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Research Article

Optimizing the Pancasila Student Profile by Implementing STEAM Learning Integrated with Project Based Learning in Physics Lessons in High School

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Abstract.
STEAM learning integrated with Project Based Learning (PjBL) is an area of interest in research as it helps develop twenty-first century skills in students. In today's global market, most jobs require creative thinking and communication skills, making it important to equip students with such skills and abilities during the learning process. This research aims to evaluate the effectiveness of STEAM learning combined with PjBL in physics lessons and its impact in optimizing students' Pancasila student Profile in creative dimension. The study employed an experimental research model with a control group and an experiment group. STEAM-integrated PjBL was used in the experiment group, while the control group received conventional education. The results of the N-gain score test showed that the average N-gain score for the experiment group was 63.51%, which falls under the highly effective category, with an N-Gain value of at least 22.22% and a maximum of 90%. In contrast, the control group had an average N-Gain score of 55.77%, classified as less effective, with a minimum N-gain score of -12.50% and a maximum of 100%. Observations of students' Pancasila Student Profile in the creative thinking dimension indicated that certain students achieved emerging category as expected. The findings show that STEAM- integrated PjBL in physics lessons can optimize Pancasila students' profile in the creative thinking dimension.

Keywords: STEAM learning, project based learning, Pancasila student profile, creative thinking

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1. Introduction

The Indonesian nation is currently implementing the Independent Curriculum for all educational units throughout the region. In implementing the Independent Curriculum there is a "Pancasila Student Profile" content that needs to be paid attention to by all educational units. Its application has been regulated through Minister of Education and Culture Regulation (Permendikbud) No. 22 of 2022. One of the characteristics of the Independent Curriculum is the freedom for teachers and students to choose the project

learning they want to carry out. This project learning is carried out at least three times a year [1].

In implementing learning projects, knowledge and creative thinking skills are needed. Creative thinking skills are needed to determine the project process and the conclusions from its implementation. Apart from that, the ability to think creatively is needed to overcome problems that arise during the project and how to solve them. Apart from the abilities that come from students, good stimulation is also needed from the students' learning environment [2].

Creative thinking skills are still lacking, despite the fact that they are crucial for classroom learning activities. Limited capacity for original thought is caused by several things. Among them is the lack of stimulation of paradigms for learning that can grow and gained students' creative thinking abilities. Apart from that, this problem is thought to be because learning is more emphasized on memorization and finding the correct answer to the questions given, so that capacity for original thought creatively is not trained enough [3].

A learning paradigm is required that can support and develop students' capacity for creative thought while also meeting the demands of project-based learning. A learning model is a plan or pattern of activities in process of teaching and learning that contains syntax and class management plans [4]. Learning model must be chosen taking into consideration the needs and characteristics of students and the material to be delivered. This is because each learning model has certain characteristics that need to be adapted [5].

Project Based Approach or PjBL is an educational approach that can be used as a learning plan in accordance with the Pancasila Student Profile. PjBL is a model of project-based learning sthat applies an inventive learning approach. Carrying out contextual learning activities through complex activities, emphasizes giving students the chance to produce work by learning activities carried out [6].

Apart from selecting a method of instruction that can project activities, a model for learning is also required that can be used to grow and foster students' capacity creative thought. The learning model needed is a model that is in line with PjBL in providing opportunities for students to develop their thinking during the learning process. One of these learning models is the STEAM model [7].

The STEAM learning model is an integrated approach that combines various Science, Technology, Engineering, Arts and Mathematics subjects as a means that can be

applied to gained inquiry, communication and critical thinking during learning. The STEAM learning model is able to provide more challenging learning and increases studentsinventiveness in indentifying solutions to learning problems they encounter [8].

According to research by [6], there is a notable impact of PjBL model for communication skills and there is a noteworthy influence of PjBL model on students' creative thinking abilities. Through the use of STEAM-based PjBL, students are able to apply creative thinking as an idea construction process. Where the flexibility of thinking to generate a variety of ideas, answers or questions, being able to evaluate an issue from multiple perspectives, search for alternatives or alternate paths, and employ a variety of methods or ways of thinking.

Meaningful physics learning is learning where students discover their own concepts through the various activities and activities carried out. Through searching for concepts, students will be trained in psychomotor skills and develop scientific attitudes. According to the Ministry of Education and Culture, the aim of learning physics/science in Independent Curriculum is to master concepts and principles and have the skills needed to develop knowledge and independence, self-confidence to continue higher education and develop science and technology. Physics learning that has been implemented still prioritizes aspects of concept/knowledge mastery, aspects of scientific skills and attitudes are still not optimized [9]. Especially in the aspect of mastering technology, students tend to have the attitude of only being users. Physics learning in understanding physics concepts is often carried out using assignment methods and practice questions, so that it has the effect of not attracting students' attention.

Based on the background that has been explained, a relationship was found between PjBL, STEAM, and students' thinking abilities. This research seeks to reveal whether it is possible to optimize students' Pancasila profile on dimension of creative thinking abilities by using the PjBL-based STEAM learning model used in Physics learning in high school.

2. Method

Subjects of this research is class X students at SMA Negeri 1 Donorojo. The sampling was using the cluster random sampling with carried out on class X.1 as an experiment group and class X.2 as a control group with a total of 36 students in each class. Students was implement STEAM learning integrating with Project Based Learning (PjBL)

on measurement material to test effectiveness of STEAM integrating with Project Based Learning (PjBL) on measurement material to optimize the Pancasila student profile with a creative thinking dimension. An assessment of how effective STEAM learning integrating with Project Based Learning (PjBL) is based on the concept of measurement in achieving students' creative thinking development with skills that match the Pancasila student profile is carried out by working on questions consisting of 5 essay.

The essay was designed to measure creative thinking skills based on the criteria set by Williams [10] which include (1) fluency, (2) flexibility, (3) originality, (4) elaboration, and (5) evaluation, observation sheets were also created to determine the profile of Pancasila students in creative thinking dimension during learning.

Data analysis was used N-gain to determine whether or not there was an increase (Gain) of the profile of Pancasila students in creative thinking dimension of students STEAM learning integrating with Project Based Learning (PjBL) (experiment class) and students learning was used conventional learning (control class). Data obtained from pre-test results and post-test with the following N-gain formula:

$$Gain\ (g) \frac{Post\ -test\ score\ -\ Pre-test\ score}{Maximum\ score\ -\ Pre-test\ score}$$

Assessment criteria for the creative thinking ability test instrument are in Table 1.

TABLE 1: Pancasila Student Profile Score Criteria (Hake, 1999).

Intervals (%)	Criteria
0 - 60	Not yet developed
61 – 70	Starting to develop
71 – 80	Developing as expected
81 - 100	Very developed

3. Result and Discussion

3.1. The Results of the Research

The effectiveness STEAM learning integrating with Project Based Learning (PjBL) with measurement material in optimize creative thinking dimension of Pancasila student profiles was implemented by providing essay questions. Average of percentage for pre-test and post-test on creative thinking dimension can be seen in Figure 1.

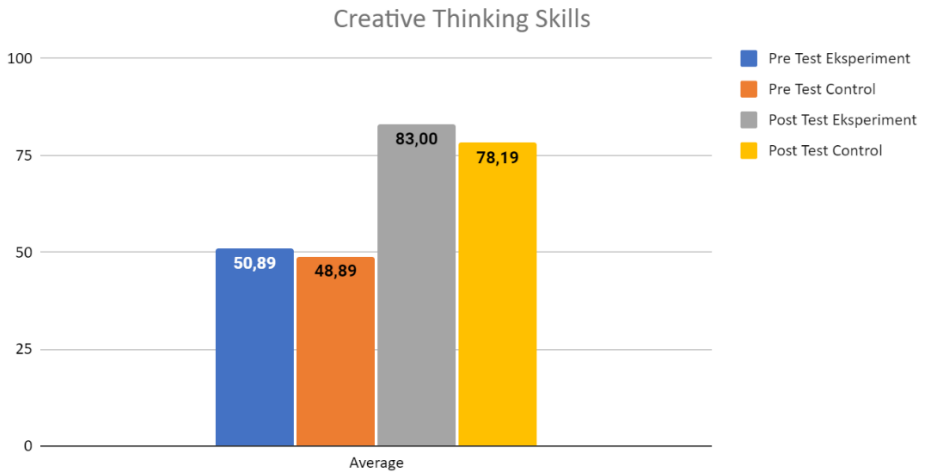

Figure 1: Average Value of Creative Thinking Skills.

From data present on Figure 1, it can be shown average of pre-test creative thinking score (KBKr) for experiment group was 50.89 and for control group was 48.89. Meanwhile, average post-test creative thinking score (KBKr) value for experiment group was 81.89 and average creative thinking score (KBKr) value for control group was 75.22. Increasement post test scores in experiment class is under Tomlinson's [11] belief that combining STEAM education with Project-Based Learning (PjBL) can improve students' comprehension and engagement. Approachment makes learning more enjoyable by enabling students to learn at a level suitable for their aptitudes.

T test is the next step, which compares the averages of two samples (control and experiment class) that are unrelated to determine whether there are any differences between them.

TABLE 2: Independent Sample T_test.

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
KBKr	Equal variances assumed	3,303	,073	2,057	70	,043	4,80556	2,33633	,14589	9,46522
	Equal variances not assumed			2,057	63,300	,044	4,80556	2,33633	,13720	9,47391

From Table 2 results for t-test for the post-test data obtained a t-test value = 2.057 and a t-table = 2.030 with a significance of 0.043, it can be seen that the t-test value> the probability of the t-test table and sig (sig. 2-tailed) is less than 0.07. So it can be said that there is a significant difference in the profile of Pancasila students in the creative thinking dimension between students who use Project-based learning combined with STEAM education (PjBL) and those who do not.

N-Gain analysis was used to determine whether or not there was an increase (Gain) in the Pancasila student profile in creative thinking dimension of students in learning using a STEAM learning integrated with Project Based Learning (experiment class) and student which used a conventional learning (control class).

Table 3: N-Gain Score Test Calculation Results.

N-Gain Score		
	Experiment Class	Control Class
Mean	65.24	57.80
Minimum	32.69	26.67
Maximum	91.07	100

Results of the N-gain test, it shows average of N-gain score for experiment class (STEAM learning integrating with Project Based Learning) is 65.24% was included in fairly effective category. With a minimum N-Gain value of 32.69% and a maximum of 91.07%. Meanwhile, average N-Gain score for control class (conventional learning) is 57.80% which is included in less effective category. With a minimum N-gain score of 26.67% and a maximum of 100%. So using STEAM learning integrated with Project Based Learning works vey well in optimize profile of Pancasila Students in creative thinking dimension in Physics subject of measurement material for Class X Students of SMA N 1 Donorojo in the academic year 2024. In meanwhile, classes that don't utilize a Project-based learning combined with STEAM education (PjBL) are less effective in optimize students Pancasila profile in the creative thinking dimension in the Physics lesson for Class X Students of SMA N 1 Donorojo in the 2024 academic. As a result, give proof that STEAM learning integrated with Project Based Learning (PjBL) in the physics subject of measurement material is more effective in optimize students Pancasila profile in the creative thinking dimension than learning that does not use Project-based learning combined with STEAM education (PjBL). Experiment group's high N-gain value aligns with Marzano's [12] opinion who views efficient learning approach, namely Learning

strategies that take into account each student's unique needs are part of an effective education, namely a STEAM learning integrated with Project Based Learning.

Table 4: Observation Results of Pancasila Student Profiles on Creative thinking Dimensions.

Element	Not Yet Developed		Starting to Developed		Developing As Expected		Very Developed	
	Eks	Con	Eks	Con	Eks	Con	Eks	Con
Generating original ideas	-	-	3	10	32	25	1	1
Produce original works and actions	-	-	2	7	28	26	6	3
Have flexibility of thinking in finding alternative solution	-	-	2	5	30	31	4	-

From Table 4, results of observation of the Pancasila student profile on creative thinking dimension in experiment class of 36 students, data was gather on element of producing original ideas, 8.33% of students began to develop, 88.89% of student was developed in accordance with expectations and 2.78% of student made significant progress. On element of producing original work and actions, 5.56% of students began to develop, 77.78% student was developed in accordance with expectations and 16.67% of students gained greatly. On the element of having flexibility of thinking in finding alternative solutions to problems, 5.56% of students began to develop, 83.3% of student was developed in accordance with expectations, and 11.1% of students gained greatly. In control class, data was gather on element of producing original ideas, 27.78% of students began to develop, 69.44% of students began to develop in line with expectations and 2.78% of student gained greatly. In element of producing original work and actions, 19.44% of students began to develop, 72.22% of studentbdeveloped met expectations and 8.33% of student gained greatly. In element of having flexibility of thinking in finding alternative solutions to problems, 13.89% of students began to develop and 86.1% of students developed according to expectations.

3.2. Create a Discussion

STEAM learning combined with Project Based Learning (PjBL) must able for maximize the success that students will obtain. STEAM learning integrated with Project Based Learning (PjBL) is an leducational process that focuses students on problems, so that it can encourage and motivate students to study concepts and basic principles of knowledge directly as real experiences [13]. Majid [14] said that PjBL integrated STEAM

learning can also be used to overcome complex problems. PjBL learning has great potential in improving students' creative thinking and critical thinking abilities because it involves students directly in solving problems that are relevant to students' daily lives. STEAM learning incorporated into project-based learning (PjBL) can be said to be more effective because it suits students' learning needs, so students do not need to make many adjustments. Effective STEAM learning incorporated into project-based learning (PjBL) is able to opstimize the Pancasila student profile, where in this research the focus is on the creative thinking dimension. This aligns with previous studies that indicate PjBL-based STEAM can have an influence in improving students' creative thinking skills [15].

4. Conclusion

PjBL is a learning model that incorporates project creation in the learning process. Meanwhile, STEAM is the integration of various scientific disciplines into one unit that seeks to bring students to master various scientific disciplines. Mastery of these scientific disciplines is used to solve issues that environments around students. Combination of STEAM and PjBL based on research that has been conducted has been proven to be able to improve students' creative thinking abilities to solve existing problems. For further research, we can further examine the factors that influence STEAM learning incorporated into project-based learning (PjBL) in optimizing profile of Pancasila students in dimension of creative thinking abilities, so that research on this topic can be more complete.

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