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The Influence of the Mind Mapping Assisted PBL Model on the Critical Thinking Ability of Fifth Grade Elementary School Students

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ABSTRAK

Saat ini masih banyak guru yang menggunakan sistem pembelajaran konvensional yaitu berpusat pada guru sehingga peran siswa cenderung pasif pada saat pembelajaran. Kepasifan siswa juga mempengaruhi kemampuan berpikir kritis siswa. Tujuan penelitian untuk menganalisis pengaruh model problem based learning berbantuan mind map terhadap kemampuan berpikir kritis siswa pada materi IPA kelas V. Jenis penelitian ini termasuk eksperimen semu (quasi eksperimen) dengan desain penelitian nonequivalent control group design. Populasi penelitian ini adalah seluruh siswa kelas V Sekolah Dasar yang berjumlah 160 siswa. Metode pengumpulan data dalam penelitian ini adalah metode tes esai yang terdiri dari 9 soal yang divalidasi. Data penelitian dianalisis menggunakan teknik analisis statistik deskriptif dan teknik analisis statistik inferensial. Data yang diperoleh dianalisis menggunakan uji-t dengan rumus variansi terpisah. Hasil analisis penelitian menunjukkan thitung = 3,825 dan ttabel = 2,009 pada taraf signifikansi 5% (α = 0,05) dengan derajat kebebasan (dk) = n_1+ n_2-2 = 26 + 26 - 2 = 50. Jadi diperoleh thitung (3,825) > ttabel (2,008) sehingga H0 ditolak. Berdasarkan hasil tersebut dapat disimpulkan bahwa terdapat perbedaan yang signifikan kemampuan berpikir kritis siswa pada materi IPA yang mengikuti model pembelajaran Problem Based Learning berbantuan mind map dan siswa yang tidak diajar menggunakan model pembelajaran tersebut di kelas V SD.

ABSTRACT

Currently, there are still many teachers who use conventional learning systems, which are teacher-centred so that students' roles tend to be passive during learning. Student passivity also affects students' critical thinking abilities. Research purposesto analyze the influence of the problem based learning model assisted by mind mapping on students' critical thinking abilities in class V science material. The research included a quasi-experiment with a nonequivalent control group design research design. The population of this study was all fifth grade students in elementary school, totaling 160 students. The data collection method in this research is the essay test method which consists of 9 validated questions. The research data were analyzed using descriptive statistical analysis techniques and inferential statistical analysis techniques. The data obtained were analyzed using the t-test with the separated variance formula. The results of the research analysis show that tcount = 3.825 and ttable = 2.009 at the 5% significance level (α = 0, 05) with degrees of freedom (dk) = n_1+ n_2-2 = 26 + 26 - 2 = 50. So, it is found that tcount (3.825) > ttable (2.008) so that H0 is rejected. Based on these results, it can be concluded that there is a significant difference in students' critical thinking abilities in science material who follow the Problem Based Learning learning model assisted by mind mapping and students who are not taught using the learning model in class V elementary.

1. INTRODUCTION

The 2013 curriculum is basically a curriculum implemented to answer the challenges of 21st century education. Education in the 21st century should produce human resources who have the ability to face the various challenges of life in the modern era. The expected learning outcomes are not only mastery of all learning material but also skills, social and knowledge. The 21st century skills aimed at in the 2013

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Curriculum are Learning and Innovation Skills-4Cs which include critical thinking, creative thinking, communication and collaboration.(Andriyani et al., 2021; Syafitri et al., 2021). Mastery of 21st century skills is very important, this is because 4C is a type of soft skill which when implemented in daily life is much more useful than just mastering hard skills(Komariyah & Laili, 2018; Oktavia & Prasetyo, 2021).KCritical thinking skills are a model of thinking about any thing, substance or problem in which the thinker will improve the quality of his thinking by skillfully handling the structures inherent in thinking and applying intellectual standards within himself.(Airlanda et al., 2018; Rahmatia & Fitria, 2020; Syafitri et al., 2021).Critical thinking skills will train students to make decisions from various points of view carefully, thoroughly, and be able to consider various things outside themselves and express their opinions.(Prasetyo & Kristin, 2020; Sitompul, 2021; Sutrisno, 2019). Critical thinking skills guide all lesson content, including Natural Science (IPA) material.

Science is one of the material contents in the thematic lessons in the 2013 curriculum which studies phenomena through a series of processes known as the scientific process. Natural Sciences (Science) is all children's activities carried out with various real activities with nature being the main thing in science learning(Paris et al., 2021; Wahyudi et al., 2021). Another definition of science is a quantitative study that studies how scientific researchers, such as writers or so on, interact with each other with a greater focus on scientific discoveries with the aim of being able to understand something better than previously, whose understanding was still lacking.(Ariyanto, 2018; Campedelli, 2021; Ikha, 2020). Natural science or often known as science is also a human effort to understand the universe which is carried out through precise observations of objects, in accordance with procedures, and explained based on reasoning so as to obtain accurate and real conclusions.(Airlanda et al., 2018; Dewi & Suadnyana, 2020; Santika, 2019).The aim of learning Natural Sciences at elementary school level is to increase understanding of natural science disciplines and creative skills to be able to produce a product that will train each person's competency mastery as a result of their learning.(Ariyanto, 2018; Wahyudi, 2021). Natural Science (IPA) is also human knowledge about natural phenomena and freedom obtained by carrying out observations, research, or trials based on the results of human knowledge.(Paris et al., 2021; Sappe et al., 2018).

However, the reality in the field shows that students' critical thinking abilities in the learning process are still relatively low. This is in line with the results of observations and interviews carried out with the class V homeroom teacher at Gugus V Elementary School, Tabanan District, Tabanan Regency. The results of observations and interviews found that science learning had not yet optimized students' critical thinking abilities through the use of innovative learning models. When teaching, teachers still use a conventional learning system that is teacher-centred so that students' roles tend to be passive during learning. In conventional learning the teacher is considered the only source of learning. When the learning process takes place, students only listen and note down the teacher's explanation which results in low critical thinking skills. Students are not given a problem that creates motivation to think critically so as to gain new knowledge. Apart from that, students' interest in science is low because they feel it is difficult to learn, even though science is a science that is very useful for life. Lack of interest in learning science will have an impact on student learning outcomes. This can be seen from the test results of class V students as much as 61.87% or 99 students out of a total of 160 class V students at SD Gugus V Tabanan are still below the KKM. Based on these results, students' mastery of questions, especially those based on HOTS, is still not optimal.

Choosing an appropriate learning model is an alternative in an effort to improve the quality of learning, so that students are able to understand what is being learned. The right learning model in a lesson will provide students with the opportunity to be directly and actively involved in the learning process, one of which is by using the Problem Based Learning (PBL) learning model.(Azzahra et al., 2023; Oktavia & Prasetyo, 2021). PBL is a teaching model that uses problems to obtain fundamental knowledge and concepts in certain subject matter(Komariyah & Laili, 2018; Tyas, 2017). Problems that can trigger high-level thinking skills are complex problems that are not solved using simple memory but require certain strategies and processes, for example using problem-based problems.problem(Dewi & Suadnyana, 2020; Rahmatia & Fitria, 2020; Suwaib et al., 2020).In its application, the PBL model is carried out by forming study groups guided by a teacher(Melindawati et al., 2022; Oktavia & Prasetyo, 2021). Teachers provide stimulus to students in the form of assistance to provide conducive learning facilities and situations so that the process of knowledge formation can be maximized. One of the advantages of the PBL learning model is that it is able to improve students' critical thinking skills(Dakabesi et al., 2019; Sari & Ganing, 2021; Sitompul, 2021). The application of the PBL learning model will be more interesting and able to develop students' thinking patterns to explore creative ideas to support learning activities, one of which is by using mind mapping media.

*Mind mapping*or mind map is a technique in learning that focuses students to be directed in studying information provided by the teacher and then this information is expressed in the form of a chart or diagram in the form of a concept map that is adapted to the student's own creativity and language style.(Hidayati et al., 2021; Mawardi et al., 2019; Saputra et al., 2021). The PBL learning model assisted by mind mapping can provide students with direct learning experiences and train students in critical thinking(Rohmanurmeta & Dewi, 2019; Sulfemi, 2019). During the learning process using mind mapping will also train students' creativity because there are colors, images, symbols and writing(Acesta, 2020; Yuniar & Hadi, 2023). So learning activities that use mind mapping make students more interested in learning. Several previous studies have revealed that the Problem Based Learning learning model provides good benefits for the learning process because it is able to increase student participation in the classroom.(Dewi & Suadnyana, 2020). Other research results also reveal that the application of the problem based learning model can improve critical thinking skills and learning outcomes in 4th grade elementary school students(Airlanda et al., 2018). The results of further research revealed that there was a significant increase in the application of Problem Based Learning assisted by Mind Mapping to learning activities(Suwaib et al., 2020). Based on several research results, it can be said that the PBL learning model and mid mapping media have a positive influence on improving student learning outcomes. It's just that in previous research, there have been no studies that specifically discuss the influence of the PBL model assisted by mind mapping on the critical thinking abilities of fifth grade elementary school students. So this research focuses on this study with the aim of finding out the effect of the PBL learning model assisted by mind mapping on students' critical thinking abilities in grade V elementary school science material.

2. METHOD

This research is classified as a quantitative type of research, using a quasi-experimental design. This is because not all variables that arise in experiments can be regulated and controlled strictly. After that, in connection with the researcher's ability to observe students' attitudes, which was limited mainly when outside of school. This research design uses two groups, namely the experimental group and the control group. The experimental group was the group that received special treatment using the Problem Based Learning (PBL) learning model assisted by mind mapping, then the control group was the group that did not receive special treatment, namely using conventional learning. The research design used was "Nonequivalent Control Group Design".

The design in this research involved 2 class groups, namely the experimental group and the control group. One group received treatment using the Problem Based Learning learning model assisted by mind mapping as the experimental group and one group that did not receive the learning model as the control group. The research began by giving a pre-test to all class V in Cluster V, Tabanan District. Giving a pre-test before treatment is used as a basis for equalizing groups. The technique used to equalize groups is using the One Way Variance Analysis (Anava A) technique. After all groups were declared equal, a drawing was carried out to determine the groups that would be used as the experimental group and the control group. Then each class was given treatment for 6 meetings. The experimental group was given treatment using the PBL learning model assisted by mind mapping, while the control group was not given treatment using conventional learning. After that, giving a post-test at the end of the activity will provide an idea of how big the impact was given by treatment (X). The aim of giving a post-test at the end of the research is to obtain data on students' critical thinking abilities in both the experimental group and the control group. giving a post-test at the end of the activity will provide an idea of how big the impact was given by the treatment (X). The aim of giving a post-test at the end of the research is to obtain data on students' critical thinking abilities in both the experimental group and the control group. giving a post-test at the end of the activity will provide an idea of how big the impact was given by the treatment (X). The aim of giving a post-test at the end of the research is to obtain data on students' critical thinking abilities in both the experimental group and the control group.

This research will take several stages, including the preparation stage, implementation stage and final experimental stage. The first stage is the preparation stage which carries out a series of initial activities before starting data collection and processing, namely determining the location of the school that will be used as a research site, submitting a research observation permit letter to the Principal at Gugus V Elementary School, Tabanan District, carrying out teaching observations and interviews with teachers. homeroom teacher for class V, carrying out trials of research instruments in class VI, conducting consultations, collecting data by giving pre-test questions to the entire population to prove group equality, analyzing pre-test data for the entire population using the One Way Analysis of Variance (Anava-A) technique), conducting a draw to determine the experimental group and control group, compiling a

lesson plan, consulting with the class V teacher and supervisor, and finally preparing learning using the PBL learning model assisted by mind mapping. The second stage, namely the implementation, was carried out by providing treatment in the form of teaching the PBL learning model assisted by mind mapping to the experimental group and providing conventional learning to the control group, giving treatment 6 times to the experimental group and the control group. Treatment was given according to class hours related to the material in the research, and provided post-test questions for each experimental group and control group. The third stage is the final stage of the experiment with detailed activities such as analyzing research data, The research population involved was 160 students from class VI from SD Gugus V, Tabanan District. The technique used for sampling uses a sampling technique. Furthermore, the sampling technique used in selecting samples in this study was cluster random sampling. Luster random sampling is a method of sampling based on clusters. Cluster random sampling is sampling carried out randomly in groups rather than individually. This method is used because it is not possible to change or randomize individuals, so what can be chosen randomly is a class or group. So that the groups are selected as they have been formed without researcher intervention and no randomization of individuals. Next, the experimental group and control group were determined by writing down each elementary school in Cluster V, Tabanan District. This lottery method is done by writing the name of each school on paper, then the paper is rolled up small and put in a bottle with a hole in the lid. The paper that has been put into the bottle is then shaken and 2 groups are obtained as samples.

The data collection method used in this research is the test method which is a tool used to measure or estimate a person's level of ability, in this case measuring the level of students' critical thinking abilities in science material. In carrying out this research, what will be analyzed is students' critical thinking abilities, which in obtaining the data uses the essay test method which functions to measure students' critical thinking abilities on science material. The essay test method allows students to answer questions using their own language by freely arranging words into sentences. The test used in this instrument was developed independently, totaling 10 questions through procedures for preparing grids, creating question items and answer keys, assessment rubrics, consultation with the homeroom teacher and supervisor, field trials and analyzing trial results. The research instrument grid is used as a guide in making research instruments. The instrument grid is adjusted to the KD and indicators in the K13 Curriculum. To measure critical thinking skills, the instrument grid is guided by the HOTS question criteria so that the cognitive levels measured are analyzing (C4), evaluating (C5), and creating (C6). The grid of critical thinking ability instruments in science material is presented in To measure critical thinking skills, the instrument grid is guided by the HOTS question criteria so that the cognitive levels measured are analyzing (C4), evaluating (C5), and creating (C6). The grid of critical thinking ability instruments in science material is presented in To measure critical thinking skills, the instrument grid is guided by the HOTS question criteria so that the cognitive levels measured are analyzing (C4), evaluating (C5), and creating (C6). The grid of critical thinking ability instruments in science material is presented in Table 1.

Table 1. Research Instrument Grid

Basic competencies		Question Indicator		Cognitive Level
3.7	Analyze the effect of heat on the temperature and shape of objects in everyday life.	3.7.1	Analyze the properties of solid, liquid and gas objects.	C4
		3.7.2	Analyze physical and chemical changes in the form of objects.	C4
		3.7.3	Create a scheme of events changing the shape of objects.	C6
		3.7.4	Analyzing heat absorption and release events	C4
		3.7.5	Summarizing events that change the shape of objects.	C5

After the test to be used has been prepared, the next step is to carry out testing of the test to test the suitability of the instrument in the form of an essay with 10 test items. The tests carried out include content validity tests, item validity tests and reliability tests. The validity test is calculated using the Product Moment correlation coefficient formula with a significance level of 5% ($\alpha = 0.05$). The criteria for reliability testing using the Cronbach's alpha formula can be seen in Table 2.

Table 2. Test Reliability Criteria

Range	Information
0.80 – 1.00	Very high
0.60 – 0.79	Tall
0.40 – 0.59	Enough
0.20 – 0.39	Low
0.00 – 0.19	Very low

Data obtained through research instruments must be processed and analyzed so that the results can be used to make decisions based on testing hypotheses or conjectures. The data analysis techniques used in this research are descriptive analysis and inferential statistical analysis. Descriptive statistics can also be known as deductive statistics, meaning statistics whose level of use includes ways of collecting data, compiling or organizing data, processing data, presenting data and analyzing numerical data.(Hilgers et al, 2019). Descriptive statistics are used to analyze data by describing or illustrating the data that has been collected. The data obtained through research results is in quantitative descriptive form by looking for the average (mean), median, mode and standard deviation. The calculated results of the average score related to the student's grades are then analyzed and converted into a five-scale Benchmark Assessment (PAP) category. Students' critical thinking abilities can be determined by comparing the average percent (M%) in the five scale PAP with the criteria inTable 3.

Table 3. PAP Conversion Guidelines with Five Scales

Value Range	Score	Letter Value	Criteria
90 – 100	4	A	Very high
80 – 89	3	B	Tall
65 – 79	2	C	Currently
40 – 64	1	D	Low
0 – 39	0	E	Very low

Next, calculations are carried out using inferential statistics. Inferential statistics is a field of statistical science that studies procedures for drawing conclusions about the state of a population, based on the results of data analysis on a part of the population called a sample. In this case, a prerequisite test is carried out first before hypothesis testing is carried out. Prerequisite tests include (1) normality test of data distribution calculated using the Chi-Square formula. The test criteria are if X^2count < Then (2) test homogeneity of variance, namelytesting whether the variances of two or more distributions are the same. This test was carried out as an effort to find the level of homogeneity with two parties taken in separate groups in one population, namely the experimental group and the control group. The test criteria in this test are, if H0 is accepted if the Fcount value ≤ Ftable price which can be interpreted as meaning that the data is homogeneous, but if Fcount>F table value, then the data is declared inhomogeneous with a significance level of 5% (α = 0.05) with degrees of freedom for the numerator, namely k - 1 and degrees of freedom for the denominator, namely n – k. The k value is the number of groups of data measured while n is the number of samples measured.If the data has met the prerequisites for normality and homogeneity tests, the analysis used is analysis in testing the research hypothesis, namely the t-test. Where this hypothesis test uses the t-test with the separated variance formula. At a significance level of 5% (α = 0.05) and . Test criteria, if tcount ≤ ttable then H0 is accepted. Conversely, if tcount > ttable then H0 is rejected.$dk = n_1 + n_2 - 2$.

3. RESULT AND DISCUSSION

Result

The data collected in this research is data on students' critical thinking abilities in class V science material at SD Gugus V Tabanan, Tabanan District, Academic Year 2022/2023. The data that has been collected is analyzed according to previously established analysis techniques. To find out the data from statistical analysis, a table of post-test data on students' critical thinking abilities on science material in the experimental group is presented as shown in Table 4.

Table 4. Frequency Distribution of Experimental Group Post-Test Data

Frequency Distribution Table								
No.	**Intervals**	**xi**	**f**	**fk**	**f.xi**	**xi-$\bar{x}$**	**(xi-$\bar{x}$)²**	**f.(xi-$\bar{x}$)²**
1	69-73	71	4	4	284	-12.88	165,894	663.58
2	74-78	76	3	7	228	-7.88	62,094	186.28
3	79-83	81	6	13	486	-2.88	8,294	49.77
4	84-88	86	4	17	344	2.12	4,494	17.98
5	89-93	91	5	22	455	7.12	50,694	253.47
6	94-98	96	4	26	384	12.12	146,894	587.58
Amount			**26**		**2181**			**1758.65**

Then, to determine the trend of students' critical thinking ability scores on science material for experimental class students, the data is also presented in the form of a polygon graph as shown in Figure 1.

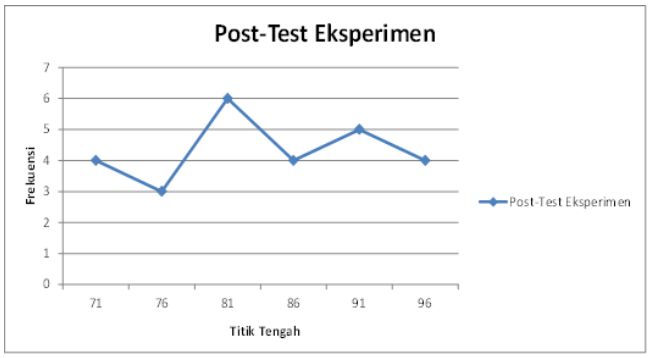

Figure 1. Polygon Graph of Experimental Group Students' Post-Test Data

The data in Figure 1 shows that the mode is greater than the median and the median is greater than the mean (Mo > Me > M), indicating that most of the values tend to be high. Then the average post-test score for students' critical thinking abilities on science material in the experimental class was converted into a five-scale PAP calculation category to determine the high or low quality of students' critical thinking abilities. Based on the results of calculating the average student scores, the PAP categories on a five scale are then arranged as in Table 5.

Table 5. Results of the Post-Test PAP Scale of Critical Thinking Ability of Experimental Group Students

Value Range	Score	Letter Value	Criteria
90 – 100	4	A	Very high
80 – 89	3	B	Tall
65 – 79	2	C	Currently
40 – 64	1	D	Low
0 – 39	0	E	Very low

Furthermore, to find out students' critical thinking abilities in the science material of the control group, you can see:table 6.

Table 6. Frequency Distribution of Control Group Post-Test Data

Frequency Distribution Table								
No.	**Intervals**	**xi**	**f**	**fk**	**f.xi**	**xi-$\bar{x}$**	**(xi-$\bar{x}$)²**	**f.(xi-$\bar{x}$)²**
1	64-67	65.5	2	2	131	-10.61	112,572	225,144
2	68-71	69.5	4	6	278	-6.61	43,692	174,768
3	72-75	73.5	8	14	588	-2.61	6,812	54,497
4	76-79	77.5	2	16	155	1.39	1,932	3,864
5	80-83	81.5	7	23	571	5.39	29,052	203,365
6	84-87	85.5	3	26	257	9.39	88,172	264,516
Amount			**26**		**1979**			**926.155**

Then, to determine the trend of students' critical thinking ability scores on the science material for control class students, the data is also presented in the form of a polygon graph as shown in Figure 2.

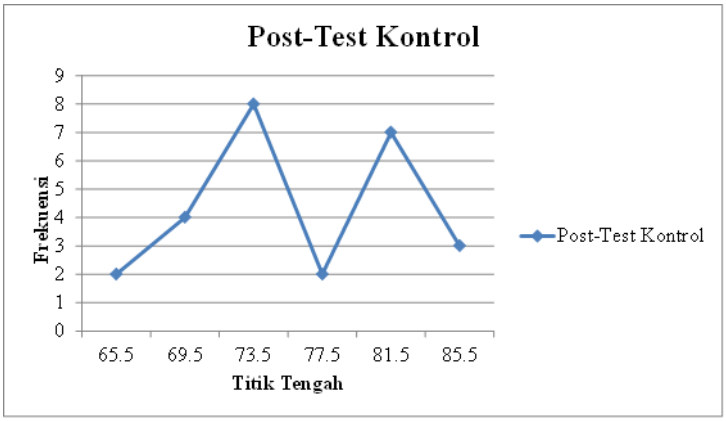

Figure 2. Polygon Graph of Post-Test Data for Control Group Students

Based on the data in Figure 2, it shows that the mode is smaller than the median and the median is smaller than the mean (Mo < Me < M), so it shows that most of the values tend to be low. Then the average post-test score for students' critical thinking abilities on science material in the control class was converted into a five-scale PAP calculation category to determine the high or low quality of students' critical thinking abilities. Based on the results of calculating the average student scores, the PAP categories on a five scale are then arranged as inTable 7.

Table 7. Control Group Post-Test PAP Scale Results

Value Range	Score	Letter Value	Criteria
90 – 100	4	A	Very high
80 – 89	3	B	Tall
65 – 79	2	C	Currently
40 – 64	1	D	Low
0 – 39	0	E	Very low

In this research, the normality test used is the Chi-Square Test with the criteria that the data is normally distributed if count ≤ table with a significance level of 5% then H0 is accepted which means the data is normally distributed and if the data is not normally distributed if count > table with a significance level of 5% then H0 is rejected. The normality test of data distribution was carried out on post-test data on students' critical thinking abilities on science material in the experimental group and control group. Data presented in$(X^2)X^2\,X^2X^2\,X^2$ Table 8.

Table 8. Recapitulation of Normality Test Results for the Experimental Group and Control Group

No.	Data Group	X2count	X2 table	Conclusion
1	Experimental Group	5,584	11.07	Normal
2	Control Group	4,229	11.07	Normal

In this study, homogeneity tests were carried out on the experimental group and the control group. The homogeneity test used is Fisher's test. The criteria in this test are if Fcount ≤ Ftable at a significance level of 5% with dfnumerator = k – 1 and dfnumerator = n – k then the two groups of data are declared homogeneous. On the other hand, if Fcount > Ftable then the two data groups are declared not homogeneous (heterogeneous). Data presented inTable 9.

Table 9. Recapitulation of Post-Test Variance Homogeneity Test Results for the Experimental Group and Control Group

No.	Sample	S2	et al	Fcount	Ftable	Conclusion
1.	Experimental Group	70,224	26	1,893	4.03	Homogeneous
2.	Control Group	37,088	26			

After carrying out the prerequisite tests with the results of normality of distribution of normally distributed data and homogeneity of variance declared to be homogeneous, then hypothesis testing was carried out using the t-test. The t-test analysis uses the separated variance formula with a significance level of 5% and . Test criteria, if tcount ≤ ttable then H0 is accepted, whereas if tcount > ttable then H0 is rejected. The recapitulation of the results of the separated variance t-test analysis can be seen in$dk = n_1 + n_2 - 2$ Table 10.

Table 10. Recapitulation of t-test calculation results

Group	Many Subjects (n)	Average Score ()$\bar{x}$	Variance	et al	tcount	ttable (ts5%)
Experiment	26	83.88	70,224	50	3,825	2,009
Control	26	76.11	37,088			

Based on the data in table 10, it is found that tcount = 3.825 and ttable = 2.009 at a significance level of 5% (α = 0.05) with degrees of freedom (dk) = 26 + 26 2 = 50. So, it is found that tcount (3.825) > ttable (2.008) so that H0 is rejected. It can be concluded that there is a significant difference in students' critical thinking abilities in science material who follow the Problem Based Learning learning model assisted by mind mapping and students who are not taught using the learning model in class V of SD Gugus V Tabanan for the 2022/2023 academic year.$= n_1 + n_2 - 2$ −.

Discussion

The results of data analysis show that there is a significant difference in students' critical thinking abilities in science material who follow the PBL learning model assisted by mind mapping and students who are not taught using the learning model in class V of SD Gugus V Tabanan for the 2022/2023 academic year. These results then show that the PBL learning model has provided students with learning experiences through problems given to students to jointly find solutions so that students will be trained in their critical thinking skills.(Wulandari & Agustika, 2018;Sutrisno 2019). It was further explained that the application of the PBL model is able to accommodate student involvement in the learning process, therefore students will more easily solve contextual problems(Lestari, 2019; Rahmatia & Fitria, 2020). The ability to solve problems through critical thinking processes must be mastered by students in order to solve various problems that exist in everyday life. Critical thinking is basically an active process and a regular way of thinking to be able to understand information in depth, thereby forming a belief and truth of the information obtained or the opinion expressed.(Andriyani et al., 2021; Komariyah & Laili, 2018; Syafitri et al., 2021).Thinking critically makes someone able to adjust, change, organize and improve their thoughts and dig deeper from various points of view so that someone is able to make the best decisions.(Airlanda et al., 2018; Oktavia & Prasetyo, 2021; Rahmatia & Fitria, 2020; Syafitri et al., 2021). Basically, critical thinking skills are needed in order to help learners, in this case students, to manage their thoughts so that they obtain appropriate learning methods, know the meaning of learning and know the main points of learning.(Prasetyo & Kristin, 2020; Sitompul, 2021; Sutrisno, 2019).

Apart from being able to be improved through the application of the PBL learning model, students' critical thinking abilities can also be improved through the application of mind mapping learning media, this is because mind mapping media is able to focus students' thinking processes through creating concept maps. Mind mapping is a technique in learning that focuses students on being directed to examine information provided by the teacher and then the information is expressed in the form of a chart or diagram in the form of a concept map that is adapted to the student's own creativity and language style.(Acesta, 2020; Saputra et al., 2021; Yuniar & Hadi, 2023). The PBL learning model assisted by mind mapping can provide students with direct learning experiences and train students in critical thinking(Rohmanurmeta & Dewi, 2019; Sulfemi, 2019). During the learning process using mind mapping will also train students' creativity because there are colors, images, symbols and writing(Hidayati et al., 2021; Mawardi et al., 2019; Saputra et al., 2021). So learning activities that use mind mapping make students more interested in learning. Learning using mind maps requires students to create a mind map by utilizing pictures/diagrams of main concepts that are interconnected, marked by curved lines that connect to the second and third branches.(Istiqoma & Sari, 2019; Sulfemi, 2019). The use of mind mapping in the learning process has several advantages, such as being able to provide a comprehensive view of the main problem or a large area, allowing students to create routes or options for solving problems, encouraging problem solving by allowing students to see ways of creative breakthroughs, and fun to look at, read, digest and remember(Fitriyati & Karyanto, 2021; Sadikin et al., 2022; Widia et al., 2020). The results obtained in this research are in line with the results of previous research, which also revealed that the Problem Based Learning learning model provides good benefits for the learning process because it is

able to increase student participation in the classroom.(Dewi & Suadnyana, 2020). Other research results also reveal that the application of the problem based learning model can improve critical thinking skills and learning outcomes in 4th grade elementary school students(Airlanda et al., 2018). The results of further research revealed that there was a significant increase in the application of Problem Based Learning assisted by Mind Mapping to learning activities(Suwaib et al., 2020). So based on several research results, it can be said that the PBL learning model and mid mapping media have a positive influence on improving student learning outcomes.

4. CONCLUSION

Based on the results of data analysis, it can be concluded that the application of the PBL learning model assisted by mind mapping has a significant effect on students' critical thinking abilities in Class V science material at Gugus V Elementary School, Tabanan District, for the 2022/2023 academic year. These results are shown by an increase in students' critical thinking abilities on science material in the experimental group after being given treatment in the form of a Problem Based Learning learning model assisted by mind mapping, while students' critical thinking abilities on science material in the control group who were not given treatment in the form of a PBL learning model assisted by mind mapping mapping but using conventional learning also experienced an increase but not as much as the experimental group.

5. REFERENCES

Acesta, A. (2020). The Effect of Applying the Mind Mapping Method on Students' Creative Thinking Abilities. Naturalistic: Journal of Education and Learning Research Studies, 4(2), 581–586.https://doi.org/10.35568/naturalistic.v4i2b.766.

Airlanda, GS, Islam, FM, & Harjono, N. (2018). Application of the Problem Based Learning Model to Improve Critical Thinking and Science Learning Outcomes in Theme 8 Class 4 Elementary School. Education Partners Journal, 2(7), 613–628.https://e-jurnalmitrapendidikan.com/index.php/e-jmp/article/view/351.

Andriyani, A., Purwandari, S., & Hisnan Hajron, K. (2021). The Influence of the Problem Based Learning Model Assisted by Thematic Ludo Media on Science Critical Thinking Ability. Borobudur Educational Review, 1(01), 22–29.https://doi.org/10.31603/bedr.4790.

Ariyanto, M. (2018). Improving Science Learning Outcomes on Earth's Appearance Material Using the Scramble Model. Elementary Education Professions, 3(2), 133.https://doi.org/10.23917/ppd.v3i2.3844.

Azzahra, R., Elizabeth Patras, Y., & Hikmah, N. (2023). The Influence of the Problem Based Learning Model Assisted by Mind Mapping Media on Learning Outcomes for the Subtheme Cultural Diversity of My Nation. Didactics: PGSD STKIP Subang Scientific Journal, 8(2), 3383–3399.https://doi.org/10.36989/didaktik.v8i2.662.

Campedelli, G. M. (2021). Where are we? Using Scopus to map the literature at the intersection between artificial intelligence and research on crime. Journal of Computational Social Science, 4(2), 503–530.https://doi.org/10.1007/s42001-020-00082-9.

Dakabesi, D., Supiah, I., & Luoise, Y. (2019). The effectiveness of problem-based learning models to increase the students' critical thinking skills. Journal of Education and Learning (EduLearn), 13(4), 543–549.https://doi.org/10.11591/edulearn.v13i4.12940.

Dewi, GAPOC, & Suadnyana, IN (2020). Problem Based Learning Model Assisted by Mind Mapping on Science Knowledge Competencies. Journal of Educational Research and Development, 4(2), 235.https://doi.org/10.23887/jppp.v4i2.26788.

Fitriyati, DN, & Karyanto, UB (2021). Effectiveness of Using the Mind Mapping Learning Method to Improve Student Jurisprudence Learning Outcomes. Indonesian Journal of Islamic Elementary Education, 1(2), 11–18.https://doi.org/10.28918/ijiee.v1i2.4243.

Hidayati, TP, Sutresna, Y., & Warsono, W. (2021). Effectiveness of Using the Problem Based Learning Model Assisted by Mind Mapping on Students' Science Process Skills. Bioed: Journal of Biology Education, 9(1), 1.https://doi.org/10.25157/jpb.v9i1.5327.

Hilgers, R.-D., Heussen, N., & Stanzel, S. (2019). Descriptive statistics. Lexikon Der Medizinischen Laboratories Diagnostics, 1(1), 2212–2212.https://doi.org/10.1007/978-3-662-48986-4_2900.

Ikha, NJ (2020). Effectiveness of Using Multimedia in Science Learning in Elementary Schools. Primary School Scientific Journal, 4(1), 54.https://doi.org/10.23887/jisd.v4i1.24135.

Istiqoma, VA, & Sari, K. (2019). Efforts to Improve Career Planning Capabilities Through Mind Mapping

Media Career Guidance. Journal of Counseling Wahana, 2(1), 20.https://doi.org/10.31851/juang.v2i1.2682.

Komariyah, S., & Laili, AFN (2018). The Influence of Critical Thinking on Mathematics Learning Outcomes. Journal of Educational Research and Mathematics Teaching, 4, 55–60.https://doi.org/10.33751/jppguseda.v3i1.2013.

Lestari, M. (2019). Implementation of an Intuition-Based Learning Model on Student Creativity. Journal of Mathematics Education, 1(1), 13–22.https://journal.iainkudus.ac.id/index.php/jmtk/article/view/ 6339/3834.

Mawardi, M., Wulandari, FA, & Wardani, KW (2019). Improving the Creative Thinking Skills of Grade 5 Students Using the Mind Mapping Model. Primary School Scientific Journal, 3(1), 10.https://doi.org/10.23887/jisd.v3i1.17174.

Melindawati, S., Puspita, V., Suryani, AI, & Marcelina, S. (2022). Literature Analysis Review of the Application of the Problem Based Learning (PBL) Model in Social Studies Learning in Elementary Schools. Educative: Journal of Educational Sciences, 4(5), 7338–7346.https://doi.org/10.31004/edukatif.v4i5.3919.

Oktavia, WA, & Prasetyo, T. (2021). The Effectiveness of Problem Based Learning and Problem Solving Learning Models on Primary School Students' Critical Thinking Abilities. Basicedu Journal, 5(3), 1149–1160.https://doi.org/10.31004/basicedu.v5i3.892.

Paris, S., Jusmawati, Alam, S., Jumliadi, & Arsyam, M. (2021). Efforts to Increase Student Learning Achievement Through a Cooperative Model with an Experimental Approach to Science Learning in Class V of SD Inpres Bangkala II, Makassar City. Junal Binagogik, 8(1), 101–108.https://ejournal.stkipbbm.ac.id/index.php/pgsd/article/view/301.

Prasetyo, F., & Kristin, F. (2020). The Influence of the Problem Based Learning Model and the Discovery Learning Model on the Critical Thinking Ability of Grade 5 Elementary School Students. Tauhidi Didaktika: Journal of Elementary School Teacher Education, 7(1), 13.https://doi.org/10.30997/dt.v7i1.2645.

Rahmatia, F., & Fitria, Y. (2020). The Influence of the Problem Based Learning Model on Critical Thinking Ability in Elementary Schools. Basicedu Journal, 4(3), 889–898.https://doi.org/10.31004/basicedu.v4i4.482.

Rohmanurmeta, FM, & Dewi, C. (2019). Development of Environmental Conservation Digital Comics Based on Religious Character Values for Thematic Learning for Elementary School Students. Muaddib: Educational and Islamic Studies, 1(2), 100.https://doi.org/10.24269/muaddib.v1i2.1213.

Sadikin, H., Nugrahani, F., & Suwarto, S. (2022). Application of the Mind Mapping Method through Poetry Writing Skills in Teaching and Learning Interactions in Class IV SDV. Journal of Education and Counseling (JPDK), 4(5).https://doi.org/10.31004/jpdk.v4i5.7859.

Santika, M. (2019). Effectiveness of Communication and Learning Outcomes of Class IV Elementary School Students in Science Learning Through the Open Ended Model. Journal of Science & Science Learning, 3(1), 21–27.https://doi.org/10.24815/jipi.v3i1.12819.

Sappe, I., Ernawati, E., & Irmawanty, I. (2018). The Relationship between Learning Motivation and Science Learning Outcomes of Class V Students at Sdn 231 Inpres Kapunrengan, Mangarabombang District, Takalar Regency. JKPD (Journal of Basic Education Studies), 3(2), 530.https://doi.org/10.26618/jkpd.v3i2.1419.

Saputra, J., Triyogo, A., & Frima, A. (2021). Application of the Mind Mapping Learning Model to Learning Outcomes in Elementary Schools. Basicedu Journal, 5(6), 5133–5141.https://doi.org/10.31004/basicedu.v5i6.1563.

Sari, SM, & Ganing, NN (2021). Development of Powtoon Learning Media Based on Problem Based Learning on Science Content Ecosystem Material for Class V Elementary Schools. Scientific Journal of Teacher Professional Education, 4(2), 288–298.https://doi.org/10.23887/jippg.v4i2.32848.

Sitompul, NNS (2021). The Influence of the Problem Based Learning Model on Improving the Mathematical Critical Thinking Ability of Class IX Middle School Students. Gauss: Journal of Mathematics Education, 4(1), 45–54.https://doi.org/10.30656/gauss.v4i1.3129.

Sulfemi, WB (2019). Mind Mapping Cooperative Learning Model Assisted by Audio Visuals in Increasing Interest, Motivation and Social Sciences Learning Outcomes. PIPSI Journal (Indonesian Social Sciences Education Journal), 4(1), 13.https://doi.org/10.26737/jpipsi.v4i1.1204.

Sutrisno, T. (2019). The Influence of Problem Based Learning on Students' Critical Thinking Ability in Class VI Civics Subjects at SDN Sumenep City. ELSE (Elementary School Education Journal): Journal of Elementary School Education and Learning, 3(2), 98.https://doi.org/10.30651/else.v3i2.3394.

Suwaib, S., Riyanto, Y., & Subroto, WT (2020). Application of the Problem-Based Learning Model Assisted

by the Mind Mapping Method to Improve Social Studies Activities and Learning Outcomes for Class IV Students at SD Negeri 002 North Sebatik, Nunukan Regency. Basic Education Review Journal: Journal of Educational Studies and Research Results, 6(2), 163–173.https://doi.org/10.26740/jrpd.v6n2.p163-173.

Syafitri, E., Armanto, D., & Rahmadani, E. (2021). Axiology of Critical Thinking Ability (Study of the Benefits of Critical Thinking Ability). Journal Of Science And Social Research, 4(3), 320.https://doi.org/10.54314/jssr.v4i3.682.

Tyas, R. (2017). Difficulties in Applying Problem Based Learning in Mathematics Learning. Tecnoscienza, 2(1).https://e-jurnalmitrapendidikan.com/index.php/e-jmp/article/view/351.

Wahyudi, M., Agung, IG, & Wulandari, A. (2021). Contribution of Cognitive Style and Scientific Attitude to Science Knowledge Competency. Journal of Educational Research and Development, 5(1), 17–25.https://doi.org/10.23887/jppp.v5i1.32307.

Widia, W., Sarnita, F., Fathurrahmaniah, F., & Atmaja, JP (2020). Using Mind Mapping Strategies to Improve Students' Mastery of Concepts. Mandala Education Scientific Journal, 6(2).https://doi.org/10.58258/jime.v6i2.1459.

Wulandari, IGAA, & Agustika, GNS (2018). The Influence of Cognitive Style on Mathematics Learning Outcomes in Semester IV Students of the PGSD Department, UPP Denpasar, Ganesha Education University, Academic Year 2016/2017. Primary School Scientific Journal, 2(1), 94.https://doi.org/10.23887/jisd.v2i1.15515.

Yuniar, V., & Hadi, S. (2023). The Influence of a STEM-Based PBL Learning Model Using Mind Mapping Assistance on Increasing Creative Thinking Abilities. Indonesian Science Tadris Journal, 3(1), 44–54.https://doi.org/10.21154/jtii.v3i1.1165.