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THE EFFECT OF PROJECT-BASED LEARNING INTEGRATED STEM TOWARD SCIENCE PROCESS SKILL OF ELEMENTARY SCHOOL STUDENT

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Abstract: This research aims to analyze the effect of the project-based learning (PjBL) model on the science process skills of Grade V students at SDN Bringinbendo II. The topic is the water cycle. This study uses a quantitative approach to the experimental method, with the type of research being one group pretest-posttest. The sample in this study was the elementary school SDN Bringinbendo II V-grade students, a total of 21 students. Data collection in this study was by using pretest and posttest question sheets in the form of essay questions with science process skills indicators. Data were analyzed using the paired sample t-test and Eta Squared. The results of the paired sample t-test hypothesis, sig. (2-Tailed) 0.000 <0.05, there is a significant effect (H_1 is accepted, and H_0 is rejected). The STEM-integrated Project Based Learning (PjBL) model affects the science process skills of class V students at SDN Bringinbendo II. In addition, it can be seen how much the increase in the results of the Eta Squared test got 0.508 in the pretest and 0.861 in the post-test. The post-test score has increased, and if $t \geq 0.14$ indicates a large influence on the Influence of the STEM (Science, Technology, Engineering, Mathematics) Integrated Project Based Learning Model on the Science Process Skills of Grade 5 Elementary School Students.

Keywords: *Science Process Skills, Project-based Learning, STEM-Integrated*

INTRODUCTION

Natural Sciences is learning related to all natural phenomena. Natural Sciences can be interpreted as a learning process that emphasizes students' ability to find out in a structured manner, and a discovery process is needed so that Natural Sciences are not just science [1]. Science is a stage of learning that provides direct experience to students to understand the natural surroundings scientifically based on an observation (observation) and experiment. Natural science is learning that discusses natural phenomena arranged systematically based on the results of experiments and human observations [1]. Science is a basic strength that can be done to improve human life with a scientific approach. Science learning does not only study collections of facts, theories, or certain concepts and principles; in discoveries based on theories, direct observation is carried out to provide experience to students so they can solve a problem and make decisions and have an attitude positive attitude towards society to help increase knowledge and understanding of scientific concepts that can develop science process skills when conducting investigations in the natural surroundings [2]. Because the concepts of science, mathematics, technology, and engineering in the 21st century have been acculturated to produce products expected to help people's lives [3].

However, cultivating a scientific attitude in Indonesian students is still in the low category. The scientific achievements of Indonesian students indicate this. The results of the PISA (The Program for International Student Assessment) in 2018 show that Indonesian student science achievement is ranked 74th. It is far below Southeast Asian countries such as Thailand, Singapore, and Malaysia. Mathematical ability, with a score of 379, is in the 73rd position, and science ability, with a score of 396, is in the 71st position [4]. So that the Ministry of Education and Culture hopes that the PISA score in 2023 will improve soon [5]. Science learning needs to emphasize process skills to students because thinking skills are trained in science process skills and all science-related processes. Science process skills can be defined as knowledge, attitudes, and skills applied in life and obtained through emphasizing the learning process and student creativity. Thus, in simple terms, science process skills are an effort made by students to develop their scientific knowledge [6]. Science process skills are applied and developed at the elementary school education level to help students independently to be able to construct student knowledge with their personal experiences and help students make discoveries so that students can solve problems related to science and train them to think at a higher level. They are expected to be active during the learning process to instill and foster a sense of responsibility and confidence and train students to dare to express their opinions to show high and good quality learning outcomes [7].

Natural Science is a subject that can provide opportunities for exploration and interaction activities. It directly emphasizes the student learning process by using science process skills to assist students in solving a problem around them [8

]. Science process skills are divided into two, namely basic science process skills and integrated science process skills. As for this research using basic science process skills, which include (1) Observing, (2) Classifying, (3) Predicting, (4) Concluding, and (5) Communicating [9].

The problem is that there are still many learning activities in the science learning process where the teacher is always the center and the only source of knowledge for students. Therefore this condition can be handled by implementing an experiment or experiment in science process skills. Observations made in three schools in the Purbalingga district show that students' science process skills still need to improve [10]. For this reason, the researcher is interested in knowing the level of students' science process skills at SDN Bringinbendo 2. Because the researcher feels the same way, based on the observations of teachers and students that the researcher did at Elementary School Negri Bringinbendo 2, precisely in class V, it was revealed that: (1) The teacher does not facilitate students when carrying out scientific performance activities in science process skills, in which the teacher only explains theoretically to students without giving students opportunities to gain a learning experience independently. As well as, the teacher only uses worksheets that the school has designed as a reference during the learning process, (2) students memorize more theories and learning concepts in books and work more on worksheet questions. Students tend only to know and follow the information provided in books and those explained by the teacher only (3). Students have never been directly involved in experiment/project-based learning and are supported by a lack of tools and materials. So that students only use student worksheet as a source of learning and information. Whereas science learning requires a learning method that is more than just a lecture learning method, with conventional learning methods resulting in the interaction space for students' thinking not to develop and the assignment of assignments and questions is only limited to achieving students' cognitive aspects, even though there are still other learning aspects that must be achieved [11]. Science learning itself is learning that will always be related to the life and environment around students. In other words, science requires direct learning to develop skills and get results or answers through the learning experiences they do. One of the determining factors for learning success lies in the educator or teacher using models, methods, and learning approaches.

In the 2013 curriculum, there are some appropriate learning models with characteristics payload eye science lessons, one of which is a learning model Project Based Learning (Pjbl) [12]. The Project-based learning (PjBL) model is a learning model that makes project (activity) is as the core of learning. Learning models Project-based learning (PjBL) . will be more effective for students If learning is associated with life-related daily with knowledge and technology [13]. Using learning models based on this project is one _ possible choice used by teachers to make it easy to understand student-related material learning to be studied or discussed because of the learning model. It directly gives practice, so If a student finds a problem in material learning, they expect to be capable of analyzing their problem face and discovering the solution-related problems. Learning models PjBL This enables a student to ask in class; active learning Can rate How a student can convey an opinion to those who have a based on a statement or question to be they convey [11].

As for Steps (syntax) of the Project Based Learning Learning Model According to the George Lucas educational foundation cited in [14], as follows: (1) Start with big questions, (2) Design a plan for the project, (3) Create a schedule, (4) Monitoring, (5) Assess the outcome, and (6) Evaluated experience (Evaluation).

Learning models Project-based learning can be integrated with the A approach so you can complete the manufacturing process of something a project with the help of science and technology. Approach This is STEM (science, technology, engineering, mathematics) approach. Science, Technology, Engineering, Mathematics. STEM is an approach to mutual learning _ integrated between one another. STEM explore and integrate teaching and learning Between the two discipline from STEM or more, or Between one discipline with other disciplines in STEM [15]. STEM is contextual and problem-based learning with connected discipline knowledge teaching hangs cohesive and active [16]. STEM consists of science Which is a discipline studying science everything related to the natural universe and everything in it, which includes phenomena, nature, facts, and created order inside. Technology is a demanding system that changes following development, modification, innovation, and environment. Engineering Is A involved profession that acquires science and mathematics from the results of experiments, studies, and applied practice with attention to the development process through assembling materials and natural strength to fulfill need human. Mathematics combines concepts and exercises that apply science, technology, and engineering For math [15].

STEM moment This is one breakthrough in the world of education in Indonesia, especially in the era of the 21st century. Combining PjBL with STEM can make more learning. Learning models PjBL STEM-based can increase interest in Study students, study more meaningful, and help students To finish problems in a manner that is real or realistic. Using learning models PjBL that

integrates STEM can also increase science process skills [15]. Learning models PjBL and STEM approaches have the same goal, i.e., To help students finish A problem with A results from A product, so expected students can develop their skills [17]. PjBL and STEM are mutually exclusive complete with their advantages and disadvantages. PjBL-STEM models can give experience to students For study contextual through complex activities like exploring planning activity study, implementing the project with work same, and in the end, producing something product, thereby Students will become more active moment learning process activities as well as a be involved directly at the creation of the project, so learning will the meaningful and can endure in a period long time [18].

The researcher has proven with existing studies that this project-based learning model can influence the results of learning and science process skills. Only one is from a study entitled "Project Based Learning: Its Influence on Science Process Skills Participant Educate in Tanggamus " In his research, He shows that in the process of implementing the project-based learning model carried out in students' class, VB is experiencing influence on science process skills, cause learning give a chance to student For dig draft more in so that can create atmosphere meaningful learning [19]. Based on the problems that have been outlined, the author feels it will be important to create varied learning for students. To use increase science process skills, students. Because of this, the author does A study Related to The Effect of Project Based Learning Models STEM Integrated Against Science Process Skills Student with a formula problem as follows: Held the influence of the STEM Integrated Project Based Learning (Pjbl) model on Science Process Skills Class V Students at SDN Bringinbendo and How significant improvement of the STEM Integrated Project Based Learning model Against Science Process Skills Class V student at SDN Bringinbendo 2?

RESEARCH METHODS

Study This uses Quantitative type pre-experimental research with design from One Group Design Pretest Posttest. The analysis is used from One-Group-Pretest-Posttest t, i.e., the researcher uses One class used as class application treatments. In the draft, there is a pretest before the given treatment and a posttest after the given treatment; the researcher uses an arrangement from the design as follows [20]:

O_1 ---------- X ---------- O_2

Information:

O_1: Pretest (before treatment)

X: Treatment

O_2: Posttest (after treatment)

The population in this study were all fifth-grade students at SD Negeri Bringinbendo 2, totaling 21 students. Samples were taken using a saturated sampling technique, namely a sampling technique when all members of the population were used as samples [20]. The sample in this study was class V which consisted of 21 students. The data collection technique used was a test with teaching materials, research instruments, and student worksheets using the STEM-integrated project-based learning model, pretest-posttest questions. The pretest-posttest is a 10-question descriptive test that refers to and is guided by the basic competencies and indicators that have been determined. A descriptive test (essay) with an indicator of science process skills was carried out to measure students' science process skills in the material "The Water Cycle and Its Impact on Earth and Living Things."

Before using the research instrument, it will be tested first and checked for validity and reliability with appropriate calculations. The instrument can be used without repair, there are improvements, and it may be completely overhauled [20]. The results of content validity the calculations use the Pearson Product Moment correlation formula with the help of the SPSS 25 application. The provisions in the validity calculation are if the sig value < 0.05. It is declared valid; if sig>, it is declared invalid. The calculations with SPSS 25 show that $r_{count} > r_{table} = 0.444$ with $\alpha = 0.05$. So it was concluded that questions 1 to 10 are valid and suitable for use in research. The reliability test using the alpha Cronbach method, the reliability calculation results showed a value of 0.768. Based on the reliability category, the Conbachs'sCronbach alpha coefficient is in the value range of 0.60 <r11 <= 0.80. It means that the essay test instrument is declared reliable and has a high level of reliability.

Table 1. Reliability Test

Reliability Statistics	
Cronbach's Alpha	N of Items
0.763	10

This research was conducted in 3 stages, namely the planning stage, the implementation stage, and the final stage. The planning stage includes making a syllabus, Learning Implementation Plan, teaching materials, Student Worksheets using the STEM-integrated project-based learning model, and pretest-posttest questions with indicators of science process skills. At the implementation stage, it is a form of application of each lesson plan prepared beforehand. Students take the initial test (pretest), carry out the learning process using the stem-integrated project-based learning model, and then

carry out the final test (posttest). During the learning process, students work on Student Worksheets. The final stage is in the form of data analysis and article writing.

RESULTS AND DISCUSSION

Study This is done on material science learning, namely the water cycle and its impact on the earth and creature life, using STEM-integrated project-based learning model syntax. As for research, this is To prove the influence of the integrated project-based learning model STEM to Science Process Skills Shiva class V SDN Bringinbendo 2. During the research process, the researcher conveys material and conditioning to the student following steps already listed in the starting RPP from activity opener until activity loading cover the steps of the Project Based Learning learning model STEM-integrated. The student requested For notice in every direction given. In an integrated project-based learning model, STEM students make groups do Experiments on Sheets and Work with Students who have research provided. The student share tasks For the tests. To use answer question practice and complete student worksheets.

Deep data retrieval study Uses a descriptive test instrument (essay), which consists of 10 related questions with material about the water cycle and its effects on creatures living on earth that refers to and guides indicator science process skills. The results of the pretest-posttest scores of 21 students at SDN Bringinbendo 2 consisted of 10 questions referring to 5 indicators of science process skills. Shown on the chart this :

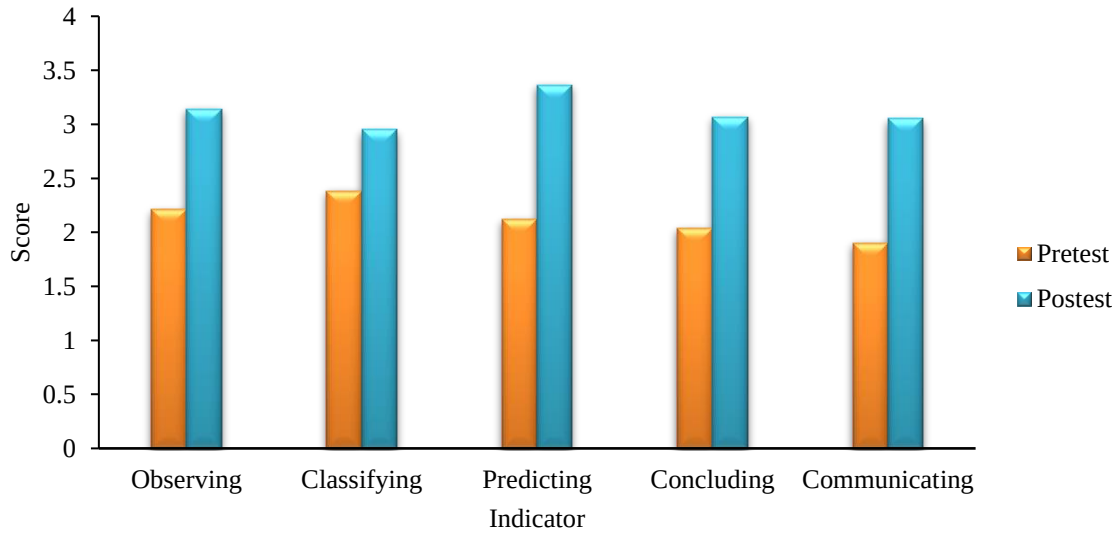

Figure 1. Comparison of Student Science Process Skill Pretest and Posttest Scores

Figure 1 shows that each indicator of science process skills has experienced a different increase. When the pretest showed that the lowest average student science process skill indicator was 1.9, and the highest average was 2.38. At the time of the posttest, it can be seen that for the average indicator of students' science process skills, the lowest was 2.95, and the highest average reached 3.36. These results indicate differences between the results obtained by students before and after giving treatment.

Data analysis was initiated to answer the first problem: Is there any influence of the STEM-integrated project-based learning model on the science process skills of fifth-grade students? Previously the researcher would conduct prerequisite tests and hypotheses. The prerequisite tests include the normality test and hypothesis testing. [21] Data analysis begins to answer the first formulation of the problem: Does the STEM-integrated project-based learning model influence the science process skills of fifth-grade students? Previously, researchers would conduct prerequisite tests and hypothesis tests. The prerequisite tests include the normality test and hypothesis testing. The researcher carried out the normality test using the SPSS 25 application. The following is the basis for making decisions in the Shapiro-Wilk normality test, namely (1) if the value (sig) is > 0.05, then the distribution is normal. (2) if the significance value (sig) < 0.05, the data is not normally distributed. [20] decision making in the Shapiro-Wilk normality test, namely (1) if the value (sig) > 0.05, then it is normally distributed. (2) if the significance value (sig) < 0.05, the data is not normally distributed [22].

Table 2. Normality Test

Tests of Normality						
	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Pretest	0.141	21	0.200 *	0.980	21	0.920
Postest	0.136	21	0.200 *	0.927	21	0.120
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Based on the normality test criteria in Table 2, if sig. > 0.05 then (H_0 is accepted/normally distributed) and if sig. <0.05 then ($H0_{is}$ rejected/not normally distributed). [23] based on the table output using SPSS 25 for Pretest data, the Significance value is 0.920, indicating that the Pretest value of students' science process skills is greater than 0.05, and it can be concluded that the Posttest scores of students' science process skills are normally distributed.

In this study, researchers used a test (paired sample t-test) with the help of SPSS 25. The criterion for making a hypothesis test (Paired Sample T-Test) is if the Significance Value (2-Tailed) <0.05 indicates a significant difference between the initial variable and the final variable [24]. It significantly affects the difference in the treatment given to each variable. Meanwhile, if the Significance Value (2- Tailed) > 0.05 indicates no significant difference between the initial and final variable. It shows no significant effect on the difference in the treatment given to each variable.

Table 3. Paired Sample T-test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Means	std. Deviation	std. Error Means	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest - Posttest	-29.905	6.434	1.404	-32.833	-26.976	-21.301	20	0.000

Table. 4 Paired Sample Statistics

Paired Sample Statistics					
		Means	N	Std. Deviation	Std. Error
Pair 1	Pretest	52.90	21	6.276	1.370
	Postest	82.81	21	2.839	0.620

Table 3 shows that the research results can be seen in sig (2-Tailed), which is significant at 0.000 <0.05. So there is a significant difference in the students' condition before and after treatment. It can also be proven by looking at Table 4, which shows the posttest average is 82.81, more significant than the pretest average 52.90. From the results of these calculations, it can be understood that the Posttest average is more significant; it can be interpreted that the influence of the STEM (Science, Technology, Engineering, Mathematics) integrated project-based learning model can be said to be effective and has a significant effect on the Science Process skills of fifth-grade students at SDN.

Bringinbendo 2. To answer the second formulation of the problem, namely how much Project Based Learning (JPL) is integrated with STEM (Science, Technology, Engineering, Mathematics) on the Science Process Skills of class V students at SDN Bringinbendo 2. Researchers used the Eta Squared test. The Eta Square test is a test of the relationship between two variables used if the data scale of the two variables is not the same, where the first variable is on a nominal data scale while the second variable is on an interval data scale [24]. The following are the Eta Squared score distribution categories:

Table 5. Indicators eta square test

Criteria How Big Gap	Information
$0.01 \leq t < 0.06$	There is Little Influence
$0.06 \leq t < 0.14$	There is a Moderate Effect
$t \geq 0.14$	There is Great Influence

Table 6. Eta Squared Test

Directional Measures		
		Value
Nominal by interval	Eta Dependent Pretest Value	0.508
	Dependent Posttest Value	0.861

Table 6 shows that the Eta Squared Test, with the help of the SPSS 25 application, obtained a result of 0.508 in the pretest and 0.861 in the posttest. Posttest scores have increased, and if $t \geq 0.14$ shows a large influence in the Influence of the STEM Integrated Project Based Learning Model on the Science Process Skills of Grade 5 Elementary School Students.

Based on the research and results-based data analysis, it can confirm that enhancement science process skills exist after given treatment moment learning in the form of a project-based learning model STEM-integrated. Based on the results calculation test paired sample t-test, there is an influence in a manner significant STEM integrated project-based learning model) to science process skills class V at SDN Bringinbendo 2.

Whereas the formula problem significantly influences results calculation, Eta Square d can conclude that there is the influence of the model of the influence of Project Based Learning model STEM integrated into science process skills class V at SDN Bringinbendo 2 with category Big. This thing caused because, during the learning process, students were directed at various loading activities _ STE M integrated project-based learning syntax. Previous research states that learning models based on projects have already been tried and tested as a learning model that can grow student attitude independence, especially in the eyes required for lessons implemented in project work, especially science [25]. Activity learning using the Project Based Learning model STEM integrated will make the learning process more difficult for students because that model can produce a product that increases the Power to absorb students to the lesson so that their memory is a more old stage. Model learning project based build and direct learning own, develop A the creativity he has, happy solve problems that occur in the cooperation in life below daily to room class so that the learning model is based on the student's hard work or can also be a small deep-scale group with the same goal which is to produce a product end [17]. It proves that science process skills students can improve through a learning process designed with interesting and fun because expected can change the method student study in a manner accompanied independently with motivation. Develop creativity in work; students create creative ideas, are trained in thinking, and are critical to problems encountered. They can make it easy for students to understand something material, learn, and practice their scientific process skills [25].

CONCLUSION

In this study, STEM-integrated project-based learning models have improved the science process skills of SDN Bringinbendo 2 students in the water cycle material and its impact on living things on earth. Based on the results of these scores, the achievement of science process skills for class V students at SDN Bringinbendo 2 is included in the Big category. The conclusions that can be drawn from this study indicate that (1) there is a significant influence of the STEM integrated project-based learning model on the science process skills of fifth-grade students at SDN Bringinbendo 2. (2) there is a large influence of the STEM integrated project-based learning model on science process skills in students SD class V at SDN Bringinbendo 2. Based on these conclusions, the researcher will submit suggestions regarding this matter. In contrast, the suggestions researcher will convey are as follows (1) Learning to improve science process skills using the STEM-integrated project-based learning model must be carried out with the maximum time planning possible or with a relatively long time compared to conventional learning models. (2) the use of the STEM-integrated project-based learning model in training students' science process skills with the lowest score, namely on the classifying indicator. Researchers hope future researchers can implement or combine other learning models to teach these skills better. So that when applying these indicators, students can classify something appropriately.

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