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Influence of Environmentally Based Learning Strategies and Learning Interest on Students' Physics Problem-Solving Abilities

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ABSTRACT: This research is a true-experimental research using a 2 x 2 factorial design which aims to analyze the physics problem-solving abilities of class X students of SMAN 5 Enrekang who are taught with an environment-based learning strategy with a direct instruction strategy, analyze the differences in the physics problem-solving abilities of students taught with an environment-based learning strategy with a direct instruction strategy, reviewed from high learning interest and low learning interest, and analyze the interaction between environment-based learning strategies and learning interest on students' physics problem-solving abilities. The population consisted of class X of SMAN 5 Enrekang. Sampling in this study used a random sampling technique with class drawing so that a sample of 128 students was obtained for the experimental class and the control class. This study was conducted by providing treatment in the form of an environment-based learning strategy on the material of work and energy. Data on learning interest were collected using a questionnaire while data on problem-solving abilities were collected using a test. The results of the research data were analyzed using the Two Way ANOVA statistical test and further tests in the form of the Tukey test. The results of the study show that: (1) $F_{Count\,(324{,}05)} > F_{Table\,(3{,}92)}$, meaning that there is a difference in the problem-solving abilities of students taught using environment-based learning strategies with students taught using direct instruction learning strategies, (2) $Q_{Count\,(6{,}43)} > Q_{Table\,(3{,}632)}$, meaning that in terms of high learning interest, there is a difference in the physics problem-solving abilities between students taught using environment-based learning strategies with students taught using direct instruction learning strategies, (3) $Q_{Count\,(3{,}666)} > Q_{Table\,(3{,}632)}$, meaning that in terms of low learning interest, there is a difference in the physics problem-solving abilities between students taught using environment-based learning strategies with students taught using direct instruction learning strategies, (4) $F_{Count\,(2{,}18)} < F_{Table\,(3{,}92)}$, meaning that there is no interaction between environmental-based learning strategies and learning interest towards the physics problem-solving abilities of class X students at SMAN 5 Enrekang.

KEYWORDS: Learning Strategy, Direct Learning, Environment-Based Learning, Learning Interest, Problem Solving Ability.

I. INTRODUCTION

The success of the learning process is inseparable from the creativity of educators in implementing the learning process. Learning implementation is a concrete stage where the learning plan prepared by the teacher is implemented in the classroom through the teaching process, interacting with students, and implementing previously designed methods or strategies (Ozdemir, 2019). Educators are required to continuously develop their professionalism. Educators are no longer required to actively deliver material, but rather function as facilitators and motivators for students. In general, schools in Indonesia still use direct learning that focuses on the teacher. This is less effective in increasing student engagement in learning and is not able to fulfill the teacher's role as a motivator and facilitator in the learning process. One way educators can carry out this task is by creating learning strategies that can actively involve students. Learning strategies that can increase student activeness in learning are environment-based learning strategies.

Environmental-based learning provides a holistic and relevant learning experience, better preparing students to face the challenges of everyday life. Students can more easily understand the material being taught because they can directly relate it to concrete phenomena around them. Furthermore, environmental-based learning also encourages students to develop problem-solving skills because they are faced with real-life problems that require practical solutions. This helps students connect theory with practice, thus better understanding the application of knowledge in everyday life. Environmental-based learning is often conducted in groups, which can improve students' collaboration and social interaction skills. Students will actively participate in the learning process, which not only improves academic aspects but also enhances their social skills. Active student involvement in learning outside the classroom will increase their enthusiasm and interest in learning.

Interest in learning is a student's tendency to fully engage with the object being studied in the learning process due to a psychological need for objects or ideas they deem important. This opinion is supported by research conducted by Taufani (2008), which revealed that interest is a psychological state characterized by increased attention, effort, and influence, experienced at a particular moment (situational interest), as well as a lasting tendency to re-engage with a particular object or topic over time. Interest in learning is also a feeling of pleasure experienced by students in participating in learning at school. One effort that can be made to increase student interest in learning is by applying environment-based learning strategies in the learning process. Environment-based learning activities can involve students directly in the learning process so that students feel responsible for the learning process (Muhajirin, 2020).

Problem-solving skills are also key to student success in learning physics. Problem-solving skills develop through the stages of a child's cognitive development. A child learns to solve problems through interaction with their environment through the process of constructing knowledge (Jean Piaget, 1969). According to Sujarwanto, Hidayat, and Wartono (2014), problem-solving skills are the ability possessed by students to determine solutions by involving the acquisition and organization of information that has been obtained. Students' problem-solving skills involve the process of identifying, analyzing, and finding effective solutions to the problems faced. This process includes understanding the problem, collecting and analyzing information, developing alternative solutions, selecting the best solution, and implementing it.

Problem-solving skills in physics learning are crucial because they help students understand fundamental concepts more deeply and apply them to real-life situations. Learning physics often involves analytical and critical thinking, requiring the ability to identify, analyze, and solve complex problems. Problem-solving skills developed through physics learning can help individuals adapt quickly to real-world changes and challenges and prepare them for careers in science and technology. Therefore, honing problem-solving skills through physics learning is crucial for students' futures.

This is in line with research conducted by Mahrus (2022), which found that the experimental group showed an increase in science problem-solving skills, as indicated by the experimental group's posttest scores. The experimental group's score increased with a highest score of 100 and a lowest score of 43, with an average score of 77.33. This increase in science problem-solving skills in the experimental class demonstrates a difference in the problem-solving abilities of students taught using environment-based authentic learning.

Research conducted by Agus, et al (2019) regarding the influence of interest on students' problem-solving abilities shows the results of calculating the collected data on students' learning interest variables and obtained the lowest value of 50 and the highest value of 97, the average value of 76.48, the standard deviation of 11.033 and the mode of 80 and the median of 78.5. Based on the test of the significance of the correlation coefficient, the sig value = 0.03 and the t count value = 2.247 can be concluded that there is an influence of learning interest on students' problem-solving abilities

Based on several supporting studies, the researcher concluded that environment-based learning strategies and learning interests influence students' problem-solving abilities. Therefore, the researcher felt it was important to conduct a study at SMA Negeri 5 Enrekang with the research title "The Influence of Environment-Based Learning Strategies and Learning Interests on Students' Physics Problem-Solving Abilities**".**

II. METHOD

This research was conducted at SMA Negeri 5 Enrekang, Baraka District, Enrekang Regency, South Sulawesi, in the academic year 2024/2025. This study is an experimental research with a true experimental design. It consisted of an experimental group taught using an environment-based learning strategy and a control group taught using direct instruction. The research design used a 2 x 2 factorial design. The independent variable was divided into two classes: the experimental class and the control class. The experimental class received treatment using the environment-based learning strategy, while the control class was taught using direct instruction. The population of this study was all tenth-grade classes at SMA Negeri 5 Enrekang, consisting of six classes: X1, X2, X3, X4, X5, and, X6. Sampling was conducted using a simple random sampling technique, by drawing lots to select the sample classes from the population.

The instruments used in this research were non-test instruments in the form of questionnaires to measure students’ learning interest, and test instruments consisting of five essay questions to measure physics problem-solving ability. Data for students’ learning interest were collected by distributing questionnaires after the treatment was given to both the control and experimental

classes. Data for students' physics problem-solving ability were collected by distributing tests after the treatment. Generally, this research consisted of three stages: preparation, implementation, and final stages.
data obtained from the research instruments were first tested for validity and reliability. The collected data were quantitative and analyzed using two techniques: descriptive analysis and inferential analysis, specifically two-way ANOVA and a follow-up test with Tukey's test.

III. RESULTS AND DISCUSSION

learning interest was measured using a learning interest instrument given to students in the experimental class taught using the environment-based learning strategy and to students in the control class taught using direct instruction. Based on the research data results, the following is a **description of the students' learning interest data:**

Tabel 1:Description of Students' Interest in Learning Physics Data

Size	Student learning interest	
	Experiment	**Control**
Number of samples	64	64
Theoretical maximum score	100	100
Theoretical minimum score	62	62
Empirical maximum score	95	94
Empirical minimum score	75	74
Mean	83,71	82,45
Standard deviation	5,31	4,45
Variance	28,19	19,80

Based on Table 1, the average learning interest of the experimental class is higher than that of the control class. This means that the learning interest data for the experimental class is closer to the mean value compared to the learning interest data for the control class. In other words, the effect of learning using the environment-based learning strategy in the experimental class is more evenly distributed compared to the effect of the direct instruction strategy in the control class.

Tabel 2: Frequency Distribution of Students' Learning Interest

Interval	Experiment		Control		Category
	Frequency (f)	**Percents (%)**	**Frequency (f)**	**Percents (%)**	
93-100	6	9	2	3	Very high
85-92	27	42	19	30	high
77-84	26	41	38	59	Medium
69-76	5	8	5	8	Low
61-68	0	0	0	0	Very low
Total	64	100	64	100	

From Table 2 above, it can be seen that the learning interest score of the experimental class, with the highest frequency or number of respondents, lies in the score range of 85-92, totaling 27 respondents or 42%. The average learning interest score is 83.71, indicating that the learning interest of students at SMAN 5 Enrekang who were taught using the environment-based learning strategy falls into the high average category. Meanwhile, the control class's learning interest scores, with the highest frequency or number of respondents, are in the score range of 77-84, totaling 38 respondents or 59%. The average learning interest score is 82.45, which indicates that students taught using the direct instruction strategy fall into the medium average learning interest category.
The frequency distribution of the experimental class' learning interest scores is displayed in the form of a histogram in Figure below:

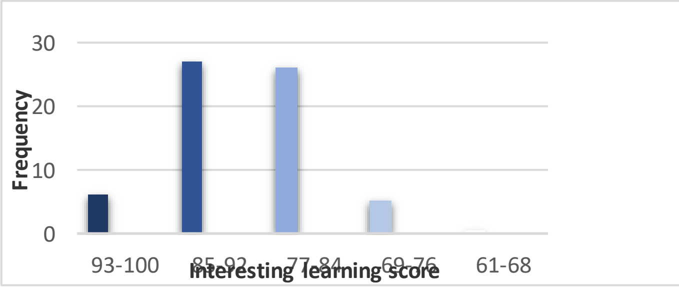

Figure 1. interesting in learning of experimental class

The frequency distribution of learning interest scores for the control class is visually displayed in the form of a histogram in Figure 2 below

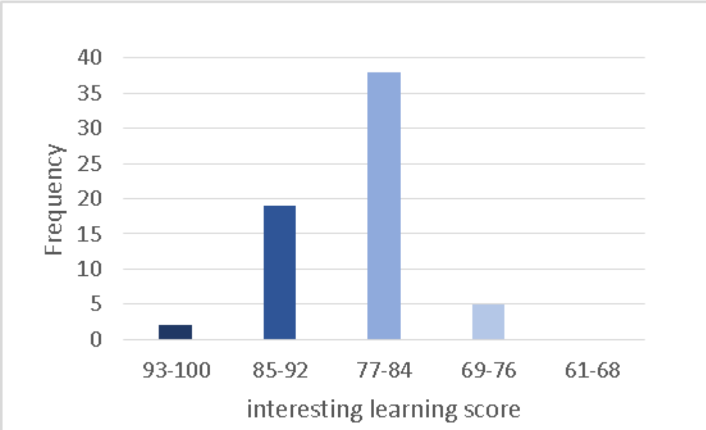

Figure 2. interesting in learning of control class

In this study, problem-solving ability is the score obtained through tests given to eleventh-grade students at SMAN 5 Enrekang. The descriptive analysis of problem-solving ability involves students in the control class applying the environment-based learning strategy and those in the experimental class applying direct instruction. Based on the research data, Table 3 below presents a description of the students' problem-solving ability data, and Table 4 shows the frequency distribution for the experimental and control classes:

Table 3: Description of Students' Physics Problem-Solving Ability Data

Measure	**Physics Problem-Solving Ability Data**	
	Experiment	**Control**
Number of samples	64	64
Theoretical maximum score	25	25
Theoretical minimum score	0	0
Empirical maximum score	25	23
Empirical minimum score	19	17
Mean	22,50	20,67
Standard deviation	1,95	1,88
Variance	3,80	3,54

Based on Table 3, the average problem-solving ability of students in the experimental class is higher than that of the control class. This means that the problem-solving ability data of the experimental class students are closer to the mean value compared to the control class. In other words, the effect of learning using the environment-based learning strategy in the experimental class is more evenly distributed than the effect of the direct instruction strategy in the control class.

Table 4 Frequency Distribution of Students' Physics Problem-Solving Ability

Interval	Experiment		Control		Category
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	
20-25	57	89	45	70	Vey high
15-19	7	11	19	30	High
10-14	0	0	0	0	Medium
5-9	0	0	0	0	Low
0-4	0	0	0	0	Very low
Total	64	100	64	100	

From Table 4, it can be seen that the problem-solving ability scores of students in the experimental class, with the highest frequency, lie in the range of 20-25, with 57 respondents or 89%, and the average learning outcome score is 22.50, indicating that the problem-solving ability of students taught using the environment-based learning strategy is in the very high average category. Meanwhile, in the control class, the highest frequency is also in the 20-25 range with 45 respondents or 70%, indicating that students taught using direct instruction also fall within the very high average category.

Visually, the frequency distribution of the problem-solving abilities of the experimental class is displayed in the form of a histogram in Figure 3 below.

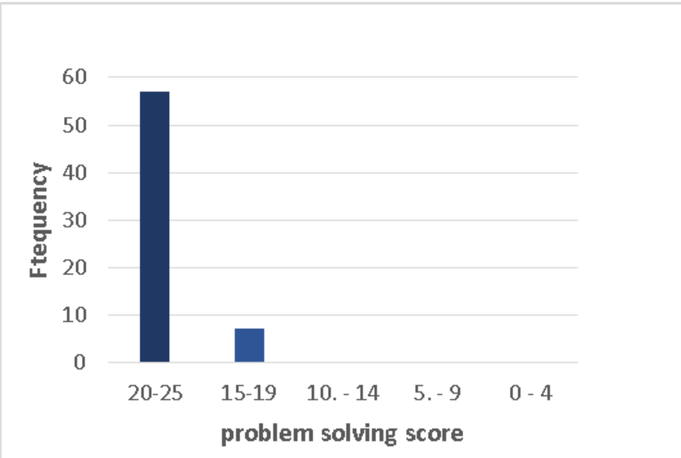

Figure 3. Problem solving of experimental class

The distribution of problem-solving abilities in the control class is visually displayed in the form of a histogram in Figure 4 below

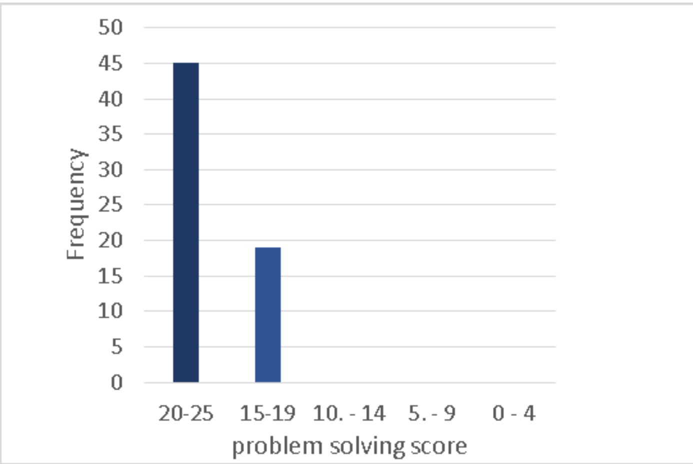

Figure 4. Problem solving of control class

Hypothesis testing was carried out using Two Way ANOVA with four treatment cells. Each treatment cell for both the experimental and control classes was as follows: (1) problem-solving ability data of students who followed environment-based learning strategy and have high learning interest, (2) problem-solving ability data of students who followed environment-based learning strategy and have low learning interest, (3) problem-solving ability data of students who followed direct instruction and have high learning interest, (4) problem-solving ability data of students who followed direct instruction and have low learning interest.

The first hypothesis based on two-way ANOVA analysis on variance between columns, shows that the $F_{calculate}$ (2.18) (333.10) > F_{table} (3.92), thus H0 is rejected and H1 is accepted. This means there is a difference between students taught using the environment-based learning strategy and those taught using direct instruction in their problem-solving ability in physics. This difference occurs because the environment-based learning model focuses on problem orientation through the surrounding environment, allowing students to have deeper learning experiences and making it easier to solve given problems.

The second hypothesis, based on follow-up Tukey test for students with high learning interest (A1B1 and A2B1), shows that $Q_{calculate}$ (6.43) > Q_{table} (3.632) and the mean difference (1.93) > critical difference (1.08). This indicates a significant difference in problem-solving ability between students with high learning interest taught using environment-based learning strategy and those taught with direct instruction. Learning interest is an internal factor that influences students' problem-solving ability. This result aligns with research by Aritonang (2008), which states that the primary factor determining whether students have learning interest is related to the teacher. Hence, environment-based learning strategies can foster students' learning interest in solving problems.

The third hypothesis based on follow-up Tukey test for students with low learning interest (A1B2 and A2B2) shows that $Q_{calculate}$ (3.666) > Q_{table} (3.632) and the mean difference (1.10) > critical difference (1.08). This shows a significant difference in problem-solving ability between students with low learning interest taught using environment-based learning strategy and those taught with direct instruction. The environment-based learning strategy promotes more active student involvement at each stage of the learning process, encouraging them to find solutions independently and understand the material optimally. This understanding is permanent, enabling students to comprehend and relate various phenomena and to construct knowledge effectively.

The fourth hypothesis about the interaction between learning strategy and learning interest results in $F_{calculate}$ (2.18) < F_{table} (3.92). H0 is accepted, meaning there is no interaction between learning strategy and learning interest on students' physics problem-solving ability in grade XI at SMA Negeri 5 Enrekang. For the high learning interest group, students taught using environment-based learning had higher problem-solving scores than those taught with direct instruction. The same pattern occurred in the low learning interest group, where environment-based learning strategy also led to higher problem-solving ability compared to direct instruction. Thus, it can be concluded that environment-based learning strategy is suitable for students with both high and low learning interest to improve problem-solving ability

CONCLUSIONS

Based on the results of the study on the effect of environment-based learning strategies and learning interest on problem-solving ability at SMAN 5 Enrekang, it is concluded that

1. There is a difference in problem-solving ability of tenth-grade students at SMAN 5 Enrekang taught using the environment-based learning strategy compared to those taught using direct instruction.
2. There is a difference in problem-solving ability between tenth-grade students with high learning interest who are taught using the environment-based learning strategy and those taught using direct instruction.
3. There is a difference in problem-solving ability between tenth-grade students with low learning interest who are taught using the environment-based learning strategy and those taught using direct instruction.
4. There is no interaction between environment-based learning strategy and learning interest on the problem-solving ability of tenth-grade students at SMAN 5 Enrekang.

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