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The Effect Of Problem-Based Learning Model (PBL) And Curiosity On Higher Level Thinking Skills (HOTS) In Science Subjects In Elementary Schools

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ABSTRACT

This thesis aims to determine and describe the effect of the Problem Based Learning (PBL) learning model on higher order thinking skills (HOTS), the effect of Curiosity on higher order thinking skills (HOTS) and there is an interaction between Problem Based Learning (PBL) and Curiosity. The method used is quantitative method. The instruments used are tests and questionnaires. The test was given to students of SD Negeri Rawa Barat 05 and SD negeri Rawa Barat 09. The data analysis used was two-way anova test. The results of this study found that there is an influence and significant between the influence of the Problem Based Learning (PBL) learning model on students' high-level thinking skills (HOTS) with a sig value of 0.000> 0.005, there is an influence and significant curiosity on students' high-level thinking skills (HOTS) with a sig value of 0.001> 0.005, there is an interaction between Problem Based Learning (PBL) with Curiosity students with a sig value of 0.008> 0.005. The Problem Based Learning (PBL) learning model has an influence on students' higher order thinking skills (HOTS), so that Problem Based Learning (PBL) will contribute to students' higher order thinking skills. Curiosity has an influence on students' higher order thinking skills, so that high curiosity will contribute to students' thinking skills. The higher the curiosity of students, the higher order thinking skills of students will also increase

A B S T R A C T

Tesis ini bertujuan untuk mengetahui dan mendeskripsikan pengaruh model pembelajaran Problem Based Learning (PBL) terhadap keterampilan berpikir tingkat tinggi (HOTS), pengaruh Rasa ingin tahu terhadap keterampilan berpikir tingkat tinggi (HOTS) dan terdapat interaksi antara Problem Based Learning (PBL) dan Rasa ingin tahu. Metode yang digunakan adalah metode kuantitatif. Instrumen yang digunakan adalah tes dan angket. Tes diberikan kepada siswa SD Negeri Rawa Barat 05 dan SD Negeri Rawa Barat 09. Analisis data yang digunakan adalah uji anova dua jalur. Hasil penelitian ini menemukan bahwa terdapat pengaruh dan signifikan antara pengaruh model pembelajaran Problem Based Learning (PBL) terhadap kemampuan berpikir tingkat tinggi (HOTS) siswa dengan nilai sig sebesar 0,000 > 0,005, terdapat pengaruh dan signifikan rasa ingin tahu terhadap kemampuan berpikir tingkat tinggi (HOTS) siswa dengan nilai sig sebesar 0,001 > 0,005, terdapat interaksi antara Problem Based Learning (PBL) dengan rasa ingin tahu siswa dengan nilai sig sebesar 0,008 > 0,005. Model pembelajaran Problem Based Learning (PBL) memiliki pengaruh terhadap kemampuan berpikir tingkat tinggi (HOTS) siswa, sehingga Problem Based Learning (PBL) akan memberikan kontribusi terhadap kemampuan berpikir tingkat tinggi siswa. Rasa ingin tahu memiliki pengaruh terhadap kemampuan berpikir tingkat tinggi siswa, sehingga rasa ingin tahu yang tinggi akan memberikan kontribusi terhadap kemampuan berpikir siswa. Semakin tinggi rasa ingin tahu siswa, maka kemampuan berpikir tingkat tinggi siswa juga akan meningkat..

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1. INTRODUCTION

Education plays a crucial role in the progress of a country. Educational policies must be adapted to developments and progress over time so that they can create graduates who will be able to answer existing challenges. In this era of globalization, all countries in the world are competing to improve the quality of education in order to prepare the younger generation to become a superior and competitive generation. One skill that students must have to become a superior and competitive generation is *High Order Thinking Skills* (HOTS) or high order thinking skills (Mayarni et al., 2021). The government hopes that students can achieve various competencies through the application of HOTS or high order thinking skills. These competencies include the ability to think critically, creatively and innovatively, communication skills, collaboration abilities, and self-confidence. These five aspects are the main focus in the education evaluation system as part of preparing students to face the demands of the 21st century (Almulla, 2019).

High-level thinking skills are also very important for students in facing real life which often involves complex, unstructured, complicated problems, and requires thinking skills that go beyond just applying the knowledge they have learned (Tambun et al., 2021). Higher order thinking skills (HOTS) are also applied considering the low level of student achievement based on the results of a survey carried out by *the Organization for Economic Co-operation and Development* (OECD) with its program known as *the Program for International Student Assessment* (PISA) and *Trends in International Mathematics and Science Study* (TIMSS) compared with other countries, so that the standard of National Examination questions is increased to catch up. The average achievement score of Indonesian students for science lessons in 2012 was 382 points, then increased in 2015 with a score of 403, but decreased in 2018 with a score of 396. Then it increased by 2 points to 398 in 2022.

One of the reasons why Indonesian students still lack high-level thinking skills is their poor mastery of the material, Indonesian students are not used to working on HOTS questions. On the other hand, research from As'ari et al. (2019) stated that the causes of students making mistakes in solving HOTS problems were not understanding the information in the problem, students' lack of accuracy, and lack of manipulation skills.

Apart from that, according to Aftiani et al. (2020) there are still many schools that implement a *teacher-centered* learning system , students only receive information provided by educators, so that students' high-level thinking skills do not appear in learning activities. Apart from that, the high-level thinking skills of students in Indonesia are still relatively low. According to Kawuwung in Fauziah et al., (2021) The low level of thinking skills in teaching and learning activities can be caused by 1) the teaching and learning process is still dominated by educators, 2) learning is less oriented towards higher level thinking skills 3) questions asked by educators oriented to cognitive levels C1 to C3 (Irdalisa, n.d.) .

Based on research conducted by Harapit (2018), the learning process implemented by educators is still conventional, educators are more dominant in providing knowledge than students building knowledge themselves. In Royantoro et al. (2018) students' activities in the classroom are dominated by listening, observing and taking notes on what is conveyed by the teacher. Apart from that, the average cognitive ability of students is still at the level of remembering, understanding and applying based on the questions given.

This is in line with the results of observations and interviews on Monday 2 October 2023, class V of SD Negeri Rawa Barat 05, it was found that students still think concretely according to the results of observations that have been found. In fact, according to the developmental stage, according to *Jean Piaget,* the age of fifth grade elementary school children is already leading to abstract thinking, which at that age fifth grade students should be able to develop higher level thinking skills. Apart from that, it was found that the questions created by class V educators were predominantly at cognitive level C1-C3 (LOTS). Apart from that, it can also be seen from the results of the 2023 education report card which is based on the Computer-Based National Assessment (ANBK) which states that students' high-level thinking skills (HOTS) still need to be improved because they are still in the middle rank with a score of 40.85.

Referring to the problems above, learning innovation is needed at SD Negeri Rawa Barat 05, to improve higher order thinking skills (HOTS) which can be done through innovative and creative learning in accordance with learning in the 21st century. 21st century learning focuses on *student centered* with the aim of providing students with thinking skills including: (1) critical thinking, (2) problem solving, (3) metacognition, (4) communicating, (5) collaborating, (6) innovation and creative, (7) information literacy (Rifa Hanifa Mardhiyah, 2021).

The hope of 21st century learning is that students have curiosity and high-level thinking skills and can be implemented in everyday life. This is in line with Kosasih (2014) *Student centered* makes learning not only about mastering students' knowledge, but so that students have the ability to think critically so they can solve problems and actively develop the ability to construct their own knowledge and increase interaction with the surrounding environment during the problem solving process (Hasanah et al., 2021).

One learning model that can improve students' high-level thinking skills is *Problem Based Learning* (PBL). According to Masduriah (2020), *the Problem Based Learning (PBL)* learning model is a learning model that utilizes students' thinking intelligence in solving problems in learning material related to everyday life. In the

research of Hamdani et al. (2022) also concluded that applying the problem-based learning (PBL) model has been proven to have a significant impact on students' high-level, active, creative and independent thinking skills. According to Utaminingsih et al. (2018) added that apart from that, *Problem Based Learning* (PBL) trains students to be able to think rationally. Knowledge gained through the stages of solving problems related to everyday life will make learning more meaningful.

the Problem Based Learning (PBL) model on higher level thinking skills, including Royan Nurochman et al who stated that *Problem Based Learning* (PBL) emphasizes the problem solving process. Meanwhile, Masduriah's research concluded that the *Problem Based Learning* (PBL) learning model can support students' HOTS skills. Meanwhile, according to Ramadhanti et al. (2022) stated that the application of the PBL model can have a positive influence on higher order mathematical thinking skills (HOTS). There are many other studies related to *Problem Based Learning* (PBL) conducted by previous researchers such as Noordin et al., (2018) , Herzon et al. (2018) , Kamid & Sinabang (2019) , Kodariyati & Astuti (2016) , Royantoro et al. (2018) etc.

Apart from learning models, student character can also influence students' higher-order thinking skills. One of the characteristics of students that must be explored is *curiosity* in students. The character of human curiosity is also an emotion that humans have which encourages behavior such as investigation, examination and learning. Leherisey stated that: Curiosity is a student's curiosity so that it can improve learning outcomes by understanding the student's learning assignments to understand in depth about assignments, whether unfamiliar or confusing assignments, as well as diligently seeking in-depth information about learning assignments. *Curiosity* is a desire to obtain new information and sensory knowledge that encourages an attitude of exploration. Meanwhile, according to Daryanto Suryatri, curiosity is an attitude that seeks to know something more deeply and broadly about something that is seen, heard and studied. *Curiosity* is one of the factors that can improve reasoning abilities. *Curiosity* in the learning process is defined as a motivation that arises within students to study the material and the problems they face. *Curiosity* can make students try to solve every existing question.

Based on the description above, researchers are interested in conducting research regarding *Problem Based Learning* (PBL) and *curiosity* in improving high-level thinking skills. The research conducted by this researcher raised the title " The Effect of *Problem Based Learning* (PBL) and *Curiosity* towards Higher Level Thinking Skills in Class V Elementary School Science Subjects "

2. METHOD

Place and Time of Research

This research was carried out at public elementary schools in Rawa Barat Village, namely Rawa Barat 05 Elementary School and Rawa West 09 Elementary School. Rawa Barat 05 Elementary School is located at Jalan Birah III No. 3 Blok-S, Rawa Barat, Kebayoran Baru, South Jakarta City while SD Negeri Rawa Barat 09 is located at Jl. Ciomas V Blok Q 1, RT.7/RW.1, Rawa Barat, Kebayoran Baru, South Jakarta City. SD Negeri Rawa Barat 05 and SD Negeri Rawa Barat 09 have A accreditation. Reasons for choosing research sites at these schools were based on several considerations. The first consideration is because the school is located in the area where the researcher teaches and looks at several elements including the affordability of the research location for the researcher, both in terms of personnel, funds and in terms of time efficiency, because the school is where the researcher teaches (Khotimah et al., 2019). Another reason which is no less important and a more fundamental consideration in selecting the location for this research is that after carrying out observation activities it was concluded that the learning outcomes tests in students' science learning still use LOTS and are not HOTS based, learning is not yet linked to daily life problems. makes learning less meaningful and it appears that educators have not implemented problem-based learning in science subjects, therefore this school is considered appropriate for conducting research. The research implementation and preparation of this research report will be carried out from September 2023 to August 2024.

Population and Sample

This research was conducted at a school in the Rawa Barat sub-district area. The population taken was selected based on the researcher's interest in implementing learning using the problem based learning model in the workplace area. The population in this research is class V students from SD Negeri Rawa Barat 05 and SD Negeri Rawa Barat 09 for the 2023-2024 academic year. Related to how to determine the sample used in this research is the cluster random sampling level. Cluster random sampling is the level of selecting a sample from a small group of units. In accordance with this sampling rate is based on groups or clusters. The cluster random sampling technique is used if complete records of all members of the population are not obtained and costs are limited and the geographic population of the population elements is far apart.

Treatment

The experimental group in this study received treatment using the Problem Based Learning (PBL) model, while the control group received treatment using Direct Learning. Before being given treatment in this class, a questionnaire was given first to classify them into categories of students who have high and low curiosity. After that, treatment is given in the form of a learning model and to measure high-level thinking skills, namely by using the HOTS test in the form of a written test with 25 questions.

Data collection technique

Data collection is a very important level in research, because the data collected is used to test the hypothesis that has been formulated.

Data Collection Instrument

Based on determining the level of data collection that has been determined to collect research data, the following is an explanation of the conceptual definition, operational definition, instrument grid, instrument validity, and level reliability of each research variable (Krismayanti & Mansurdin, 2020).

Hypothesis Testing

Based on the hypothesis proposed, the hypothesis test in this study used a two way ANOVA test. Anava (analysis of variance) is a procedure used to see variations that arise due to several treatments so that it can be concluded whether there are differences in means in the population or not. If related to experimental design, this test procedure aims to test whether or not there are differences in the effects of several treatments (factors) on one dependent variable.

3. RESULTS AND DISCUSSION

Data Description

This research uses a 2 x 2 Factorial design, where there are two variables whose influence is analyzed on students' higher level thinking skills. These two variables are the learning model and students' curiosity. Each variable has two categories. In this research, the learning model used is Problem Based Learning (PBL) for the experimental class, namely the VA class of SD Negeri Rawa Barat 05 and VB SD Negeri Rawa Barat 09, while the other classes use the direct learning learning model as the control class, namely VC SD Negeri Rawa Barat 05 and VA SD Negeri Rawa Barat 09. The level of curiosity of students in both classes is categorized into high curiosity and low curiosity. Based on the test results, in the experimental class there were 17 students who had high curiosity and 17 students who had low curiosity. In the control class there were 17 students who had high curiosity and 17 students who had low curiosity. Thus the total number of samples analyzed was 68 students. After the learning process is complete, all students are given a posttest to obtain research data in the form of high-level thinking skills test scores (SAPTENNO, Audrey et al., 2019).

Results of Higher Level Thinking Abilities in Problem Based Learning Classes

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Problem Based Learning (PBL) learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing the respondents' answers, it was found that the highest score of students' high-level thinking skills for group A1 was 96 and the lowest was 54. After analysis, it turned out that the average (x^-) of the data was 77.53 with a standard deviation (SD) of 10 .92. The following is the test result data for class A1 which is presented in

Table 1. Data on posttest results for high-level thinking skills in group A1

N	Results *Posttest*			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
34	96	54	77.53	10.92

Results of Higher Order Thinking Abilities in Direct Learning Classes

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Direct Learning learning model. The posttest consists of 25 questions in multiple choice form (Rotgans & Schmidt, 2019).

From the results of processing the respondents' answers, it was found that the highest score of students' high-level thinking skills for group A2 was 90 and the lowest was 46. After analysis it turned out that the average (x^-) of the data was 70.03 with a standard deviation (SD) of 11 .49. The following is the test result data for class A2 which is presented in the table

Table 2. Data on posttest results for high-level thinking skills in group A2

N	Results *Posttest*			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
34	90	46	70.03	11.49

The results of the analysis above show that the average score for those who often use Direct Learning (PBL) is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Results of High Level Thinking Ability in Classes with High Curiosity Ability (B1)

The research data was obtained from the posttest of high-level thinking skills given to students before carrying out the science learning process using the Problem Based Learning or Direct Learning learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing respondents' answers, it was found that the highest score of students' high-level thinking skills for group B1 was 92 and the lowest was 52. After analysis it turned out that the average (x^-) of the data was 77.32 with a standard deviation (SD) of 9 .78. The following is the test result data for class B1 which is presented in table 4.5

Table 3. Data on the results of the posttest Thinking Skills High level thinking in group A2

N	Results *Posttest*			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
34	92	52	77.32	9.78

The results of the analysis above show that the average score for those with high curiosity is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Results of High Level Thinking Ability in Classes with Low Curiosity Ability (B2)

The research data was obtained from the posttest of high-level thinking skills given to students before carrying out the science learning process using the Problem Based Learning or Direct Learning learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing the respondents' answers, it was found that the highest score of students' high-level thinking skills for the B2 group was 96 and the lowest was 46. After analysis it turned out that the average (x^-) of the data was 70.24 with a standard deviation (SD) of 12 .60. The following is the test result data for class B1 which is presented in the table

Table 4. Data on the results of the posttest Thinking Skills High level thinking in group B2

N	Results *Posttest*			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
34	96	46	70.24	12.60

The results of the analysis above show that the average score for those with low curiosity is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Results of High Level Thinking Ability in Problem Based Learning Class with High Curiosity Ability (A1B1)

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Problem Based Learning (PBL) learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing respondents' answers, it was found that the highest score of students' high-level thinking skills for group A1B1 was 92 and the lowest was 60. After analysis it turned out that the average (x^-) of the data was 78.06 with a standard deviation (SD) of 10 .59. The following is the test result data for class A1B1 which is presented in the table

Table 5. Data on posttest results for high-level thinking skills in group A1B1

N	Results *Posttest*			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
17	92	60	78.06	10.59

The results of the analysis above show that the average score for those who frequently use Problem Based Learning (PBL) is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Research Results in Problem Based Learning Classes with Low Curiosity Ability (A1B2)

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Problem Based Learning (PBL) learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing respondents' answers, it was found that the highest score of students' high-level thinking skills for the A1B2 group was 96 and the lowest was 54. After analysis it turned out that the average (x^-) of the data was 77.00 with a standard deviation (SD) of 11 .55. The following is the test result data for class A1B2 which is presented in the table

Table 5. Posttest Results Data on Thinking Skills High level thinking in Group A1B2

N	Posttest Results			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
17	**96**	**54**	**77.00**	**11.55**

The results of the analysis above show that the average score for those who frequently use Problem Based Learning (PBL) is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Research Results in *Direct Learning Classes* with High *Curiosity Ability* (A2B1)

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Direct Learning learning model. The posttest consists of 25 questions in multiple choice form.

From the processed results of respondents' answers, it was found that the highest score of students' high-level thinking skills for group A1B2 was 90 and the lowest was 52. After analysis, it turned out that the average ($\bar{x}$) of the data was 76.59 with a standard deviation (SD) of 9.17. The following is the test result data for class A2B1 which is presented in table 4.13

Table 6. Posttest Results Data on Thinking Skills High level thinking in Group A2B1

N	Posttest Results

	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
17	**90**	**52**	**76.59**	**9.17**

The results of the analysis above show that the average score for those who frequently use Direct Learning is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Research Results in Direct Learning Classes with Low Curiosity Ability (A2B2)

The research data was obtained from the posttest of high-level thinking skills given to students after carrying out the science learning process using the Direct Learning learning model. The posttest consists of 25 questions in multiple choice form.

From the results of processing the respondents' answers, it was found that the highest score of students' high-level thinking skills for the A1B2 group was 84 and the lowest was 46. After analysis it turned out that the average (x^-) of the data was 63.47 with a standard deviation (SD) of 9 .84. The following is the test result data for class A2B2 which is presented in the table

Table 7. Posttest Results Data on Thinking Skills High level thinking in Group A2B2

N	Posttest Results			
	Xmax	Xmin	$\bar{\chi}$	Standard Deviation
17	**84**	**46**	**63.47**	**9.84**

The results of the analysis above show that the average score for those who frequently use Direct Learning is quite good. Likewise, the frequency with which respondents had the highest score was above the average score.

Data Analysis Prerequisite Test

the posttest results carried out in the experimental class and control class became research data that was analyzed to carry out a hypothesis. Before carrying out a hypothesis test, the data being analyzed must be normally distributed and have a homogeneous variance. Therefore, data analysis prerequisite tests were carried out consisting of normality tests and homogeneity tests.

Normality Test

The normality test is used to determine whether research data is normally or not normally distributed. The data normality test in the control class and experimental class was carried out using the *Liliefors formula* (X^2) with a significance level of 5% ($\alpha = 0.01$). The results of the normality test in both classes can be seen in table 4.17.

Table 8. Normality Test Calculation Results

Class	L_{count}	L_{table}	Criteria	Information
A1B1	0.123	0.2060	Lcount < Ltable	Normal
A1B2	0.1816	0.2060	Lcount < Ltable	Normal
A2B1	0.167	0.2060	Lcount < Ltable	Normal
A2B2	0.126	0.2060	Lcount < Ltable	Normal

Homogeneity of Variance Test

Based on the normality test, the data results from the four groups were normally distributed. Therefore, the analysis prerequisite test is followed by a homogeneity test to determine whether the research data variance is homogeneous or not. The homogeneity testing technique uses *the Bartlett test* with a significance level of 5% ($\alpha = 0.05$). The results of the homogeneity test in both classes can be seen in table

Table 9. Homogeneity Test Calculation Results

Class	elementary school	V	χ^2 ount	χ^2 c 1(3)	Criteria 0.0	Information
A1B1	10.59	112.18	0.942	11.34	χ^2 count < χ^2 table	Homogeneous Variance
A1B2	11.55	133.38				
A2B1	9.17	84.13				
A2B2	9.84	96.76				

Hypothesis Testing

In the prerequisite test results for data analysis, data from the control class and experimental class were normally distributed and had homogeneous variance, so the hypothesis test was continued using the t-test with a significance level of 1% (α = 0.01) to test the null hypothesis (H_0) which reads "There is no influence of the *Problem Based Learning* (PBL) and *Curiosity learning models* on higher order thinking skills (HOTS)". A summary of the t-test results can be seen in the table below.

Table 10. Hypothesis Test Calculation Results (Anova Table Summary)

S. Variance	JK	db	RJK	Fh	Ft α=0.05	Ft α=0.01	Decision
Between	956.25	1	956.25	8.97	3,991	7,048	Reject H0, Accept H1
Between B	854.13	1	854.13	8.01	3,991	7,048	Reject H0, Accept H1
Intera AxB	618.01	1	618.01	5.80	3,991	7,048	Reject H0, Accept H1
In	6823.29	64	106.61				
Total	9251.69	67					

Based on the data above, the proposed research hypothesis can be answered. The explanation regarding the table above is as follows:

First hypothesis: There is an influence of the *Problem Based Learning* (PBL) learning model on high-level thinking skills in class V in elementary school.

Based on the table, the Anova results are obtained with a value of 8.97 > 3.991, so the null hypothesis H0 is rejected and H1 is accepted. This means that there is an influence of the *Problem Based Learning* (PBL) learning model on students' high-level thinking skills.

Second hypothesis: There is an influence of *curiosity* on higher level thinking skills in class V in elementary school.

Based on table, the Anova results obtained with a value of 8.01 > 3.991, it can be concluded that H_0 is rejected and H_1 is accepted, which means that there is an influence of student *curiosity* on the high level thinking skills of class V in elementary schools in science subjects.

Third Hypothesis: There is an interaction effect between the learning model and curiosity on students' higher-order thinking skills.

Based on table, the Anova results obtained with a value of 5.80 > 3.991 reject H0, it is concluded that there is an interaction between the effect of implementing *the Problem Based Learning* (PBL) model and *Curiosity* towards the higher order thinking skills of class V students in elementary school science subjects. Based on the results of data analysis for testing the third hypothesis regarding the existence of interactions between the *Problem Based Learning* (PBL) and Direct Interaction (DI) learning models with high, low *curiosity* in influencing students' high-level thinking skills, it can then be depicted with the following plot graph:

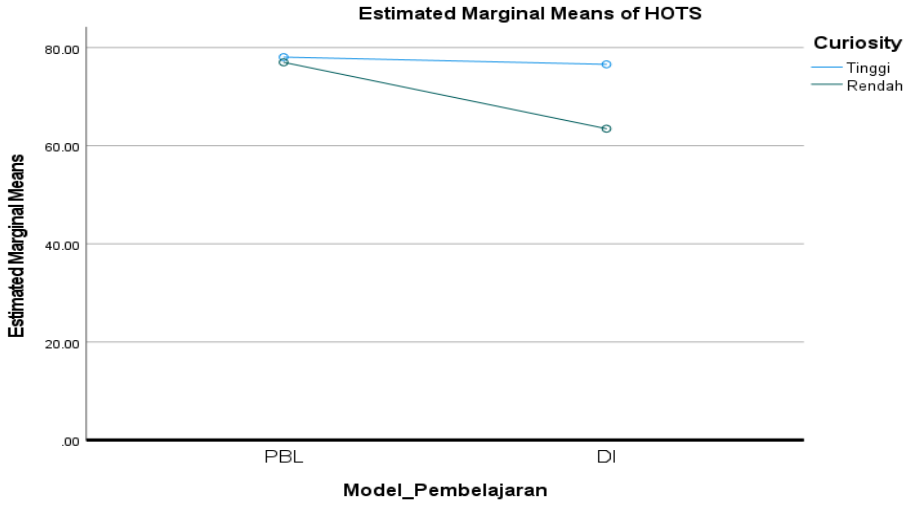

Figure 1. Graph plot between learning model and student *curiosity*

Tukey's test

The advanced stage of variance analysis calculation using the Tukey Test is to compare groups that have significant differences in the use of learning models and student curiosity.

A summary of the results of the Tukey Advanced Test calculations can be seen as follows. Based on showing that the Tukey Test calculations can be concluded that:

a. The average results of students' high-level thinking skills in groups A1B1 and A1B2 have a difference of 1.06, where the high-level thinking skills of students in the group using *the Problem Based Learning* (PBL) model with a high level of *Curiosity* are 1.06 points greater than high-level thinking skills. high level of students in the group using *the Problem Based Learning* (PBL) model with a low level *of Curiosity*
b. The average results of students' high-level thinking skills in groups A1B1 and A2B1 have a difference of 1.47, where the high-level thinking skills of students in the group using *the Problem Based Learning* (PBL) model with a high level of *Curiosity* are 1.47 points greater than high-level thinking skills. high level of students in the group with the *Direct Interction model* with a High *Curiosity level* .
c. The average results of students' high-level thinking skills in groups A1B1 and A2B2 have a difference of 14.59, where the high-level thinking skills of students in the group using *the Problem Based Learning* (PBL) model with a high level of *Curiosity* are 14.59 points greater than high-level thinking skills. high level of students in the group with the *Direct Interction model* with a low level of *Curiosity* .
d. The average results of students' high-level thinking skills in groups A1B2 and A2B1 have a difference of 0.41, where the high-level thinking skills of students in the group using *the Problem Based Learning* (PBL) model with a low level of *Curiosity* are 0.41 points greater than high-level thinking skills. students in the group with the *Direct Interction model* had a high level of *Curiosity* .
e. The average results of students' high-level thinking skills in groups A1B2 and A2B2 have a difference of 13.53, where the high-level thinking skills of students in the group using *the Problem Based Learning* (PBL) model with a low level of *Curiosity* are 13.53 points greater than high-level thinking skills. high level of students in the group with the *Direct Interction model* with a low level of *Curiosity* .
f. The average results of the high-level thinking skills of students in groups A2B1 and A2B2 have a difference of 13.12, where the high-level thinking skills of students in the group using the *Direct Interction model* with a high level of *Curiosity* are 13.12 points greater than the high-level thinking skills of students in the group with a *Direct Interaction model* with a low *Curiosity level* .

Discussion

Based on hypothesis testing, it shows that all research working hypotheses can be accepted, thus the *Problem Based Learning* (PBL) and *curiosity learning models* are proven to have an influence on students' high-level thinking skills.

***Problem Based Learning* and *Direct* Learning Models on High Level Thinking Skills in Science Subjects**

Based on hypothesis testing, the results obtained meet the criteria of *tcount > ttable , namely with a value of 8.97 > 3.991, so it can be said that Ho is rejected and H1 is accepted, which means that there is a significant*

influence from the use of the Problem Based Learning (PBL) learning model on high level thinking skills (HOTS).) students on Heat material. In the research data, it was found that the average *posttest score* for the experimental class was higher than the control class. This proves that the use of the *Problem Based Learning* (PBL) learning model in the experimental class is better than the *direct learning model* in the control class. This is in line with research conducted by Royan Nurochman, that learning by applying *problem-based learning* can improve high-level thinking skills. Apart from that, research conducted by Hanif Masduriah, et al also states that learning using *problem-based learning* can improve elementary school students' high-level thinking abilities.

The research was conducted regarding heat material and its changes, which according to BSKAP can be seen in the competency standards and basic competencies in science subjects for class V semester 2. One of the objectives of science learning according to the Merdeka Curriculum (Pratiwi & Wuryandani, 2020) is to solve problems that arise. This includes the ability to understand problems, design science models, complete models and interpret the solutions obtained. This increase in high-level thinking skills occurs because of the opportunities given to students to solve problems according to appropriate problem-solving procedures. Even though higher order thinking skills have improved, there are still students who experience difficulties, especially in planning solutions. This is because students are used to filling in answers straight away without planning it first, so some students often experience mistakes when solving problems. Bayer (Fanani, 2018) states that the indicators of high-level thinking skills are as follows.

1. Demonstrate the ability to create your own ideas , including the ability to construct, design, create, develop, write and formulate the necessary things.
2. Able to evaluate , including the ability to make your own decisions in everyday situations in science.
3. Selecting and analyzing problem solving strategies, including the ability to come up with Specifying aspects/elements, comparing, checking, criticizing, testing various possibilities or alternative ways of solving, which formulas or knowledge can be used in solving the problem.

Thus, students should plan first before solving the problem. Therefore, in order for students to be able to produce these indicators, habituation is needed. This is in line with Pavlov's theory, namely habituation (*conditioning*). Pavlov (Djonomiarjo, 2020) stated that habituation has a relationship with teaching and learning activities. Based on this statement, during the implementation of learning, students should continue to be given familiarization through practice in planning problem solving, so that students can carry out problem solving according to their planning.

The learning that has been carried out in this experimental class contains the steps of a *problem-based learning approach* , namely the first is student orientation to the problem. This step is where students are given an explanation of the learning objectives and motivate students as encouragement for problem solving activities. The teacher here provides stimulus to students through a problem by connecting it to everyday life. This is in line with *Piaget's theory*, that every student at any age is actively involved in the process of acquiring information and constructing their own knowledge. Connecting problems with students' daily lives can make students construct their own knowledge.

This linking of problems with everyday life is also one of the characteristics of science learning in elementary schools, namely gradual science learning. These characteristics provide concepts from simple to more difficult concepts, so that problems related to everyday life create students' initial knowledge. The next step is to organize students to study. In this step there are stages, namely teams, identification, and planning. This activity is to help students solve problems, where students are more directed towards their activities systematically . Then, identification here students identify the problems they face and then move on to the planning stage. At the planning stage, students are required to plan their learning procedures, for example students can divide tasks with their members.

After that, the next step in *problem-based learning* is to guide individual and group investigations. In this step, there is a stage, namely investigation, where students carry out investigations to obtain/collect, analyze and evaluate the information they have obtained with the group, as well as carry out problem solving based on the investigations that have been carried out. The next step is to develop and present the work. This step includes the final project stage, namely students can check the results of their investigation and prepare a report to be presented later. Next is the presentation stage, where students present the results of their discussion in front of the class. The final step is to analyze and evaluate the problem solving process with the group investigation strategy stage, namely evaluation. At this stage students and teachers can evaluate things that happen in group activities.

Based on the explanation above, it can be seen that the science learning carried out in this experimental class is going well. The learning carried out in this experimental class is a combination of the *problem based learning model* . Duch, that the *problem-based learning model* is a learning model that is carried out by giving students a problem as a challenge that must be resolved, so that students can learn truly and can work to find solutions with their group. The *Problem Based* Learning learning model is suitable for use in learning that requires analysis, synthesis and information acquisition as an effort to solve a problem. Thus, learning using a problem-based learning approach can make it easier for students to understand the material of heat and its changes, where

heat and its changes are part of the same whole. This can make things easier for students, because as Subarinah (Chen et al., 2021) points out, science is a science that studies abstracts and relationship patterns. The obstacles that occur when learning takes place can be overcome and do not provide obstacles to achieving learning objectives, so the research results state that the problem-based learning approach with a group investigation strategy can improve the high-level thinking skills of class V students on heat material and its changes significantly.

The influence of Curiosity on students' higher order thinking skills.

In this research, *curiosity* is categorized into 3, namely low *curiosity* , medium *curiosity* and high *curiosity* . In this study, the data analyzed was only high *curiosity data* and low *curiosity data* , moderate *curiosity data* was not analyzed because it was considered neutral by the researcher. *Curiosity* of students who learn using the *Problem Based Learning* (PBL) Learning Model, there are 17 students who have low *curiosity* in learning science, 18 students who have moderate *curiosity* in learning science, and 17 students who have high *curiosity* in learning science. Meanwhile, there are 17 students who have low *curiosity in learning science* , 18 students who have moderate *curiosity* in learning science, and 17 students who have *high curiosity in* learning science.

For students with high *curiosity* , the tasks given can be done correctly and precisely. For students with moderate *curiosity* , the assignments are done correctly but there are still some that need deeper understanding. Meanwhile, students with low *curiosity* work on questions less carefully. Patience is needed to deal with students who are slow in doing assignments, because science subjects require students to do assignments with high curiosity in order to find out more deeply about the material. Teachers must try to arouse *the curiosity* of students who have difficulty learning. Students' *curiosity* is greatly influenced by the environment and so on.

Based on hypothesis testing, the results obtained meet the criteria of *tcount* > *ttable* , namely with a value of 8.01 > 3.991, so it can be said that Ho is rejected and H1 is accepted, which means that there is an influence of the influence of students' *curiosity* on the high level thinking skills of class V in elementary schools in natural science subjects. heat and its changes.

Many factors influence the success of students in achieving optimal high-level thinking skills, one of which is *Curiosity* or the curiosity that students have. The differences in students' curiosity can produce different high-level thinking ability scores. A student who has high curiosity will continue to try to explore new things in order to improve high-level thinking skills in various fields.

The high-level thinking skills of the group of participants who have high *Curiosity* (B_1) show differences with the high-level science thinking skills of students who have low *Curiosity* (B_2). This difference can be seen from the difference in the average (mean) score of the high-level thinking skills obtained by each group. This is in line with research conducted by Risdeni Hutagalung (Safaruddin et al., 2020) which states that curiosity (*cariocity*) and learning style can together influence student learning outcomes. Apart from that, other research conducted by Irna Hanifah Ameliah, et al suggests that curiosity *and* self-confidence can influence student learning outcomes. Harlen also explains that *curiosity* as part of a scientific attitude is an attitude that always wants to get the right answer from the object being observed. Someone will be motivated to learn because of the curiosity that arises from feelings of curiosity. When the reading process is able to satisfy the *curiosity instinct* , what happens is a feeling of pleasure, and there is a strong desire to repeat it again, so that interest begins to form. Curiosity can make students aware of the importance of new learning on an ongoing basis and collaborating with students' parents.

Interaction between the Problem Based Learning Model and Curiosity in science learning

In this research, to determine the relationship between *Problem Based Learning* and student *Curiosity* , it can be done using the Spearman correlation test. *Curiosity* has a correlation with students' high-level thinking skills, because according to Rosnenty (Sari, 2018) *Curiosity* can influence individuals in doing something, keep doing something, and help in completing tasks. Motivation will be a driving force for students in carrying out learning activities, thereby directing students to achieve learning goals. The Independent states that one of the goals of learning mathematics is solving problems. In connection with this, this motivation can achieve the goal of science learning, namely solving problems in everyday life using heat material. This is in line with the results of the 2-way ANOVA test that there is an interaction between *problem based learning* and student *curiosity* . This can be seen from the results of Fo (AB) 5.80 > F_{tab} , so that H_0 is rejected and H_1 is accepted.

The results of high-level thinking skills in the group of students who were taught using the *Problem Based Learning learning model* and had high *curiosity* (A_1B_1) *showed differences with the results of the high-level thinking skills of students in the group taught using the Direct Learning* learning model and had high *curiosity* (A_2B_1). The high-level thinking skills of the group of students who were taught using the *Problem Based Learning*

(PBL) learning model and had low *curiosity (A_1B_2) showed differences with the high-level thinking skills of students who were taught using the Direct Learning* learning model and had low *curiosity* (A_2B_2).

In the *Problem Based Learning learning model* , learning activities in the *Problem Based Learning* (PBL) technique allow students to be more relaxed in learning as well as fostering a sense of cooperation, competition and responsibility, without abandoning the objectives of the existing learning (Timor et al., 2021). Teaching science using the *Problem Based Learning* (PBL) learning model challenges students to think about the events that have made our world like this. Lessons must be so interesting and interactive that no child finds them boring. So teachers set high standards for high-level thinking abilities and expect students to achieve these standards. By setting such standards, students who have low *curiosity* will try to achieve these standards optimally which in the end will provide higher results than students who are taught using the *Direct Learning learning model* (Aslan & Duruhan, 2021).

According the aim of learning science is not only so that students are able to understand science concepts but have awareness and concern for society and are able to develop their knowledge about economic activities and types of business in everyday life. With their science knowledge, students can improve their high-level thinking skills in supporting knowledge in other sciences. Apart from that, by training students to be active and creative in science learning, students become accustomed to being active and creative in their daily lives, both in the school environment and outside of school.

4. CONCLUSION

Based on the research results, data analysis and discussion of research results in class V at SD Negeri Rawa Barat 05 and SD Negeri Rawa Barat 09, Kebayoran Baru District, the following conclusions can be drawn:

1. There is an influence of the Problem Based Learning (PBL) learning model on students' high-level thinking skills in class V science subjects.

This is proven by the results of Fo(A) = 8.97 > Ftab = 3.99. The results of high-level thinking skills with the Problem Based Learning (PBL) model are higher than the Direct Learning learning model . In implementing the Problem Based Learning model, students can develop high-level thinking skills enthusiastically to learn independently or in groups. Students' experiences will be more impressive and show their identity so that students compete to encourage their learning to get the best results. Here the teacher only acts as a facilitator so that students can carry out independent learning without being pressured.

2. There is an influence of curiosity on the higher order thinking skills of class V students.

This is proven by the results of Fo(A) = 8.01 > Ftab 3.99, so it can be concluded that H0 is rejected, H1 is accepted, which means there is a Curiosity Effect.

The high level thinking skills of students who have high curiosity are higher with the Problem Based Learning model treatment compared to the Direct Learning model treatment. The implementation of the Problem Based Learning learning model prioritizes student activity because there is cooperation in solving problems, so that students are encouraged to be creative in learning and understand the subject matter easily because they learn by playing games. In teaching and learning activities, students are active in carrying out the tasks given, although there are differences between students with high and low curiosity. For students with high curiosity, the tasks given can be done correctly and quickly. Meanwhile, students with low curiosity can work on assignments for a long time.

3. There is an interaction effect between the learning model and curiosity on students' higher-order thinking skills.

This is proven by the results of Fo (A) = 5.80 > Ftab = 3.99, rejecting H0, it is concluded that there is an interaction between the influence of the application of the Problem Based Learning (PBL) model and curiosity on the high-level thinking skills of class V students in the subject. Elementary School Science.

The interaction between learning models and curiosity on students' high-level thinking skills aims for teachers to be able to determine the appropriate learning model for students from the classification of curiosity results. If students have high curiosity, they are advised to use Problem Based Learning (PBL) and students who have low curiosity are advised to use Direct Learning.

In supporting the learning process teachers have an important role. In science learning, students need a comprehensive understanding in order to be able to understand the material. Teachers are one of the components in students' success in teaching and learning activities. Teachers have professional skills in using appropriate learning models. Teachers as educators must also master the material presented, be good at creating interesting teaching situations and conditions in delivering learning material.

One of the materials that can stimulate students to be more interested in the learning material presented by the teacher and train students to be more creative is the Problem Based Learning (PBL) learning model. The

Problem Based Learning learning model is useful for developing material and curiosity about student learning so that participants Students can obtain material information more quickly by exchanging ideas with their friends. The Problem Based Learning (PBL) learning model is also a technique for solving natural science (science) problems quickly and projecting the problems faced in the form of natural science (science) questions so that students understand them more easily.

Students' curiosity is very low, affecting their mindset in learning. So that several stages in the learning model which should be good for improving students' high-level thinking skills have not been able to achieve the Criteria for Completion of Learning Objectives.

5. ACKNOWLEDGE

Based on the results of the research conducted, the researchers put forward several suggestions as follows:

1. For teachers, to improve students' high-level thinking skills in Natural Science (Science) subjects, teachers should carry out initial tests to determine students' characteristics and motivation in learning. So that differentiated learning can be carried out using fun and appropriate learning models.
2. School leaders as managers in educational units should support efforts to improve science learning both morally and materially for teachers so that teachers are able to develop their teaching abilities.
3. Next researchers, considering that these high-level thinking skills have not been widely researched, especially in science lessons, further research will be further developed with the latest learning models and adapted to the latest curriculum.

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