JPPIPA 11(6) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

The Effect of Implementing the Problem Based Learning Model Integrated with Reading, Mind Mapping, and Sharing on Creative Thinking Skills and Learning Motivation of Class XI Science Students

Nur Khafifah[1*], Mushawwir Taiyeb[1], Rachmawaty[1], Firdaus Daud[1], Faisal[1]

[1] Program Studi Pendidikan Ilmu Pengetahuan Alam, Universitas PGRI Semarang, Semarang, Indonesia.

Received: April 15, 2025
Revised: May 30, 2025
Accepted: June 25, 2025
Published: June 30, 2025

Corresponding Author:
Nur Khafifah
nurkhafifah1631@gmail.com

DOI: 10.29303/jppipa.v11i6.11534

Abstract: The main focus of this study is to explore the effect of implementing the Problem Based Learning model integrated with reading, mind mapping and sharing on creative thinking skills and biology learning motivation of class XI IPA students at SMA Negeri 21 Makassar. The type of research used is quasi-experimental research with a quantitative approach. This research was conducted at SMA Negeri 21 Makassar with class XI IPA students as subjects. Samples were taken using a random method. From the results of data analysis, it was obtained that: Innovative thinking skills in the treatment group and comparison group during the pretest were classified as moderate or less than optimal and during the posttest there was an increase in creative thinking skills. The experimental group had a higher and more comprehensive level of biology learning motivation, while in the control group, namely the creative category; The control group's biology learning motivation was not yet comprehensive and limited; The results of the ANOVA test showed that Problem Based Learning integrated with reading, mind mapping, and sharing strategies had an effect on students' creative thinking skills; The results of the ANOVA test showed that the Problem Based Learning model integrated with reading, mind mapping, and sharing had a significant effect on students' learning motivation; The results of the Manova analysis show that the Problem Based Learning model integrated with reading, mind mapping, and sharing has a simultaneous effect on students' creative thinking skills and learning motivation.

Keywords: Creative thinking skills; Design research; Learning Motivation; Problem based learning; Quasi Experiment

Introduction

Education has a strategic function in supporting the quality of human resources and realizing national goals in educating society. Based on Law Number 20 of 2003, education is directed to advance skills, increase intelligence, foster creativity, and build moral character in accordance with the structure of national education policy. The main target of the Education system can be realized through 21st century skills. Based on Prasanna et al. (2019), Kabanda (2021), the 21st century is an era of globalization with very competitive competition in various sectors. Challenges in the era This is increasingly complex, so students need to master various 21st century skills which include 6C, namely critical thinking, creativity, culture, communication, collaboration, and connectivity (Nugroho & Anugerahwati, 2019). 21st century skills are essential for

How to Cite:
Khafifah, N., Teiyeb, M., Rachmawaty, Daud, F., & Faisal. (2025). The Effect of Implementing the Problem Based Learning Model Integrated with Reading, Mind Mapping, and Sharing on Creative Thinking Skills and Learning Motivation of Class XI Science Students. *Jurnal Penelitian Pendidikan IPA*, *11*(6), 684-696. https://doi.org/10.29303/jppipa.v11i6.11534

success in today's educational work environment. This is. Excellent education is the foundation for forming individuals who have the competence to compete in the arena international. In the era of digitalization and the rapid flow of information, students are faced with various complex problems that require reflective thinking skills and imaginative. One of the skills that supports and complements each other in the cognitive process is creative thinking (Larraz-Rabanos, 2021; Dwyer et al., 2025). Creative thinking is very much needed in thinking. Every good thought will succeed in designing or giving birth, forming or creating or producing something with a purpose in thinking (Buchanan, 2019; Ardilansari et al., 2023).

The ability to think creatively and the motivation to learn, especially in biology learning, certainly requires a strategy or learning model to achieve it. In the learning process, The deal is that teachers are expected to be able to carry out the learning process effectively so that students can learn well (Darling-Hammond et al., 2024). The important thing during learning activities is a series ofiInteraction (Wu et al., 2022; Zhao et al., 2023; Sejati et al., 2019). The interaction in question is a two-way relationship between students and teachers. This communication can raise students' enthusiasm in learning through the learning method model used in the learning process in the classroom that is effective and enjoyable (Choiri et al., 2023). Determining the right learning strategy can make it easier for students to master the material in more depth while also stimulating students to think. innovative during the learning process. The use of models in learning activities also provides a constructive impact on students in encouraging learning enthusiasm.

Problem Based Learning (PBL) combined with Reading, Mind Mapping, and Sharing (RMS) is a learning process approach that combines the strengths of several varied teaching approach strategies to build a more active, in-depth, and student-centered learning experience. Problem Based Learning (PBL) is a learning approach based on real problems in real situations aimed at students to form an understanding of science. (Yew et al., 2016). According to Rehman et al. (2024), Maesaroh et al. (2023), the Problem Based Learning (PBL) model encourages increased analytical and problem-solving skills. students' imagination to develop because they are encouraged to learn, evaluate, and create solutions to the problems they face. The PBL model can be integrated with the Reading, Mind Mapping, and Sharing (RMS) approach. Reading, Mind Mapping, and Sharing (RMS) is a way to engage students through reading activities, making mind maps, and sharing understanding.

The right reading strategy can make it easier for students to understand and analyze more in-depth information. Things this is in accordance with Anggraini et al. (2023), which shows that the use of mind mapping in the learning process can develop students' creativity. Mind mapping as a visual aid that can make it easier for students to organize de and data in a more structured and creative way (Fu et al., 2024). Besides there, the sharing process Information between students can improve social interaction and deepen their knowledge of the topics studied, thus creating a collaborative learning environment. Statement this is reinforced by the results of research conducted by Muhlisin et al.(2020), that the integration of Problem Based Learning (PBL) with the Reading, Mind Mapping, and Sharing (RMS) learning model can be an efficient strategy to optimize the quality of learning and student learning achievement. The main objective of the learning approach This is to encourage students to be more confident and innovative in imagination, and through students' creative imagination is directed to produce new findings or develop old findings (Samaniego et al., 2024; Purwati et al., 2024).

Problem Based Learning (PBL) integrated with Reading, Mind Mapping, and Sharing (RMS) as a learning design that involves students in solving problems using mind mapping, opens up greater opportunities for students to be active and responsible in all areas. Based on the statement above, the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) can overcome the final learning objectives by increasing the potential innovative and academic motivation of students.

Method

The type of research used is quasi-experimental research with a quantitative approach. The research design used is pretest-posttest control group design. Description of research design this can be seen in table 1 this.

Table 1. Design Pretest-Posttest Control Group Research

E	O1	X	O2
K	O3	-	O4

Target subjects of research this is all class XI students of SMA Negeri 21 Makassar totaling 414 students in the odd semester of the 2024/2025 academic year. The sampling method in this study this is random, namely the process of selecting sample members from the population randomly in a certain class or without considering the level in the population. The sample consists of two classes, namely XI.1 and XI.2 from a total of twelve classes in class XI of SMA Negeri 21 Makassar. The preparation of measuring instruments must reflect

the objectives of the study and have stability over time. Validity measurement The instrument is carried out by comparing the calculated r value and the table r value. Language Indonesia: at a certain level of significance of 5%. If r count > r table then a measuring instrument is declared valid if r count < r table then the measuring instrument is considered invalid. Validity testing is carried out using SPSS Version 25.0 for Windows software. Consistency evaluation applies the Cronbach's Alpha approach so that r count is represented by the alpha value. A measuring instrument is said to be consistent if the Cronbach's Alpha result is > 0.60. Reliability testing is analyzed using SPSS 25.0 software. Descriptive review is conducted to identify the distribution pattern and proportion of each independent variable and dependent variable. Descriptive data review begins by determining the lowest limit, highest limit, average, variation value, and standard deviation. Presentation and in analysis this is done in table form. Initial statistical processing is done using the SPSS 25 application.

Creative Thinking Skills

The data in the form of creative thinking ability tests, then analyzed to determine the percentage of scores from the average values that have been collected, then tabulated to produce data that can describe student learning achievements skill ability predicate score interval student innovation is shown in table 2.

Table 2. Creative Thinking Skills Category

Score interval	Category
76-100	Very creative
51-75	Creative
26-50	Quite creative
1-25	Low
0	Very low

Motivation to learn

Information on learning motivation is processed based on questionnaire data collection. The analysis aims to describe the level of learning motivation before and after learning is carried out using a learning model. The score interval for the learning motivation category predicate can be seen in table 3.

Table 3. Criteria for Measuring Learning Motivation

Score interval	Category
81 - 100	Very good
61-80	Good
41-60	Pretty good
21-40	Not good
0-20	Very bad

Preliminary analysis was conducted by testing the normality of data distribution and data uniformity. The determination steps based on the normality test are as follows: If the significance is more than 0.05 then the data is normal; If the significance is below 0.05 then the data does not meet the normality assumption; Decision making in the homogeneity test is as follows: If the significance is more than 0.05 then the data is uniform; If the significance value is below 0.05 then there is inequality of variance. Hypothesis testing was conducted using the ANACOVA (analysis of covariance) method and the MANOVA (multivariate analysis of variance) test. Causal factors and effect factors in the dataset were analyzed using the SPSS version 25 program. Testing this aims to detect the influence of the integrated PBL learning approach of Reading, Mind Mapping, and Sharing (RMS) in developing logic, imaginative and learning motivation. The hypothesis is as follows: if the level of significance < (sign value < 0.05) then H1 is accepted, the condition This shows that there is an influence: if the significance level > (sign value > 0.05) then H0 is accepted, This means no influence.

Results and Discussion

The findings from narrative data processing show a comprehensive picture of data on students' creative thinking skills and learning motivation as shown below.

Creative Thinking Skills Learned Using the Problem Based Learning (PBL) Model Integrated with Reading, Mind Mapping, and Sharing (RMS) Experimental Class and PBL Learning Model with a Scientific Approach Control Class

In the research this presents the results of frequency distribution analysis and descriptive analysis of students' creative thinking skills data. The data analyzed came from the results of the pretest and posttest in the control class and the experimental class. The aim is to describe the development of creative thinking skills after the implementation of the integrated Problem Based Learning (PBL) learning model Reading, Mind Mapping, and Sharing (RMS). The assessment of students' creative thinking skills used before and after learning was carried out was measured using a creative thinking skills test. The creative thinking skills test consists of 4 questions on 4 ndicator in the form of an essay then students are asked to provide answers where each answer will be given a score. The results of the creative thinking skills test data can be seen in the following table 4.

Table 4. Distribution of Descriptive Statistical Values of Pretest and Posttest of Creative Thinking Skills of Experimental and Control Class Students

Statistics	Creative Thinking Skills			
	Test (Integrated PBL Learning Model Reading, Mind Mapping and Sharing (RMS))		Control (PBL Learning Model Scientific Approach)	
	Pretest	Posttest	Pretest	Posttest
Sample Size	30	30	30	30
Average	41.40	83.76	39.77	74.47
Std. Deviation	9,832	8,397	11,159	8,203
Lowest Value	19	31	44	38
The highest score	56	94	63	94

Based on the results of the descriptive analysis of creative thinking skills above, it can be seen that the average pretest score obtained by students in the experimental class through the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping and Sharing (RMS) was 42.40, with a standard deviation of 9.832, the lowest score was 19 and the highest score was 56. While the average posttest score obtained by students in the experimental class through the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping and Sharing (RMS) was 83.76, with a standard deviation of 8.397, the lowest score was 31 and the highest score was 94.

The creative thinking skills of students in the control class through the PBL learning model with a scientific approach can be seen that the average pretest score obtained by students was 39.77 with a standard deviation of 11.159, the lowest score was 44 and the highest score was 63. While the average posttest score obtained by students in the control class through the PBL learning model with a scientific approach was 74.47, with a standard deviation of 8.203, the lowest score was 38 and the highest score was 94.

The following presents the frequency distribution and percentage of creative thinking skills of students in the experimental class based on the results of the pretest and posttest in table 5.

Table 5. Frequency Distribution of Creative Thinking Abilities of Pretest and Posttest of Experimental Class Students

Mark interval	Category	Test (Integrated PBL Learning Model Reading, Mind Mapping and Sharing (RMS))				Control (PBL Learning Model)			
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
		F	%	F	%	F	%	F	%
76-100	Very Creative	0	0%	21	70%	0	0%	9	30%
51-75	Creative	4	13%	9	30%	3	10%	21	70%
26-50	Quite Creative	23	77%	0	0%	21	70%	0	0%
1-25	Low	3	10%	0	0%	6	20%	0	0%
0	Very Low	0	0%	0	0%	0	0%	0	0%

Based on table 5, it can be seen that the frequency distribution of creative thinking skills is obtained by the pretest value of experimental class students through the integrated Problem Based Learning (PBL) learning model Reading, Mind Mapping, and Sharing (RMS) that there are 4 students in the creative category with a percentage of 13%, 23 students are in the fairly creative category with a percentage of 77%, and 3 students are in the fairly creative category with a percentage of 10%. While the distribution of posttest scores of students, there are 21 students in the very creative category with a percentage of 70% and 9 students are in the creative category with a percentage of 30%.

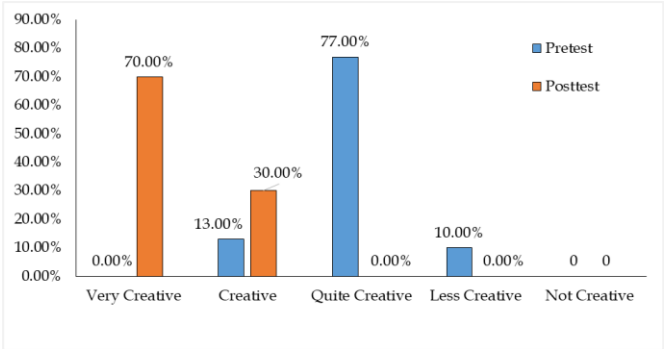

Figure 1. Frequency distribution diagram of creative thinking skills scores of experimental class students

Frequency distribution of students' creative thinking skills before the implementation of the integrated Problem Based Learning (PBL) learning

model Reading, Mind Mapping, and Sharing (RMS), the majority of students in the experimental class were in the "Quite Creative" (77%) and "Low" (10%) categories, while only 13% were in the "Creative" category. However, after learning, there was a significant increase, where 70% of students reached the "Very Creative" category, and 30% were in the "Creative" category. There were no more students in the "Quite Creative" and "Low" categories, the overall shift in categories reflects a significant increase in creative thinking skills.

Furthermore, to determine the frequency distribution and percentage of creative thinking skills scores of students in the control class based on the pretest and posttest results.

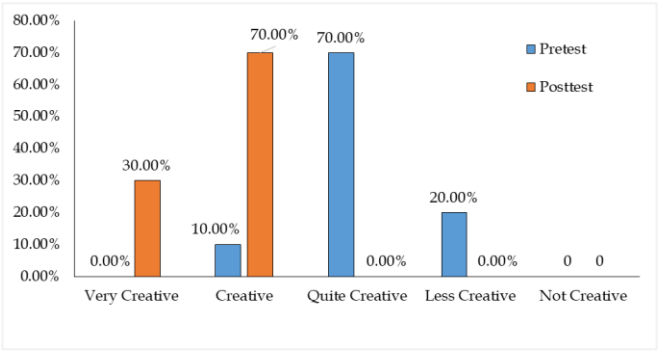

Figure 2. Frequency distribution diagram of creative thinking skills scores of control class students

The results of the frequency distribution analysis showed that during the pretest, the majority of students in the control class were in the "Creative" category (10%), "Quite Creative" (70%), while the rest (20%) were in the "Low" category. After learning, there was an increase in the proportion of students in the "Very Creative" category to 30%, while those in the "Creative" category also increased to 70%. There were no students who reached the "Quite Creative" category or were included in the "Low" or "Very Low" categories either before or after learning.

Learning Motivation Learned Using Problem Based Learning Model Integrated with Reading, Mind Mapping, and Sharing (RMS) Experimental Class and PBL Learning Model Scientific Approach Control Class

The assessment of students' learning motivation used before and after learning is measured using a learning motivation questionnaire. The learning motivation questionnaire consists of 25 statement items, then students are asked to provide answers where each answer will be given a score. The results of obtaining learning motivation data can be seen in table 6.

Based on the results of the descriptive analysis of learning motivation above, it can be seen that the average pretest score obtained by students in the experimental class through the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping and Sharing (RMS) was 49.00 with a standard deviation of 3.742, the lowest score was 41 and the highest score was 55. While the average posttest score obtained by students in the experimental class through the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping and Sharing was 70.40, with a standard deviation of 5.587, the lowest score was 62 and the highest score was 84.

Table 6. Distribution of Descriptive Statistical Values of Pretest and Posttest of Students' Learning Motivation in Experiment

Statistics	Motivation to learn			
	Test (Integrated PBL Learning Model Reading, Mind Mapping and Sharing (RMS))		Control (PBL Learning Model Scientific Approach)	
	Pretest	Posttest	Pretest	Posttest
Sample Size	30	30	30	30
Means	49.00	70.40	44.27	60.87
Standard Deviation	3,742	5,587	4,034	8,295
Lowest Value	41	62	35	41
The highest score	55	84	50	74

The learning motivation of students in the control class through the PBL learning model with a scientific approach can be seen that the average pretest score obtained by students was 44.27, with a standard deviation of 4.034, the lowest score was 35 and the highest score was 50. While the average posttest score obtained by students in the control class through the PBL learning model with a scientific approach was 60.87, with a standard deviation of 8.295, the lowest score was 41 and the highest score was 74.

The following presents the frequency distribution and percentage of students' learning motivation in the experimental and control classes based on the results of the pretest and posttest.

Based on table 7 it is known that the frequency distribution of learning motivation obtained from the distribution of pretest scores of experimental class

students through the integrated Problem Based Learning (PBL) learning model Reading, Mind Mapping, and Sharing that there are 30 students in the fairly good category with a percentage of 100%, where no students are in the very good, good, less good, and very bad categories. While the distribution of posttest scores there is 1 student in the very good category with a percentage of 3%, and 29 students are in the good category with a percentage of 97%, meaning that student motivation increases "Very Good" and "Good" after learning is carried out.

Table 7. Frequency Distribution of Pretest and Posttest of Learning Motivation of Students in Experimental and Control Classes

Mark interval	Category	Class (Integrated PBL Learning Model Reading, Mind Mapping and Sharing (RMS))				Control (PBL Learning Model)			
		Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
		F	%	F	%	F	%	F	%
81 - 100	Very good	0	0%	1	3%	0	0%	0	0%
61-80	Good	0	0%	29	97%	0	0%	17	57%
41-60	Pretty good	30	100%	0	0%	26	87%	13	43%
21-40	Not good	0	0%	0	0%	4	13%	0	0%
0-20	Very Bad	0	0%	0	0%	0	0%	0	0%

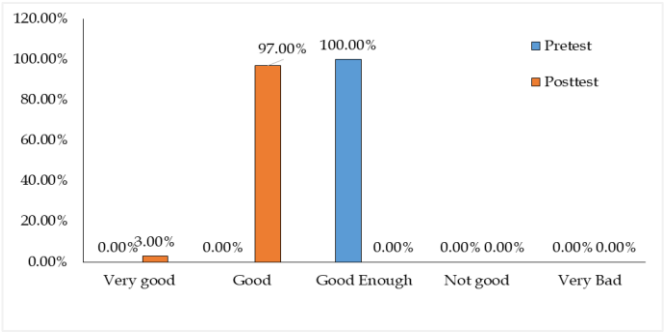

Figure 3. Frequency distribution diagram of learning motivation scores of experimental class students

Based on Figure 3, the distribution diagram of learning motivation of experimental class students before and after the implementation of the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS), there was a positive shift in learning motivation. Before learning, the majority of students were in the "Quite Good" category (100%). After learning, the number of students in the "Quite Good" category decreased drastically or there were no students at all, while the "Good" category increased from 0% to 97%, and the "Very Good" category increased to 3%. In general, there was an increase in the quality of students' learning motivation as seen from the pretest and posttest.

Based on Figure 4, the distribution diagram of students' learning motivation in the control class before and after learning, there was a change that tended to be stable with a significant increase. Before learning, most students were in the "Quite Good" (87%) and "Not Good" (13%) categories. After learning, there was a slight increase in the "Good" category from 0% to 57%, and "Quite Good" from 87% to 43%. While yes, neither the number of students nor the percentage6 in the "Poor" and "Very Poor" categories decreased slightly to 23%, and no students reached the "Very Good" category in either the pretest or posttest.

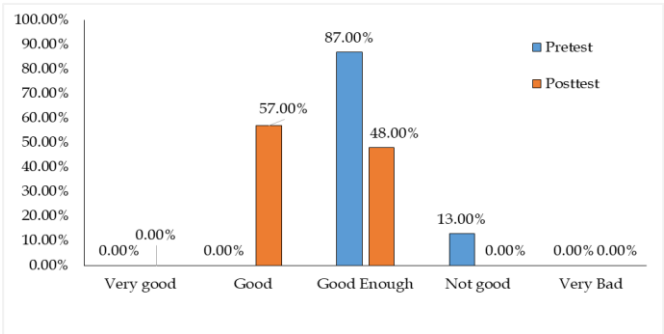

Figure 4. Frequency distribution diagram of learning motivation scores of control class students

Normality Test

The first stage carried out is the normality test to test whether the data is normally distributed or not. The normality test uses the One-Sample Kolmogorov-Smirnov Test by using the help of the SPS for Windows 25 program to ensure that the data on creative thinking skills and student learning motivation from the pretest and posttest in the experimental and control classes are normally distributed, so that they are suitable for analysis using parametric statistical tests.

Based on table 8, it can be seen that the results of the normality test on creative thinking skills and learning motivation of students from the pretest and posttest scores in the experimental class and control class show a significance value above 0.05, which means that the data on creative thinking skills and learning motivation of class XI students at SMA Negeri 21 Makassar through Implementation of the integrated Problem Based Learning (PBL) learning model Reading, Mind

Mapping, and Sharing (RMS) and the PBL learning model Scientific approach has normally distributed data. Thus, the learning motivation data in both groups can be said to be normally distributed. This ensures that the data meets the assumption of normality, so that statistical analysis can be carried out. The reference method using parametric methods can be applied appropriately to research this.

Table 8. Results of the Pretest and Posttest Normality Test of Creative Thinking Skills and Student Learning Motivation

Variables	Data	Sign	Sign Level(α)	Conclusion
Creative Thinking Skills	Pretest Experiment	0.129	>0.05	Normally Distributed
	Posttest Experiment	0.139		
	Pretest Control	0.026		
	Posttest Control	0.121		
Motivation to learn	Pretest Experiment	0.033	>0.05	Normally Distributed
	Posttest Experiment	0.200		
	Pretest Control	0.200		
	Posttest Control	0.196		

Homogeneity Test

The following homogeneity test results are the variance for the creative thinking skills variable in the pretest and posttest data. Based on table 9, the results of homogeneity of variance using SPSS for Windows 25 data obtained can be described that students' creative thinking skills show a sign value. Pretest of 0.617> 0.05 and posttest of 0.346> 0.05. The results of the homogeneity analysis show a significance value greater than 0.05 which means that there are creative thinking skills and learning motivation of class XI students at SMA Negeri 21 Makassar using the application model of the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) in the experimental class and the PBL learning model with a Scientific approach. Thus, the assumption of homogeneity is met so that parametric statistical analysis can be used to compare students' creative thinking skills and learning motivation validly (Tinungki et al., 2024).

Table 9. Results of Homogeneity Test of Pretest and Posttest of Creative Thinking Skills and Learning Motivation of Students

Variables	Statistics	Pretest	Posttest
		Control Experiment	Control Experiment
Creative Thinking Skills	Sig.	0.617	0.346
	Significance Level (α)		>0.05
	Conclusion	Homogeneous	Homogeneous
Motivation to learn	Sig.	0.670	0.165
	Significance Level (α)		>0.05
	Conclusion	Homogeneous	Homogeneous

Hypothesis Testing

To examine the effect of the Problem Based Learning (PBL) model integrated with Reading, Mind Mapping, and Sharing (RMS) on the creative thinking skills of class XI students of SMA Negeri 21 Makassar, a hypothesis test was conducted. The Anacova hypothesis test with the help of the SPSS for Windows 25 program was used to determine the differences in creative thinking skills and learning motivation of students who were taught using Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) and PBL learning model Scientific approach students of class XI SMA Negeri 21 Makassar. Decision-making provisions if the sig value > 0.05, then the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) has no difference, but if the sig value < 0.05, and the PBL learning model Scientific approach have differences.

Based on the data from the hypothesis test results on creative thinking skills and learning motivation of class XI students at SMA Negeri 21 Makassar with the application of the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) can be seen in table 10 and table 11.

Based on table 10, the test results show that the significance value is <0.000. This shows a sig. value < α (0.05), so it can be concluded that H0 is rejected and H1 is accepted. This means that there is a difference in the creative thinking skills of students who are taught using the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) in students.

Table 10. ANOVA Test Results of Students' Creative Thinking Skills

Tests of Between-Subjects Effects					
Dependent Variables:			Creative thinking skills		
Source	TypeiI Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1290.567a	2	645,283	9.253	.000
Intercept	24225.202	1	24225.202	347,366	.000
Class	20,967	1	20,967	.301	.586
Mark	1287.472	1	1287.472	18,461	.000
Error	3975.166	57	69,740		
Total	380358.000	60			
Corrected Total	5265.733	59			

Table 11. ANOVA Test Results on Student Learning Motivation

Tests of Between-Subjects Effects					
Dependent Variables:			Motivation to learn		
Source	TypeiI Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1376.570a	2	688.285	13,588	.000
Intercept	1438.372	1	1438.372	28,395	.000
Class	13.303	1	13.303	.263	.610
Mark	869,029	1	869,029	17,156	.000
Error	2887.364	57	50,656		
Total	262728.000	60			
Corrected Total	4263.933	59			

Based on table 11, the test results show that the significance value is <0.000. This shows a sig. value < α (0.05), so it can be concluded that H0 is rejected and H1 is accepted. This means that there is a difference in learning motivation of students who are taught usingProblem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) for students, to test the effect of the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) on the creative thinking skills and motivation to learn biology of class XI students at SMA Negeri 21 Makassar, a hypothesis test was conducted using multivariate analysis (MANOVA). This aims to see whether the learning model has a simultaneous effect on the two variables studied.

Table 12. MANOVA Test Results of Creative Thinking Skills and Student Learning Motivation

Multivariate Test						
	Effect	Value	F	Hypothesis df	df error	Sig.
Group	Pillai's Trace	.328	13.414b	2,000	55,000	.000
	Wilks' Lambda	.672	13.414b	2,000	55,000	.000
	Hotelling's Trace	.488	13.414b	2,000	55,000	.000
	Roy's Largest Root	.488	13.414b	2,000	55,000	.000

Based on table 12, the test results show that the significance value is <0.000. This shows a sig. value < α (0.05).Matter This shows that there is a significant influence of the learning model Problem Based Learning (PBL) integrated Reading, Mind Mapping, and Sharing (RMS)towards creative thinking skills and students' motivation to learn biology together. Thus, the alternative hypothesisit is concluded that H0 is rejected and H1 is accepted, which means learning model. This is effective in improving both variables in class XI students at SMA Negeri 21 Makassar.

Integrated Problem Based Learning Model Integrated with Reading, Mind Mapping, and Sharing (RMS) on Creative Thinking Skills of Class XI IPA at State High School 21 Makassar

Creative thinking skills of class XI IPA at SMA Negeri 21 Makassar showed quite diverse variations before and after the learning process took place. Pretest data indicated that most students were at the level of creative thinking skills that were in the creative category and the fairly creative category, with some students still at the less creative category. Conditionsi this shows the need to encourage the improvement of creative thinking skills in order to achieve a higher category and support an effective learning process according to expectations in biology learning.

Based on the results of data analysis conducted through the analysis of variance (ANOVA) test with pretest values as covariates, it was found that the Problem Based Learning (PBL) learning model integrated with the Reading, Mind Mapping, and Sharing (RMS) strategy had an effect on students' creative thinking skills. This can be seen from the significant differences between students who follow learning with the Problem Based Learning (PBL) model integrated with Reading, Mind Mapping, and Sharing (RMS) and those who follow PBL learning with a Scientific approach. Students in the experimental class showed much better development of creative thinking skills, which was reflected in the posttest results.

Implementation model Problem Based Learning (PBL) integrated Reading, Mind Mapping, and Sharing (RMS) give chance to participant educate For involved active in process learning, start from understand problem through activity read, compile mind folder For organizeiinformation, until shareiwith And solution through presentation. Implementation modelithis push participant educate for think more flexible, original, fluent And elaboration in finish problem in think creative. Process learning on material "Transport on Plant" seen that participant educate think flexible (like can explain method plant adapt to land sandy, land clay And land Which excess water, as well as convey more from One method how root absorb water in environment Which different), think original (like make or do practical work transport on plant Alone with use plant boyfriend water), think fluent (like mention various factor Which influence transpiration, as well as to put forward Lots method plant optimize absorption water And mineral from land), And think elaboration (like explain with Details stages absorption water by root, journey water through xylem, until evaporation pass stomata). Process think creative which developed participant educate coversi indicator skills think creative which explore various possibility and produceide-ide new in a way independent and collaborative.

Further analysis shows that the learning model This still shows a significant influence on creative thinking skills even when considering students' initial skills through pretest scores. this shows that Learning interventions provided through the Problem Based Learning (PBL) model integrated with Reading, Mind Mapping, and Sharing (RMS) are able to encourage the improvement of creative thinking skills effectively, not limited to students with high initial skills. This means that the approach This is able to accommodate diverse learning needs and provide a positive impact on all students in the class.

During the learning process, students in the experimental class showed enthusiasm and active involvement. They seemed to enjoy the process of reading the material, making mind maps to organize ideas, and discussing openly and actively during the sharing session. Interactions between students run dynamically and constructively, which ultimately creates a learning environment that is conducive to the development of creative thinking skills. Such a classroom situation reflects that problem-based learning with The integration of Reading, Mind Mapping, and Sharing (RMS) strategies can create a fun and meaningful learning experience.

Findings this is reinforced by Guilford's (1950) theory regarding creative thinking skills which include fluency, flexibility, originality, and elaboration. Through the Problem Based Learning (PBL) model which provides space for divergent thinking and open problem solving, students are encouraged to develop diverse and original ideas. The Reading, Mind Mapping, and Sharing (RMS) strategy helps students strengthen their understanding of concepts through reading, organize their thoughts through mind mapping, and develop elaboration through sharing ideas.

Besides yes, Vygotsky's (1978) constructivism theory is also the basis that supports the effectiveness of the model. this. Vygotsky emphasized the importance of social interaction in the learning process through the Zone of Proximal Development (ZPD). In the “sharing” activity, students exchange opinions and work together to solve problems, so that the learning process occurs actively and meaningfully. Thus, The integration of Reading, Mind Mapping, and Sharing strategies in the PBL model not only improves learning outcomes, but also significantly strengthens students' creative thinking skills.

The results of the study on the first hypothesis which shows that the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) has a significant influence on students' creative thinking skills and learning motivation are in line with various previous studies. For example, Nihlah (2024) study found that RMS-integrated PBL had a significant effect on students' biological literacy and critical thinking skills, with a significance value of 0.000 <α, and higher effectiveness than the regular PBL model. Findings this is also supported by research by Muhlisin et al. (2020) which shows that The integration of PBL with RMS significantly improved problem-solving skills, as indicated by significantly higher post-test scores compared to traditional classes.

Besides there, the result This is in line with the research of Ariyatun et al. (2020) which stated that the implementation of the STEM integrated PBL model significantly improved students' critical thinking skills with a calculated t value > t table at a significance level of 5%. Research by Zumaria et al. (2022) also strengthens

the findings This is with the result that PBL integrated with Mind Mapping has a positive effect on metacognitive knowledge and critical thinking skills of students. No less important, Firdaus et al. (2022) emphasized that the PBL learning model integrated with Mind Mapping can significantly increase students' learning motivation, which in turn provides satisfactory learning outcomes.

Integrated Problem Based Learning (PBL) Learning Model Reading, Mind Mapping, and Sharing (RMS) on Student Learning Motivation in Class XI PA at State High School 21 Makassar

Learning motivation of class XI students PA at SMA Negeri 21 Makassar before the learning process, all students were in the fairly good category, which indicated a level of readiness and enthusiasm for learning between individuals. There were no participants who showed a level of learning motivation that was significantly less than good and very less than good, so that the initial conditions were generally quite conducive to learning.

After the learning process took place, the distribution of learning motivation levels shifted. In the experimental class, there was a very significant increase, the majority of students were in the good category. Only a small number of students showed development to a higher level with a very good category. This reflects that the learning implemented is able to maintain students' learning motivation, although the increase tends to be limited and not comprehensive.

Based on the results of data analysis using analysis of variance (ANOVA) with pretest scores as covariates, it was found that there was a significant influence of the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) on students' learning motivation. The learning model was implemented with an approach thatininnovative and activity-based, the test results show that the Problem Based Learning (PBL) learning model integrated with Reading, Mind Mapping, and Sharing (RMS) is able to provide a significant difference in increasing learning motivation.

These results indicate that students' learning motivation is more influenced by factorsiinternal that has been formed previously, as reflected in the pretest value which actually shows a significant relationship to the posttest learning motivation. In other words, the initial motivation possessed by students plays a dominant role in determining the final results. While Yes, with the integrated Problem Based Learning (PBL) Reading, Mind Mapping, and Sharing (RMS), it is strong enough to provide additional encouragement that can significantly increase motivation during the learning implementation period.

In the learning process, students appear active and involved in reading activities, compiling mind maps, discussions and presentations. These experiences are fully capable of forming or changing attitudes and motivation.itheir intrinsic to learning activities. As fori learning motivation indicators such as the desire and wish to succeed (students show enthusiasm to be able to master the material on transport in plants because wanting to achieve good learning outcomes), there is motivation and a need to learn (it can be seen that students can complete the mind map task on time), there is hope for the future (some students are serious about learning because they have ambitions want to continue to the college of their dreams), there are interesting activities in learning (students feel interested in learning because they use media interactive such as mind maps to explain the material), and the existence of a conducive learning environment (some students prefer if their class is clean, quiet, and has adequate learning facilities and they also like it if the study group supports each other and increases the enthusiasm for learning). This is due to the existence of a strong emotional connection or relevance between learning materials, learning approaches, and students' learning interests. Factors such as the learning environment, social support, and perceptions of the importance of the material being studied can also be external factors that influence students' motivation and learning outcomes.

In the context of theory, the results this can be explained through the motivational theory approach of Abraham Maslow, especially at the level of self-actualization needs. According to Maslow, motivation Individuals in learning are greatly influenced by the fulfillment of basic needs to a higher level, such as a sense of security, recognition, and self-actualization. If these needs have not been met, then a learning approach that is Even though it is innovative, it is not necessarily able to motivate students effectively. Therefore, Therefore, it is important for educators to not only change learning strategies, but also create learning environments that support the psychological needs of students.

Another relevant theory is the learning motivation theory of Deci and Ryan (Self-Determination Theory), which states that learning motivation is formed strongly when three basic psychological needs are met: competence, autonomy, and social relatedness. In In its implementation, if students do not yet feel autonomous in the learning process, do not yet feel competent in their tasks, or have little connection with teachers or fellow students, then motivation will be low. intrinsic is difficult to grow. Therefore Therefore, the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) in increasing learning motivation will be more optimal if

accompanied by the fulfillment of these basic needs systematically.

The Influence of the Problem Based Learning (PBL) Model of Integrated with Reading, Mind Mapping, and Sharing (RMS) on the Creative Thinking Skills and Motivation to Learn Biology of class XI IPA at State High School 21 Makassar

Study this also simultaneously tests the effect of the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) on two variables at once, namely creative thinking skills and learning motivation of class XI students at SMA Negeri 21 Makassar. To test the hypothesis This, multivariate analysis (MANOVA) was used, which allows researchers to evaluate the effect of treatment on more than one dependent variable simultaneously. The test results show that the integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) has a significant effect on both variables simultaneously, as indicated by the significance value of 0.000 which is smaller than the significance level of 0.05.

Findings this indicates that the learning approach focuses on problem solving and active involvement of students through reading, creating concept maps, and sharing. de is able to provide a positive impact on the development of creative thinking skills while increasing students' learning motivation. This is in line with the characteristics of PBL which are nheren encourages students to think critically and creatively in finding solutions to contextual problems, as well as the Reading, Mind Mapping, and Sharing (RMS) strategy which provides space for students to explore and express their understanding independently and collaboratively.

Learning model This can be considered effective because it not only targets cognitive skills (creative thinking), but also affective aspects (learning motivation). Reading activities provide a strong foundation of understanding, making mind maps helps visualization and organization. information creatively, and the process of sharing supports social engagement and the courage to express ideas. de. Combination This creates a meaningful and enjoyable learning experience, which theoretically also contributes to increased motivation. intrinsic to learning.

Within the framework of constructivism theory, the results This supports the view that student-centered learning provides challenges and involves Active and reflective interaction will encourage cognitive and affective development simultaneously. Problem Based Learning (PBL) integrated with Reading, Mind Mapping, and Sharing (RMS) encourages students to build their own knowledge through experience and interaction, so that it not only improves creative thinking skills, but also makes them feel in control of their learning process.

Besides there, findings this is also in line with the theory of Humanism in education, especially according to Carl Rogers' view, which emphasizes that effective learning occurs when students feel valued, given space to express themselves, and involved in the learning process. The learning environment prepared through the PBL-RMS model creates such an atmosphere, so that students are more motivated and facilitated in developing their creative thinking potential.

Thus, the results of the simultaneous test this reinforces that the implementation of the integrated Problem Based Learning (PBL) model of Reading, Mind Mapping, and Sharing (RMS) can be used as an alternative learning strategy that is not only effective in the cognitive aspect, but is also able to support the affective aspect simultaneously. This is very relevant to be applied in the context of 21st century learning which emphasizes the importance of developing high-level thinking skills and student character.

The results of the study related to the integrated Problem Based Learning (PBL) learning model Reading, Mind Mapping, and Sharing (RMS) simultaneously influence creative thinking skills and learning motivation of students, also consistent with the findings of previous studies. Multivariate analysis showed a significant influence of the learning model on both variables simultaneously, indicating the influence of Problem Based Learning (PBL) integrated with Reading, Mind Mapping, and Sharing (RMS) in improving various aspects of learning. Nihlah (2024) research which tested the influence of Problem Based Learning (PBL) integrated with Reading, Mind Mapping, and Sharing (RMS) on literacy and critical thinking skills also supports the findings This is where the model provides significant improvements in students' cognitive skills while increasing learning motivation.

Besides that, research by Muhlisin et al. (2020) which highlights the integration of PBL with RMS in improving problem solving skills showed similar results with a significant increase in students' skills after learning using the model. Research by Zumaria et al. (2022) and Firdaus et al. (2022) also provides strong support with the results that the integration of Mind Mapping in the PBL model not only improves critical thinking skills but also significantly increases students' learning motivation. Thus, the results of the study this strengthens the evidence that Problem Based Learning (PBL) integrated with Reading, Mind Mapping, and Sharing (RMS) is an effective alternative learning model and is able to provide a positive impact simultaneously on students' creative thinking skills and learning motivation.

Conclusion

The integrated Problem Based Learning (PBL) learning model of Reading, Mind Mapping, and Sharing (RMS) has a significant simultaneous influence on the creative thinking ability and motivation to learn biology of class XI IPA students of SMA Negeri 21 Makassar. This confirms that the implementation of this learning model has succeeded in strengthening both aspects simultaneously.

Acknowledgments
Thank you to all parties who have supported the implementation of this research. this. Hopefully the research this can be useful.

Author Contributions
Research design N.K, Conducted the article, M. T, Collected and analyzed data R. All authors have read and approved the published version of the manuscript.

Funding
Researchers fund research this is in a way independent.

Conflicts of Interest
The author declares no conflict of interest.

References

Anggraini, D., Yustina, Y., Daryanes, F., & Natalina, M. (2023). Influence of Problem-Based Learning and Blended Learning on Students' Creative Thinking Ability in Class XI SMAN Plus Riau Province Material Body Defense System. *Jurnal Penelitian Pendidikan IPA*, *9*(4), 1916–1921. https://doi.org/10.29303/jppipa.v9i4.1973

Ardilansari, Nizaar, M., & Nagy, E. K. (2023). The Right Method for Developing Elementary School Student's Creative Thinking Skills. *Jurnal Ilmiah Sekolah Dasar*, *7*(3), 452–460. https://doi.org/10.23887/jisd.v7i3.58273

Buchanan, R. (2019). Systems Thinking and Design Thinking: The Search for Principles in the World We Are Making. *She Ji: The Journal of Design, Economics, and Innovation*, *5*(2), 85–104. https://doi.org/10.1016/j.sheji.2019.04.001

Choiri, M. M., Rokhim, A., & Cindarbumi, F. (2023). Strategi Membangun Komunikasi Dua Arah Antara Guru Dan Murid Pada Pembelajaran Daring Di MTs. Al-Rosyid Dander Bojonegoro. *Discovery : Jurnal Ilmu Pengetahuan*, *8*(2), 63–68. https://doi.org/10.33752/discovery.v8i2.5103

Darling-Hammond, L., Schachner, A. C. W., Wojcikiewicz, S. K., & Flook, L. (2024). Educating teachers to enact the science of learning and development. *Applied Developmental Science*, *28*(1), 1–21. https://doi.org/10.1080/10888691.2022.2130506

Dwyer, C. P., Campbell, D., & Seery, N. (2025). An Evaluation of the Relationship Between Critical Thinking and Creative Thinking: Complementary Metacognitive Processes or Strange Bedfellows? *Journal of Intelligence*, *13*(2), 23. https://doi.org/10.3390/jintelligence13020023

Fu, X., & Relyea, J. E. (2024). Exploring the Role of Mind Mapping Tools in Scaffolding Narrative Writing in English for Middle-School EFL Students. *Education Sciences*, *14*(10), 1119. https://doi.org/10.3390/educsci14101119

Kabanda, M. N. (2021). Globalization and Curriculum in the 21st Century: A Case for Flexible and Dynamic Curriculum. *Asian Journal of Interdisciplinary Research*, 18–29. https://doi.org/10.34256/ajir2132

Larraz-Rábanos, N. (2021). Development of Creative Thinking Skills in the Teaching-Learning Process. In *Teacher Education – New Perspectives*. IntechOpen. https://doi.org/10.5772/intechopen.97780

Maesaroh, M., Firdausi, J., Kartikawati, E., Irdalisa, I., & Elvianasti, M. (2023). Using Digital Mind Mapping with Microsoft 365 to Improve Student's Creative Thinking on Biology. *Jurnal Penelitian Pendidikan IPA*, *9*(9), 7258–7263. https://doi.org/10.29303/jppipa.v9i9.4170

Muhlisin, A., Siswanto, S., Singgih, S., Dewantari, N., & Mohtar, L. E. (2020). Integration PBL with RMS: Improving problem solving skills on environmental education. *Biosfer*, *13*(2), 155–166. https://doi.org/10.21009/biosferjpb.v13n2.155-166

Nugroho, W. F., & Anugerahwati, M. (2019). Project-Based Learning: Enhancing EFL Students' Speaking Skill through Vlog. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(8), 1077. https://doi.org/10.17977/jptpp.v4i8.12679

Prasanna, R., Jayasundara, J., Naradda Gamage, S. K., Ekanayake, E., Rajapakshe, P., & Abeyrathne, G. (2019). Sustainability of SMEs in the Competition: A Systemic Review on Technological Challenges and SME Performance. *Journal of Open Innovation: Technology, Market, and Complexity*, *5*(4), 100. https://doi.org/10.3390/joitmc5040100

Purwati, D., Astawan, I. G., & Antara, P. A. (2024). Enhancing Creative Imagination Ability in Early Childhood: A Study on Differential Learning Assisted with Loose Parts Media and Social Skills. *Jurnal Pendidikan Anak Usia Dini Undiksha*, *12*(1), 26–35. https://doi.org/10.23887/paud.v12i1.74007

Rehman, N., Huang, X., Mahmood, A., AlGerafi, M. A. M., & Javed, S. (2024). Project-based learning as a

catalyst for 21st-Century skills and student engagement in the math classroom. *Heliyon*, *10*(23), e39988. https://doi.org/10.1016/j.heliyon.2024.e39988

Samaniego, M., Usca, N., Salguero, J., & Quevedo, W. (2024). Creative Thinking in Art and Design Education: A Systematic Review. *Education Sciences*, *14*(2), 192. https://doi.org/10.3390/educsci14020192

Sejati, A. E., Kasmiati, S., & Ikhsan, F. A. (2019). The relationship between learning process interactions and student's learning outcomes in environmental sustainability matter geography-social science education subject. *IOP Conference Series: Earth and Environmental Science*, *382*(1), 012026. https://doi.org/10.1088/1755-1315/382/1/012026

Tinungki, G. M., Hartono, P. G., Nurwahyu, B., Islamiyati, A., Robiyanto, R., Hartono, A. B., & Raya, M. Y. (2024). Exploring the team-assisted individualization cooperative learning to enhance mathematical problem solving, communication and self-proficiency in teaching non-parametric statistics. *Cogent Education*, *11*(1), 2381333. https://doi.org/10.1080/2331186X.2024.2381333

Wu, X., He, Z., Li, M., Han, Z., & Huang, C. (2022). Identifying Learners' Interaction Patterns in an Online Learning Community. *International Journal of Environmental Research and Public Health*, *19*(4), 2245. https://doi.org/10.3390/ijerph19042245

Yew, E. H. J., & Goh, K. (2016). Problem-Based Learning: An Overview of its Process and Impact on Learning. *Health Professions Education*, *2*(2), 75–79. https://doi.org/10.1016/j.hpe.2016.01.004

Zhao, Y., Kleinknecht, M., & Ko, J. (2023). Dialogic Interactions in Higher Vocational Learning Environments in Mainland China: Evidence Relating to the Effectiveness of Varied Teaching Strategies and Students' Learning Engagement. In *Effective Teaching Around the World* (pp. 207–224). Springer International Publishing. https://doi.org/10.1007/978-3-031-31678-4_9