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MASTERY OF THE CONCEPT OF GLOBAL WARMING WITH SEARCH, SOLVE, CREATE AND SHARE LEARNING MODEL INTEGRATED MIND MAPPING

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Abstract : *Search, Solve, Create, and Share is a learning model that guides students to the process of solving problems. With this Search, Solve, Create, and Share learning model, students can train creative thinking skills to be able to expand or search for ideas independently. This study was conducted to see the difference in mastery of the concept of students who use the Search, Solve, Create, and Share learning model and conventional learning on global warming material. This study was designed with Posttest-Only Control Design. The samples used were class XI IPA 1 as an experimental class with an integrated Search, Solve, Create, and Share learning model Mind Mapping and XI IPA 2 as a control class with conventional learning. The results of the t-test show that there are differences in mastery of the concepts of students who apply the Search, Solve, Create, and Share learning model integrated with Mind Mapping with control classes that apply conventional learning.. The conclusion of this study is that there are differences in mastery of the concepts of students who apply the Search, Solve, Create and Share learning model integrated with Mind Mapping with students who apply conventional learning, and mastery of the concepts of students who apply the Search, Solve, Create, and Share learning model better than the control class with conventional learning.*
Keywords : *Global Warming; Learning Model; Integrated Mind Mapping.*

Abstrak : *Search, Solve, Create, dan Share merupakan model pembelajaran yang membimbing siswa dalam proses menyelesaikan masalah. Dengan model pembelajaran Search, Solve, Create, dan Share ini, siswa dapat melatih keterampilan berpikir kreatif untuk dapat mengembangkan atau mencari ide secara mandiri. Penelitian ini dilakukan untuk melihat perbedaan penguasaan konsep siswa yang menggunakan model pembelajaran Search, Solve, Create, dan Share serta pembelajaran konvensional pada materi pemanasan global. Penelitian ini dirancang dengan Desain Kontrol Post-Test Saja. Sampel yang digunakan adalah kelas XI IPA 1 sebagai kelas eksperimen dengan model pembelajaran terintegrasi Search, Solve, Create, dan Share dengan Mind Mapping, dan kelas XI IPA 2 sebagai kelas kontrol dengan pembelajaran konvensional. Hasil uji t menunjukkan adanya perbedaan dalam penguasaan konsep siswa yang menerapkan model pembelajaran Search, Solve, Create, dan Share yang terintegrasi dengan Mind Mapping dengan kelas kontrol yang menerapkan pembelajaran konvensional. Kesimpulan dari penelitian ini adalah terdapat perbedaan dalam penguasaan konsep siswa yang menerapkan model pembelajaran Search, Solve, Create, dan Share yang terintegrasi dengan Mind Mapping dengan siswa yang menerapkan pembelajaran konvensional, dan penguasaan konsep siswa yang menerapkan model pembelajaran Search, Solve, Create, dan Share lebih baik daripada kelas kontrol dengan pembelajaran konvensional.*
Kata Kunci : *Pemanasan Global; Model Pembelajaran; Mind Mapping Terintegrasi.*

INTRODUCTION

Learning is the process of developing and storing information carried out through activities designed in such a way as to facilitate the delivery of specific learning objectives. Basically, learning is also an interaction that is considered positive between educators and students and also between students and other students. To achieve these learning objectives, it is necessary to choose the right and effective learning model (Husna, 2023). There are many learning models that can be applied to create a variety of good interaction and communication between students and educators, but not all learning models applied are in accordance with the characteristics of students and subject matter.

Physics is the most fundamental science, because it deals with the behavior and structure of objects. Physics can also be interpreted as a science that discusses natural and surrounding phenomena. Physics is also part of natural science (science) derived from the results of research and studies of natural phenomena carried out by scientists through the scientific process. The scientific process itself involves observation, data collection, analysis, and verification of natural data and phenomena.

The concept of "The nature of science" as outlined by Razak (2016) encompasses three significant aspects; 1) In this perspective, science is regarded as a collection of facts, concepts, principles, laws, formulas, theories, and models delivered to students in the form of learning materials. This includes topics, sub-topics, subject matter, and teaching materials that form the core of the science subject taught to students; 2) Science is considered a series of processes involving observation, measurement, experiments, investigations, and publications. These processes lead to the development of Science Process Skills (SPS), which are integral to learning. Teachers are tasked with teaching and guiding students through these processes to train them to explore, analyze, and develop knowledge in the future, and; 3) Science as an Attitude. The most critical part of science is the scientific attitude that scientists must possess. This encompasses an objective approach, honesty, openness to accepting others' opinions, great curiosity, trust, and a commitment to conducting experiments or investigations. This attitude serves as the foundation for carrying out appropriate scientific processes and for communicating findings to others (Mukaffan., et al, 2023). Overall, understanding the nature of science as a product, process, and attitude as depicted is crucial in forming a comprehensive understanding of how science is viewed, learned, and applied in education and research.

Physics is one branch of natural science (IPA) that studies natural events and is related to how to find out nature systematically in the form of discovery, mastery, and collection of knowledge. This knowledge includes facts, concepts, or principles, as well as the process of further development in applying knowledge in everyday life. In physics learning, students are also directed to find out so that they can help to gain deeper mastery of concepts (Depdiknas, 2006).

In physics learning is also directed to find out so that it can help students to gain deeper mastery of concepts (Permendiknas, 2006 No 22). The purpose of learning physics is to master physics concepts so that they can be applied in everyday life, this is in accordance with the objectives of the 2006 Minister of National Education No. 22. Mastery of concepts is defined as the ability of students to apply the knowledge they have just gained to phenomena or events that occur in everyday life (Zuhdi Ma'aruf 2022:3). Mastery of concepts is very important for students because it is an indicator that students have fully understood what has been taught, not just memorizing. So that later mastery of this concept can help students in solving problems, not only in the learning process but also in everyday life.

According to Bloom, Benjamin S. (1956) in Nurita *et al*. (2022) Mastery of concepts is the ability to capture meaning such as expressing a material presented in applying it. Cognitive Domain is a domain that includes mental activities (brain) for the abilities possessed by a learner can be seen in Table 1 (Handayani, 2020).

Table 1: Data Indicators of Mastery of Student Concepts

No	Cognitive Domain	Description
1	C1 (*Knowledge*)	The ability of learners to be able to draw conclusions back to stored information.
2	C2 (*Understanding*)	The ability of students to construct meaning or understanding based on their initial knowledge.
3	C3 (*Application*)	The ability of students to use a procedure in order to solve problems or do their tasks.
4	C4 (*Analysis*)	The ability of learners to decompose a problem or object to its elements and determine how they relate between those elements.
5	C5 (*Evalution*)	The ability of learners to combine several elements into a form of unity.

One of the important outputs of learning physics is mastering physics concepts as a whole. Mastery of concepts is very important for students because it is an indicator that students have fully understood what has been taught, not just memorizing. So that mastery of this concept can help students to solve problems that are not only in school. Based on student value data, it shows that students' ability to master concepts is still low. Mastery of concepts is very important because students not only understand simply, but students are required to have the ability to apply, analyze, and evaluate physical phenomena in everyday life (Hermawanto *et al.*, 2013; Silaban, 2014). This is one of the problems faced by teachers in learning physics. Mastery of the concepts of students in one material is related to other materials.

The implementation of the physics learning process, mastery of student concepts is also focused on activeness in learning and the teacher's ability to create varied learning patterns or models. A learning model is a design or pattern that is used as a guideline in designing learning in the classroom. The purpose of the learning model is to help learners acquire skills, values, ways of thinking, and how to express themselves and also to teach them how to learn. The learning model can also be interpreted as a framework that provides a systematic picture to carry out the learning process in order to be able to help students learn in certain goals to be achieved. Learning models are also used so that learning can be understood by students with a pleasant learning atmosphere.

In this case, the teacher is very influential to help students achieve predetermined learning goals. According to Khotimatul (2023) that there is a teacher's effort in learning to be able to help students understand the material so that learning objectives are met. One way that is considered to be able to overcome problems in the learning process is by forming small groups in the classroom and student-centered learning. According to Igidius, B., *et al.* (2015), cooperative learning, where this learning students can work together in small groups, consisting of 4-6 students who have different abilities and help each other in learning. Cooperative learning itself is a learning strategy that involves students working collaboratively to achieve common goals. Cooperative learning is structured in an effort to increase student participation, facilitate students with experience of leadership attitudes and make decisions in groups and provide opportunities for students to interact and learn together from different backgrounds (Hasanah and Himami, 2021).

Cooperative learning is what will provide opportunities for students to learn with fellow students in structured tasks. Through cooperative learning, a student will become a source of learning for other friends. So cooperative learning is developed on the basis of the assumption that the learning process will be more meaningful if learners can teach each other. This cooperative learning model that has the potential to increase student activeness in acquiring concepts is the Search, Solve, Create, and Share learning model. This learning model has simpler steps.

The Search, Solve, Create, and Share learning model is a learning model that directs a problem-solving process by developing problem-solving abilities designed to develop and apply concepts of science and critical thinking skills. This learning model also involves students in every stage. In the implementation handbook by Pizzini explains that there are four steps can be seen in Table 2 (Parno, 2015).

Table 2: Search, Solve, Create, and Share Learning Model Steps

Phase	Activities Performed
Search	1. Understand the problems given to learners, in the form of what is known, what is unknown, and what is asked. 2. Conduct observations and investigations into these conditions. 3. Make small questions. 4. As well as analyzing existing information so that a set of ideas is formed.
Solve	1. Analyze and implement plans to find solutions. 2. Develop critical thinking and creative skills. 3. Form a hypothesis which in this case is an alleged answer. 4. Choose a method to solve the problem. 5. Collect data and analyze.
Create	1. Creating a product in the form of a problem solution based on the guesses that have been selected in the previous phase. 2. Test the conjectures made whether they are true or false. 3. Display the results as creatively as possible and if necessary learners can use graphics, posters or models.
Share	1. Communicate with teachers, group mates and other groups in class meetings, to communicate solutions to problems. Students can use recorded media, videos, posters, and reports. 2. Express their thoughts, receive feedback and evaluate solutions.

According to Anggraini *et al*. (2023) This learning model has the advantage of providing opportunities for students to develop problem-solving skills. The Search, Solve, Create, and Share learning model has four stages in the problem-solving step, namely the Search, Solve, Create, and Share phases. This Search, Solve, Create, and Share model can provide opportunities for students to explore ideas independently, requires students to be able to write solutions with systematic completion steps, and requires participants to actively discuss during the learning process.

The opportunity in the Search, Solve, Create, and Share learning model for students is that in order to expand or search for ideas independently, students are required to create and produce solutions from the ideas they get with systematic completion steps. In this case, it can also encourage students to be active in discussing during the learning process and be able to explain their ideas to others. The Search, Solve, Create, and Share learning model is a learning model that directs a problem-solving process by developing problem-solving abilities designed to develop and apply concepts of science and creative thinking skills. In the learning process to improve the ability to master concepts, students need to be trained to think creatively, namely by organizing material in the form of concept mapping. According to Widia *et al*. (2020), the ability of students to think can be trained by grouping material in the form of Mind Mapping.

Mind mapping or mind maps are a creative way for individual learners to provoke ideas to record things learned or plan new projects. Mind Mapping can also be referred to as a route map that uses memory, making students able to arrange facts and thoughts in such a way that the natural workings of the brain will be seen from the beginning so that remembering information will be easier than using traditional note-taking techniques. Mind Mapping is a form of learning used to train the ability to present material content with mind mapping or categorized in creative note-taking techniques, because making Mind Mapping requires the use of imagination (Ridwan, 2014). According to Ristiasari, Tia., *et.al.* (2012) explained that Mind Mapping is able to improve students' ability to think because it can advance and develop the working potential of the brain, so that attention is focused on subjects that are able to develop ways of organizing thoughts in detail and with this Mind Mapping students are also able to reconstruct the information that has been obtained. In addition to improving mastery of the concept, Mind Mapping can also improve the skills of students to think creatively. According to Suhada *et al.* (2020) the achievement of creative thinking of students who use the Mind Mapping model is better than students who use conventional models. Based on the description of the problem above, research on mastery of concepts in global warming material for grade XI students of SMA N 15 Pekanbaru with the Search, Solve, Create and ShareIntegrated Mind Mapping model is considered necessary to be carried out.

METHOD

This research is a quasi-experimental research that serves to determine the effect of experiments or treatments on the desired characteristics of the subject. The research design used in the study was posttest-only control design. This design is a design in which there are two groups, namely the experimental class and one control class (Creswell, 2015). This research was carried out at SMA N 15 Pekanbaru and the implementation time was in the even semester of the 2022/2023 academic year in May-June. The population of this study was 104 students in class XI science. Sampling in this study was randomized after normality tests and homogeneity tests. The research sample consisted of class XI Science 1 as an experimental class with a total of 36 students and class XI Science 2 as a control class with a total of 36 students.

The independent variable in this study is the Search, Solve, Create, and Share learning model integrated with Mind Mapping and for the dependent variable is the mastery of the concept of learners. The research instrument used is a test instrument (posttest) in the form of multiple-choice questions with a total of 15 questions. Posttest questions are arranged based on indicators of mastery of concepts which include C1 (Remembering), C2 (Understanding), C3 (Applying), C4 (Analyzing), and C5 (Evaluating). Data collection in this study by providing a learning outcome test (posttest), where after all learning process activities are carried out, a posttest is carried out as the final result. Posttest is given to classes whose learning process uses the integrated Search, Solve, Create, and Share learning model Mind Mapping and classes that use conventional learning. The data obtained from the study was then processed using descriptive analysis and inferential analysis and continued with an independent sample t-test with the help of SPSS 25 software.

Table 3: Interpretation of Student Concept Mastery

Category Acquisition Scale (%)	Criterion
$X \geq 90$	Very High
$80 \leq X < 90$	Tall
$70 \leq X < 80$	Keep
$60 \leq X < 70$	Low
$X < 50$	Very Low

Table 3 interpretation of mastery of concepts to calculate the comparison of the mastery score obtained by students against the maximum score applied. The interpretation of Table 3 involves assessing the mastery of concepts by calculating the comparison between students' mastery scores and the maximum possible score. This analysis aims to evaluate how well students have comprehended and internalized the concepts taught in the study. By comparing students' achieved mastery scores against the maximum attainable score, it allows for an understanding of the extent to which students have grasped the concepts taught. This comparison offers insights into the proficiency level of students in mastering the subject matter, indicating whether they have reached, exceeded, or fallen short of the maximum score attainable, which serves as a benchmark for comprehensive understanding of the concepts.

RESULT AND DISCUSSION

The presentation of research results consists of two kinds of analysis, namely descriptive analysis and inferential analysis. Descriptive analysis consists of mastering concepts and inferential analysis consists of hypothesis testing. The results of the analysis are as follows:

1. **Descriptive Analysis**

   This study used a type of Quasi-Experimental research with a posttest only design. The data analyzed in this study are data from mastery of the concepts of experimental class students and control classes on global warming material. Data on the results of mastery of student concepts are obtained from posttest results conducted after applying the Search, Solve, Create, and Share learning model integrated Mind Mapping and conventional learning.

Mastery of the concept of students, in this study seen from the results of posttest score analysis for each indicator on global warming material in the experimental class and control class which can be seen in Table 4.

Table 4: Results the Students' Concept Mastery Score for Each Indicator

Concept Mastery Indicators	Experimental Class		Control Class	
	Posttest Score	Category	Posttest Score	Category
C1 (Remember)	95,37	Very High	88,88	Tall
C2 (Understand)	87,04	Tall	96,29	Very High
C3 (Applycation)	83,33	Tall	74,07	Keep
C4 (Analyze)	69,44	Low	63,19	Low
C5 (Evaluate)	69,48	Low	59,72	Very Low
Rata – Rata	**80,93**	**Tall**	**76,43**	**Keep**

Based on the results of the concept mastery score in Table 4, it can be seen that each indicator of concept mastery in the experimental class is higher than the control class. From the scores obtained, it can also be said that the experimental class is in the high criteria, while the control class is in the medium criteria. The results showed that there was a difference between the experimental class and the control class. This is due to the different treatments given to experimental classes that apply the integrated Search, Solve, Create, and Share learning model Mind Mapping and control classes apply conventional learning models. From the average score obtained between the two classes, it can be seen that the experimental class has a better average score of mastery of concepts compared to the control class.

Based on the analysis of concept mastery data for each indicator in the control class and experimental class, there are differences. This can also be seen from the posttest chart between the two classes in figure 1 as follows:

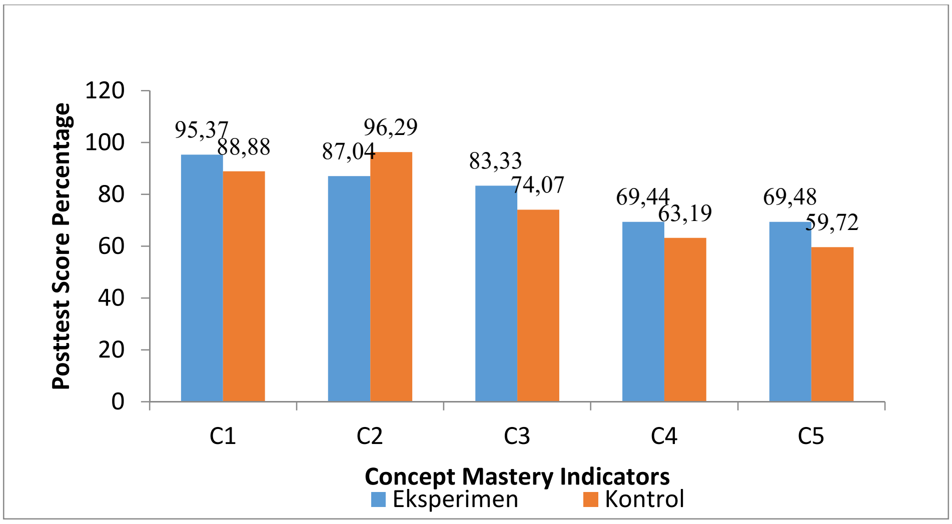

Figure 1: Posttest Score Percentage Graph of Each Concept Mastery Indicator

In the graph of figure 1, it can be seen that each percentage of mastery of concepts is different in each class. Mastery of this concept is the ability of students to overcome concepts at the level of cognitive development of students according to Bloom's revised classification (Handayani, 2020). The explanation for each indicator is as follows;

Table 5: Bloom's Revised Classification

Level	Explanation
Level C1 (Remembering)	It can be seen that the experimental class has a higher average than the control class by 6.49%. This shows that both classes have good memories in remembering the concept of global warming from the Search, Solve, Create, and Share integrated learning process of Mind Mapping and conventional learning. The results of this study are in line with research conducted by (Safirah, 2018:259) where the remembering indicator (C1) is on high criteria
Level C2 (Understanding)	It can be seen that the control class has a higher average than the experimental class by 9.25%. At this C2 cognitive level, the control class is higher. At the C2 cognitive level, the control class is better than the experimental class in understanding the material of the concept of global warming delivered by the teacher with the problems contained in the C2 cognitive problem

Level C3 (Applying)	It can be seen that the experimental class has a higher average than the control class by 9.26%. The results of C3 cognitive ability (applying) in relating every problem that causes global warming found in everyday life, namely by not burning piles of garbage but by burying the garbage, are good enough from going through the learning process with the Search, Solve, Create, and Share learning model. This is in line with (Iftitah, 2017:76) which states that the ability of students to apply concepts to solve C3 problems is quite good
Level C4 (Analyze)	It can be seen that the experimental class has a higher average than the control class by 6.25%. The problem applied to mastering this concept is analyzing greenhouse gases that cause an increase in oxygen. Mastery of the concept of analytical thinking is the ability to identify the correct conclusion relationship between statements, concepts, images or other forms that represent so that they can provide a belief, opinion, experience, reason, information, or opinion on a problem. Learning Physics requires the ability to analyze, because there are many types of problems that require analytical thinking to solve problems
Level C5 (Evaluate)	it can be seen that the experimental class has a higher average than the control class by 9.76%. The ability to evaluate is an activity to assess the value of an idea, creation, or method (Puccio, 2011). This explains that someone who masters the concept of evaluation is able to creatively describe the right ideas and methods in solving problems and problems and this is reflected in the posttest results. Mastery of evaluation is one of the abilities to be able to criticize an argument and provide an assessment of solutions (Hammod, 2020)

Based on the posttest value of mastery of concepts obtained by students, the learning model in the experimental class is in the high category and the control class is in the medium category and the discussion that has been described can be said that the application of the Search, Solve, Create and Share Integrated Mind Mapping learning model on global warming material can provide a difference in students' mastery of concepts to be increased and more effective than classes that apply Conventional learning. In line with research conducted by Johan (2014), research results were obtained that there was an increase in mastery of the concepts of students who participated in Model Search, Solve, Create and Share (SSCS) learning significantly higher than students who followed conventional learning. This can also be seen from the analysis of inferential data previously carried out normality tests and homogeneity tests to conduct hypothesis tests.

Data from this study include data on the results of instrument validation (question quality test), data on the results of cognitive style tests, data on pretest-posttest results, and data on the results of hypothesis testing. The number of sample members in each school can be seen in Table 6.

Table 6: Data on Number of Sample Members

Class	Treatment	Number of Students	Percentage
XI MIPA-1 Kraksaan	PBL with team assisted individualization	32	25 %
XI MIPA-2 Kraksaan	PBL with think pair share	32	25 %
XI MIPA-1 Paiton	PBL with team assisted individualization	33	25 %
XI MIPA-2 Paiton	PBL with think pair share	33	25 %
Total		130	100

Based on table 6, the number of sample members is the same in one school, and the number of sample members differs for different schools. The total number of sample members in this study was 130 students. At the time of the implementation of learning that applies the learning model in research in class XI Mathematics and Natural Sciences (MIPA), a test of the quality of the questions is carried out, which includes validation, reliability, difficulty level, and differentiating power on the question instrument. The instrument questions are in the form of multiple-choice acid-base questions of as many as 25 items. The research subjects for this validation test were 30 students of class XII

Mathematics and Natural Sciences (MIPA) SMAN Paiton Probolinggo East Java Indonesia. The results of the instrument validation can be seen in Table 7.

Table 7: Results of Instrument Item Analysis

Question Quality	Value	Category
Validity	0,89	Very High
Reliability	0,94	Very High
Level of Difficulty	92 % moderate	Problem Moderate
Distinguishing Power	6,82	Acceptable

Based on Table 7, the research instrument includes a very valid and highly reliable category. The difficulty level of the question is moderate, so this research instrument is suitable for use as a pretest and posttest. The following research sample was given a cognitive style test or thinking style. The results of the cognitive style test can be seen in Table 8.

Table 8: Results of Cognitive Style Test in Learning Model Group

Cognitive Style	Learning Model		Total
	PBL with team assisted individualization	PBL with think pair share	
Field Independent (FI)	38	37	75
Field Dependent (FD)	27	28	55
Total	65	65	130

Table 8 shows that of the 130 students as a sample of research obtained, 75 students with cognitive style Field independent and 55 students field dependent. In the next stage, after the research sample gets the cognitive test, students do a pretest test and finish learning, then do a post-test. Post-test results are research data that will be tested for normality and homogeneity as a condition for conducting a two-way ANOVA test. The results of the pretest and post-test can be seen in Table 9.

Table 9: Pre-test and Post-test Results

Group	*Pre-test*			*Post-test*		
	Min.	Max.	Average	Min.	Max	Average
Control (PBL with team assisted individualization)	16	72	46,34	56	92	73,23
Experiment (PBL with think pair-share)	12	80	45,11	56	96	76,80

Based on the pretest and posttest data in Table 9, initially, the experimental group, before being given the treatment of applying the combination learning model, had a lower pretest average value than the control class. However, after being given treatment in each sample class with a different combination learning model, the average value of posttest learning outcomes of the experimental class (problem-based learning with think pair share combination) is greater than the control class (problem-based learning with team-assisted individualization combination).

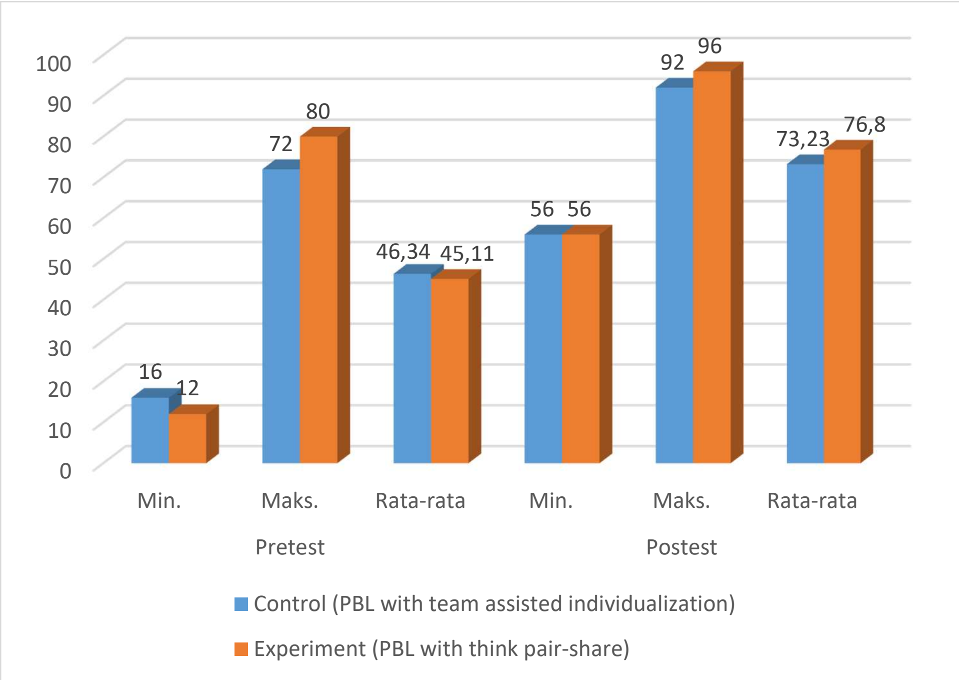

Figure 2: Histogram of Comparison of Pre-test and Post-test Results in Different Groups

The results of post-test data analysis using the SPSS version 25 program can be seen in Table 10.

Table 10: Results of Descriptive Analysis of Post-test Data

Learning Model	Cognitive Style	Mean	Standard Deviation	Number Sample
PBL_TAI	*Field Independent* (FI)	75.58	8.763	38
	Field Dependent (FD)	69.93	8.105	27
	Total	73.23	8.886	65
PBL_TPS	*Field Independent* (FI)	77.51	8.608	37
	Field Dependent (FD)	75.86	9.268	28
	Total	76.80	8.866	65
Total	*Field Independent* (FI)	76.53	8.683	75
	Field Dependent (FD)	72.95	9.140	55
	Total	75.02	9.021	130

The results of descriptive analysis of posttest data (acid-base learning outcomes) in Table 10 explain that in the problem-based learning with team-assisted individualization combination learning model, the average value of the posttest of students with cognitive field independent (FI) style is 75.58 greater than the average value of the posttest of students with cognitive field dependent (FD) style of 69.93. The average posttest value of students with a cognitive field independent (FI) cognitive style of 77.51 in problem-based learning with a think-pair-share combination learning model is greater than that of students with a cognitive field dependent (FD) cognitive style of 75.86.

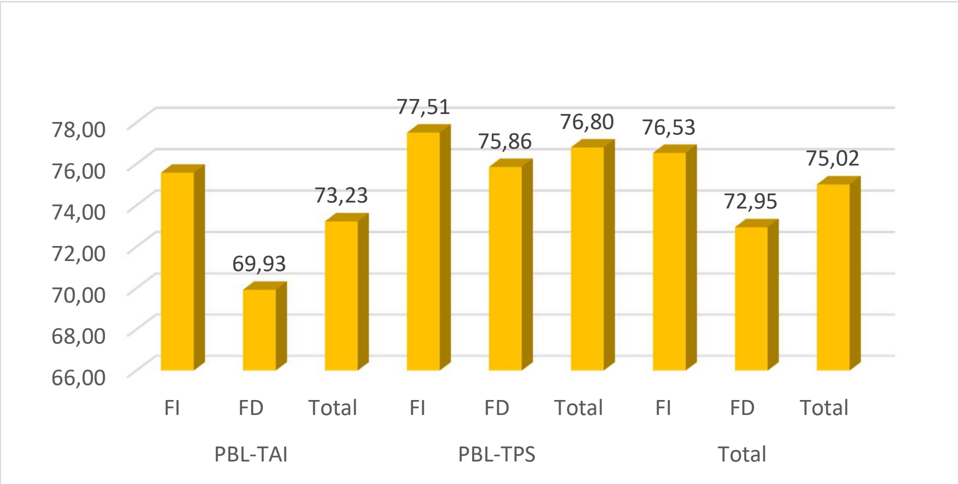

Figure 3: Histogram of Comparison of Post-test Mean Values Based on Cognitive Style and Learning Model

Research hypothesis testing includes testing to determine the effect of independent variables and moderator variables and to determine the interaction effect of independent variables and moderators on the dependent variable. Before hypothesis testing, prerequisite tests must be carried out which include normality test and data homogeneity test. Testing the normality of the data in this study using the Kolmogorov-Smirnov normality test. This data normality test includes data normality testing based on the learning model. The results of normality testing can be seen in table 11.

Table 11: One Sample Kolmogorov-Smirnov Test

		PBL with team assisted individualization	PBL with think pair share
N		65	65
Normal Parameters[a.b]	Mean	72,23	76,80
	Std. Deviation	8,886	8,866
Most Extreme Differences	Absolute	,107	,098
	Positive	,107	,098
	Negative	,085	,087
Test Statistic		,107	,098
Asymp. Sig. (2-tailed)		.064	,200

a. Tes distribution is normal

b. Calculated from data

Table 11, as above, shows the significance value of 0.064 in the problem-based learning with team-assisted individualization combination group is greater than the significance level value (α = 0.05), and the significance value of 0.200 in the problem-based learning with think pair share combination group is also more significant than the significance level value (α = 0.05). The data concluded that both control and experimental classes had a normal data distribution in both sample groups. This means that the research data (posttest) has met the first requirement to go to the data hypothesis test. Data homogeneity test results based on the learning model and cognitive style can be seen in Table 12.

Table 12: Homogeneity Test Results Based on Learning Model and Cognitive Style

	Levene Statistic	df1	df2	Sig.
Acid-Base Learning Results	,198	3	,126	,898

The post-test data tested for normality and homogeneity is then tested using two-way ANOVA to test the hypothesis of this study. The results of the two-way ANOVA test can be seen in Table 13.

Table 13: The Results of the Two-way ANOVA

Source	Type III Sum Of Squared	df	Mean Square	F	Sig.
Corrected Model	962.182[a]	3	320.727	4.238	.007
Intercept	708411.848	1	708411.848	9360.517	.000
Learning Model	490.669	1	490.669	6.483	.012
Cognitive Style	423.709	1	423.709	5.599	.019
Learning Model * Cognitive Style	126.677	1	126.677	1.674	.198
Error	9535.787	126	75.681		
Total	742048.000	130			
Corrected Total	10497.969	129			

a. R squared = 092 (Adjusted R squared =.070)

Table 13 shows the R squared value of 0.092, which means 9.2% of the strength of the relationship between the independent and dependent variables. The test results also showed an F value of 6.483 and a significant value of 0.012 for the effect of the learning model factor on learning outcomes. F value of 5.599 and a significance value of 0.019 for the influence of cognitive style factors on learning outcomes. F value of 1.674 and a significance value of 0.198 for the effect of the interaction factor of learning model and cognitive style on learning outcomes.

2. The Difference in Acid-Base Learning Outcomes between the Problem Based Learning with Team-Assisted Individualization Combination Learning Model Group and the Problem-Based Learning With Think Pair-Share Combination Learning Model Group

Based on the data in table 8, then for the first hypothesis test obtained the value of FA = 6.483. This value will be compared with the F table value for the significance level α = 0.05, namely F (0.05;1;128) = 3.92 and the significance value (sig) = 0.012. So the value of FA = 6.483 is greater than the value of Ftable = (3.92) with significance = 0.012 less than 0.05 so that H0A is rejected and H1A is accepted. This significance value of 0.012 is the conclusion of the fact that there is a difference between the mean value of the pretest and the mean value of the posttest in the experimental and control groups. In the experimental group, the mean value of the pretest was 45.11 and the posttest was 76.80. While in the control group the average value of the pretest was 46.34 and the posttest was 73.23. Overall, the average value of student learning outcomes in the experimental class (problem based learning with think pair share combination) is 76.685 greater than the average value of student learning outcomes in the control class (problem based learning with team assisted individualization combination).

At the time of the pretest the control class had an average value greater than the experimental class but for the posttest average value the experimental class was greater than the control class. The reference for learning success uses the last learning outcome or posttest after students get the material as a whole and treatment in the form of applying a combination learning model. This is evident for the experimental class or group of students who use the problem based learning with think pair share combination learning model is superior to the control class or group of students who use the problem based learning with team assisted individualization combination learning model. The superiority of learning outcomes of the experimental group (problem based learning with think pair share combination) can be seen in Figure 4.

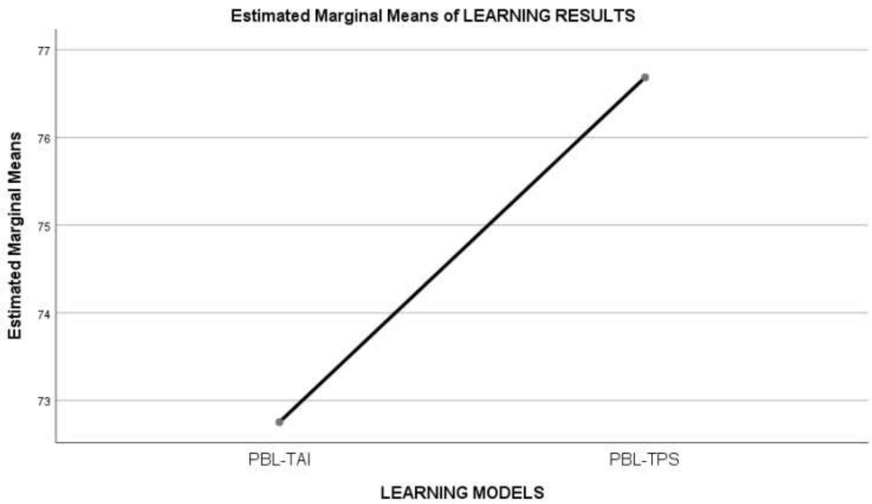

Figure 4: Plot Graph of the Effect of Learning Model on Learning Outcomes

In the analysis of the first hypothesis, the learning outcomes of students show optimal in the group of students who get learning with a combination of problem based learning with think pair share models than the group of students who get learning with a combination of problem based learning with team assisted individualization models. This means that through the application of the problem based learning with think pair share model combination, students more easily understand the acid-base solution material both for concepts and calculations. Classical sharing activities in the problem based learning with think pair share group are more effective. While in the problem based learning with team assisted individualization study group the learning outcomes were lower due to less optimal group work through peer tutors. This can happen if the tutor or friend who is considered to have more ability in the group is unable to make his friends understand and understand the concepts and calculations. This inability is due to too little or limited time that cannot understand his friends whose abilities vary. So, in problem based learning with team assisted individualization groups the number of group members must also be considered to adjust to the time allocation during learning. It is better to have a group of three children. One tutor helps two children. It is more optimal than one tutor holding or teaching three children so that it does not become a burden. In problem based learning with think pair share learning groups in one group there are only two children or one pair so that group work is more optimal and reinforced by explanations from classical sahring/sharing sessions through presentations.

The results of this study are in line with previous studies, among others: Amelia (2019) stated that the use of the PBL learning model combined with the TPS model had an influence on the understanding of the mathematical concepts of grade IV students on the material of Equivalent Fractions and Fractional Forms at MIN 11 Bandar Lampung. Learning using the PBL approach with the TPS type coopertaif learning model has the best effect on improving problem solving skills and self confidence (Sugiarti & Dewanti, 2018). There was an increase in the percentage of automotive electrical learning outcomes in cycle II as a result of the application of the combined PBL and TPS learning model (Hardiyan, 2014). There is an effect of the application of the Think Pair Share learning model on student learning outcomes for class IV SDN 77 Kota Tengah Kota Gorontalo (Rivai & Mohamad, 2021). Based on the results of research conducted by Wirevenska et al (2022), it was concluded that there was a comparison of the TPS and PBl learning models on students' mathematical communication for the material on the system of linear equations of three variables, each of which obtained an average value of 81.78 and 81.10.

3. The Difference in Acid-base Learning Outcomes Between Groups of Students Who Have a Field Dependent Cognitive Style and a Field Independent Cognitive Style

The results of the second hypothesis test obtained FB value = 5.599. This value will be compared with the Ftable value for the significance level α = 0.05 (α = 5%), namely

F (0.05; 1; 128) = 3.92 and the significance value (sig) = 0.019. So FB = 5.599 is greater than Ftable = (3.92) with significance = 0.012 smaller than 0.05 so that H0B is rejected and H1B is accepted. The existence of this difference is based on the average value of learning outcomes of students with cognitive field independent (FI) style of 75.58 and the average value of learning outcomes of students with cognitive field dependent (FD) style of 69.93 in the control class (problem based learning with team assisted individualization combination). In the experimental class (PBL_TPS combination) students who are cognitive field independent (FI) have an average value of learning outcomes of 77.51 and students who are cognitive field dependent (FD) have an average value of learning outcomes of 75.86.

Overall, the differences in learning outcomes of students based on cognitive style resulted in an average value of learning outcomes of students who have cognitive style field independent (FI) of 76.53 and the average value of learning outcomes of students who have cognitive style field dependent (FD) of 72.95. These results can be seen in Figure 5.

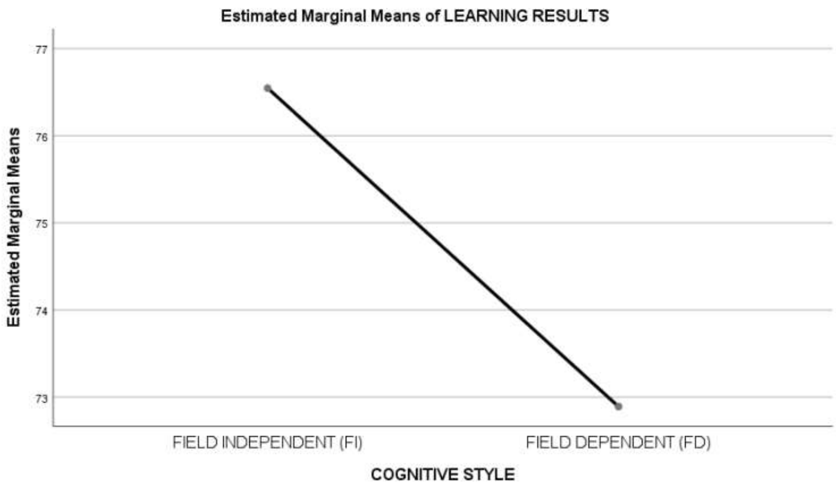

Figure 5: Plot Graph of the Effect of Cognitive Style on Learning Outcomes

On the results of the analysis of the second hypothesis shows the group of students who have cognitive style field indepedndent obtain higher learning outcomes than the group of students who have cognitive style field dependent. We know in this study obtained the number of students who have a cognitive style field independent higher than the group of students field depedndent both in problem based learning with think pair share study group and problem based learning with team assisted individualization study group. This is directly proportional to the expertise or specialization of students in the field of Mathematics and Natural Sciences which emphasizes and accustoms students to have the ability to analyze and independent, independent in learning. This potential also influences the acquisition of learning outcomes. As a result in the group of learners who have a cognitive style field independent remain superior in the learning group with the application of different learning models.

Based on these data it can be concluded that there is a significant difference in the learning outcomes of students who have a cognitive style field independent (FI) with students who have a cognitive style field dependent (FD). The results of this study are in line with the results of research which states that the group of students with field independent cognitive style has better mathematical reasoning ability than the group of students with field dependent style (Mirlanda & Pujiastuti, 2018). Learners with a field independent thinking style are able to use spatial reasoning and represent well than field dependent participants who have not been able to apply spatial reasoning as well as not being able to represent appropriately (Utomo & Pujiastuti, 2020).

4. The Interaction of Student Learning Outcomes With Learning Models and Cognitive Styles

Based on table 8. the results of the third hypothesis test obtained the value FA = 1.674. This value will be compared with the Ftable value for the significance level α = 0.05 ($^{\alpha}$ = 5%), namely F (0.05;2;127) = 3.07 and the significance value (sig) = 0.19. So FA = 1.674 is greater than Ftable = (3.07) with a significance of 0.198 greater than 0.05 so that H0C is accepted and H1C is rejected. This means that the two variables studied do not produce a significant combination effect. Based on these data it can be concluded that there is no interaction of student learning outcomes with a combination of problem based learning with team assisted individualization learning model, problem based learning with think pair share combination and cognitive style field independent (FI) and cognitive style field dependent (FD).

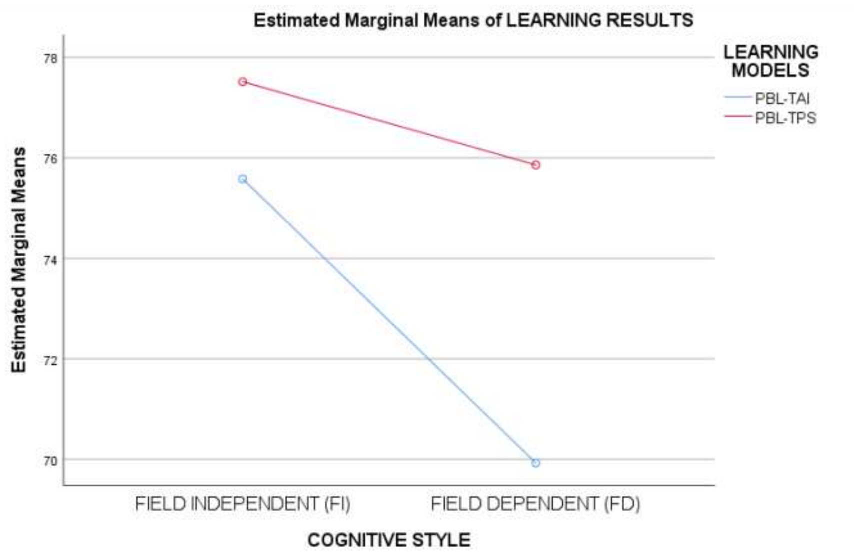

Figure 6: Graph of the Interactive Effect of Learning Model and Cognitive Style on Acid-Base Learning Outcomes

From the plot graph in Figure 6, displays two lines that are separate or not intersecting which indicates that there is no interaction on two variables, namely the learning model variable and the cognitive style variable in influencing student learning outcomes. The red line or problem based learning with think pair share combination learning model occupies a position above the blue line or problem based learning with team assisted individualization combination learning model. It shows that the use of problem based learning with think pair share combination learning model is more effective than problem based learning with team assisted individualization combination learning model. In the plot graph also shows students who have a cognitive style field independent (FI) with the treatment of problem based learning with think pair share combination learning model obtained higher learning outcomes than students who have a cognitive style field dependent (FD). Learners who have a cognitive style field independent (FI) and get a combined learning model treatment problem based learning with team assisted individualization also obtained learning outcomes superior to students who have a cognitive style field dependent (FD). Thus students who have a cognitive style field independent (FI) obtained superior learning outcomes in both the control class (problem based learning with team assisted individualization combination) and the experimental class (problem based learning with think pair share combination) than students who have a cognitive style field dependent (FD). Based on the results of the above analysis shows in this research sample students obtained posttest learning outcomes are not influenced by the absence of interaction between the application of a combination learning model with cognitive style.

CONCLUSION

Based on the results of data analysis and discussion, three conclusions can be drawn; 1) There is a significant difference in the learning outcomes of acid-base solutions between the group of students who received the problem based learning with team assisted individualization combination learning model and the group of students who received the problem based learning with Think Pair Share combination learning model. This indicates that the teaching method used significantly influences the students' learning outcomes in the context of acid-base solutions; 2) There is a difference in the learning outcomes of acid-base solutions between the group of students who have a Field Dependent cognitive style and the group of students who have a Field Independent cognitive style. This suggests that students' cognitive styles also play a crucial role in their learning outcomes in the topic of acid-base solutions; and, 3) There is no significant interaction between the application of the PBL with TAI learning model, the PBL with Think Pair Share learning model, and cognitive style on the learning outcomes of acid-base solutions. This means that the influence of each of these factors on the learning outcomes of acid-base solutions does not significantly affect each other. In other words, students' cognitive style does not moderate the impact of the learning model on their learning outcomes in this topic.

These conclusions help us understand that in the context of learning about acid-base solutions, the choice of the learning model can have a significant impact on students' learning outcomes, and students' cognitive styles also have their own influence. However, there is no significant interaction between these two factors in this particular learning context.

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