomes

The results of the descriptive analysis of student learning outcomes showed that before using the PJBL model, the initial test scores in the very low category were 21 people (60.0%) and the low category were 14 people (40.0%), in the PjBL 1 experimental class while in the PjBL 2 experimental class the very low category was 22 people (62.9%) and the low category was 13 people (37.1%). After being studied using the PJBL model and *conducted* post-test, there was a change in learning outcomes for the medium category as many as 25 people (71.4%) and the high category as many as 10 people (28.6%) in the PjBL 1 experimental class and for the low category as many as 3 people (8.6), the medium category as many as 27 people (77.1%) and the high category as many as 5 people (14.3%) in the PjBL 2 experimental class, thus it can be said that the application of the *Project-based learning* model improves student learning outcomes.

The influence of the PJBL model on student learning outcomes is due to the more active learning process of students. The advantages of PjBL, namely: (1) providing challenges to students to solve real problems in the field through project activities, (2) training students to be active in learning, (3) making student performance in completing projects more organized, (4) giving freedom to students in completing projects, (5) motivating students to compete to produce the best products, and (6) make students independent and have responsibility for the projects undertaken (Ananda et al., 2021). The PJBL strategy involves various stages that are able to improve the cognitive of students, through projects students are able to involve all mental and physical, nerves, senses including social skills by doing many things at once (Syamsudin, 2019).

The findings of this study are supported by the procurement of Krajcikk et al, in Syamsudin (2019), that the PjBL model benefits students in terms of helping students improve the ability to integrate content understanding into the process, encouraging students to be responsible for their learning so that they become independent learners, learning to work together to solve problems through sharing ideas to find answers to fundamental questions, and exposing students to actively share tasks. Looking at some of the benefits of PjBL, it can be argued that PJBL motivates students to acquire knowledge by their involvement in authentic cognitive tasks in generating projects and motivating students in subsequent learning processes.

In the cognitive realm, the treatment of the PjBL learning model in the PjBL 1 experimental class and PjBL 2 experimental class, familiarizes students to think critically and creatively in solving problems given in the form of projects. In its implementation, students are given a project framework that can guide these students to find solutions to problems so that they are able to complete the project in accordance with the planned time. Students are trained to be able to develop their mindset to construct new knowledge that is associated with existing knowledge in accordance with the surrounding environment (Adnan, 2014; Yance, 2013). This is in accordance with constructivism, knowledge does come from outside, but is constructed by and from within a person because knowledge is formed by two important factors, namely the object being the material of observation and the ability of the subject to interpret the object. Similarly, from the results of research by Adnan (2014) and Firdaus et al. (2023) stated that the use of constructivistic approaches in the learning process is better than conventional learning, this is because learning using a constructivistic approach makes students motivated and encouraged to learn actively so that students' critical and creative thinking skills increase.

The PjBL learning model that uses a constructivistic approach and basis is not just about providing knowledge about concepts but making that knowledge meaningful through project activities that turn concepts that have been abstract into reality, so that the concepts last a long time in the minds of students.

Conclusion

The learning outcomes of grade VII students at SMP Negeri 2 Barombong show that they are in the medium category. This research indicates a significant influence of the application of the project-based learning model on student learning outcomes. In other words, the application of this learning model is effective in improving the learning outcomes of students in grade VII SMP Negeri 2 Barombong. The project-based learning model is able to provide a more interactive and immersive learning experience, which in turn has a positive impact on student academic achievement.

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