The Effectiveness of *Problem Based Learning* (PBL) Model Assisted with *Mind Mapping* to Improve Critical Thinking of IPS Class V Students

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ABSTRACT

The results of the analysis of students's report of fifth grade students at SDN Bangunharjo in the IPS subject were still below the KKM. This is related to the results of preliminary studies in the field which show that learning is still textual. There is a lack of HOTS questions to explore students' critical thinking processes and there was no study that presented a variety of situations to solve. This study aimed to analyze the effectiveness of the *mind mapping*-assisted PBL model to improve students' critical thinking.

This research was conducted at Bangunharjo Elementary School, Semarang City. This type of research used quasi-experiments. The method used is a quantitative method. The entire population of class V at SDN Bangunharjo is 50 students. The research subjects were 25 students in the experimental class, class 5 B and 25 students in the control class, class VA. Sampling using nonprobability sampling with saturated sampling technique. Research data obtained from *pretest-posttest*, questionnaire, observation, and documentation. The data analysis used is the normality test, homogeneity test, sample t-test, gain test, and effective contribution.

The results showed that the PBL model assisted by *mind mapping* was effective in increasing students' critical thinking: (a) the mean similarity results showed p = 0.988 and *t count* = 0.017, (b) completeness test, has result Sig value. showed a result of $0.05 \leq 0.05$, (c) the independent t-test showed a significance value showing the number 0.00 <0.05, (d) The n-gain result showed an average of 0.43.

it conclusde, the *problem based learning* (PBL) model assisted by *mind mapping* is effective in increasing social studies students' critical thinking. For future researchers and for teachers, during the learning process the teacher should play an active role in providing direction and stimulus then students were able to learn independently and focus on learning. The problem-based learning model assisted by *mind mapping* can be used and developed in other learning materials and content to improve the quality of learning.

Keywords: Critical Thinking, *Mind mapping, Problem based learning,*

INTRODUCTION

Susilo (2012: 13) stated that critical thinking is thinking full of skills in making sense or concepts, applying, analyzing, synthesizing, and evaluating which will guide in determining attitudes and actions. The ability to think critically is one of the abilities that must be possessed to face the 21st century. The development of increasingly modern science and technology in the 21st century raises increasingly of complex problems. Therefore, critical thinking skills really need to be developed in the learning process because it can help students understand and act on existing problems.

The ability to think critically cannot be separated from the success of a student in understanding a concept in a lesson. Nowaday, the Indonesian government is implementing the 2013 curriculum where each subject is integrated into one theme. In grades IV, V, and VI there are social studies subjects which are combined with other subjects. An understanding of the IPS concept is necessary to increase students' knowledge. Conceptual understanding is a person's ability to understand what is taught, grasp the meaning of what is learned, and utilize the contents of the material being studied, and solve problems related to the material being studied. The process of critical thinking has an important role in increasing students' understanding of concepts. The application of critical thinking cannot be taught only by the lecture method. Teachers need innovation to provide optimal teaching to students.

The results of the analysis of report student's sores for Class VA and VB students of 70 Semester 2 students at SDN Bangunharjo for the 2021/2022 academic year show that the average IPS score was still below the Minimum Completeness Criteria (KKM) of 80. This was in the data I found that students who scored 90-100 with an A rating of 5 with a percentage of 7%, students who scored 80-89 with a B rating of 20 students with a percentage of 29%, students who scored 70-79 with a C rating of 45 students with a percentage of 65 %.

From the data above, it can concluded that the grades in the social studies subject at SDN Bangunharjo Class V in 2021/2022 were still below the KKM. This is related to the results of preliminary studies in the field which showed that learning is still textual. Teachers find it difficult to determine what learning model is right. The teacher's limitations in making teaching aids lead to students not being able to understand the mastery of the material being taught properly so that it affects students' social studies scores. Further, the IPS learning process has only recorded material read by the teacher. Teachers do not provide learning strategies so that children can memorize social studies well. As well as in learning students tend to be passive, the learning process is less interesting, there is a lack of HOTS questions to explore students' critical thinking processes, and there is no learning that presents various situations to be solved.

The results of observations made by researchers regarding the process of critical thinking and understanding of Social Sciences concepts during learning were as follows: the first problem, when the teacher asked questions about the economic concepts of production, distribution, and consumption. Of the 35 students who did not answer there were 20 students who answered there were 15 students. The second problem, when the teacher asked students to re-explain the production, distribution, consumption material that had been taught there were only a few students who answered even though the material had been taught at the previous meeting that was being taught. In the learning process not all students show active involvement. When learning takes place students tend to accept the information conveyed. When discussing activities, most students only refer to textbooks in doing assignments and discussion activities with group mates were still not much done. In addition, student activities in interpreting a problem, making predictions, making conclusions, and determining actions on a problem have not been seen in the learning process. The result of students' critical thinking skills have not been able to develop.

One of the appropriate learning models to develop students' critical thinking skills is the *Problem based learning* (PBL) learning model. Nafiah (2014: 130) stated that PBL is a learning model that uses real world problems as a context for students to learn about critical thinking and problem solving skills.

The use of the *Problem based learning* (PBL) model is expected to provide opportunities for students to improve student learning outcomes in building the

four pillars of learning, because student understanding can increase (learning to know) through a process of scientific work (learning to do) which is carried out collaboratively (learning to do). to live together), so the independent learning in students will be achieved (learning to be).

The PBL model often seemed difficulties in implementing it, because there is a change in students' learning habits from initially only learning to hear, record and memorize information from the teacher to learning by searching for data, analyzing, compiling hypotheses, and solving problems themselves (Rusman, 2011). With real problems in implementing the PBL model, it is necessary to develop a strategy that can complement and cover the deficiencies of the PBL model, namely *mind mapping*.

Rahmawati (2014: 126) explained that through *mind mapping*, students not only hear explanations from the teacher, but also take an active role in the learning process so that they better understand and master the material. *Mind mapping* is categorized as a creative note-taking technique and creative learning technique because in making mind maps requires the use of the imagination of the maker (Swadarma, 2013). *Mind mapping* can improve students' memory because *mind mapping* is a combination of images, colors and visual-spatial. *Mind mapping* according to Buzan (2013) can be useful for (1) stimulating the work of the left and right brain synergistically (2) freeing oneself from expression (3) helping a person flow freely (4) making a plan or story framework (5) developing an idea (6) planning personal goals (7) starting a new learning (8) summarizing the contents of a book (9) flexible (10) can focus (11) increase understanding (12) fun and easy to remember.

The research results of Aweke Shishigu Argaw, Beyene Bashu Haile, Beyene Tesfaw Ayalew, Shiferaw Gadisa Kuma (2017), showed that this study proved PBL as a more effective teaching method for physics topics chosen compared to conventional teaching methods.

This study aimed to analyze the effectiveness of using the *Mind mapping*-assisted *Problem based learning* (PBL) model to improve critical thinking of fifth grade students.

MATERIALS & METHODS

The method used in this study is a Quasi-Experimental method. quasi-experimental research is quasi-experimental research in which research subjects are not randomly grouped, but accept the condition of the subject as it (Ruseffendi, 2006). The research design used Nonequivalent [Pre-Test and Post-Test] Control Groups Design (NCGD). In this design the experimental group (A) and control group (B) were selected without random assignment procedure (without random assignment). Both the *pretest* and *posttest* were carried out in the two groups, only the experimental group was given treatment (Creswell, 2014). Then, from the two existing research groups, namely the experimental class and the control class, they were selected by Saturated Sampling. Saturated sampling is a sampling technique when all members of the population are used as samples. In this study, the samples were 24 students in the VA class as the control class with the conventional model, and 26 students in the VB class as the experimental class with the problem-based learning model assisted by *mind mapping*. The data collection technique used was a test technique to measure students' critical thinking skills with a test instrument in the form of questions. Data analysis techniques used are trend frequency, sample *t-test*, independent sample *t-test*, and *n-gain test*.

RESULT

1) Frequency of Experiment Class Students' Critical Thinking Ability

The effectiveness of the *Problem based learning* model assisted by *mind mapping* to improve students' critical thinking skills can be seen from the *pretest-posttest* scores of fifth grade students at SD N Bangunharjo.

The following table shows the tendency of critical thinking skills presented in Table 1.

Table 1. The Tendency in *Pretest-Posttest* Results of Students' Critical Thinking Ability

Score Range	Categories	Absolute Frequency		Relative Frequency (%)	
		Pretest	*Posttest*	*Pretest*	*Posttest*
86-100	Very Good	-	10	-	38%
71-85	Good	2	13	8%	50%
56-70	Fair	2	3	8%	12%
40-55	Poor	15	-	58%	-
25-39	Very Poor	7	-	26%	-

Analysis of the results of the tendency of students' critical thinking skills before and after participating in the *Mind mapping* Assisted *Problem based learning* model showed an increase. Critical thinking skills on the results of the *pretest* did not have students who were in the very good category, 2 students were in the good category with a percentage of 8%, 2 students were in the good category with a percentage of 8%, 15 students were in the less category with a percentage of 58%, and 7 students are in the very poor category with a percentage of 26%. After implementing learning using the *Problem based learning* model assisted by *mind mapping* and *posttest*, the results gained were 10 students who were in the very good category or 38%, there were 13 students who were in the good category with a percentage of 50%, 3 students were in the fair category with a percentage by 12%, there were no students in the poor and very poor category. A more detailed picture can be seen in Figure 1.
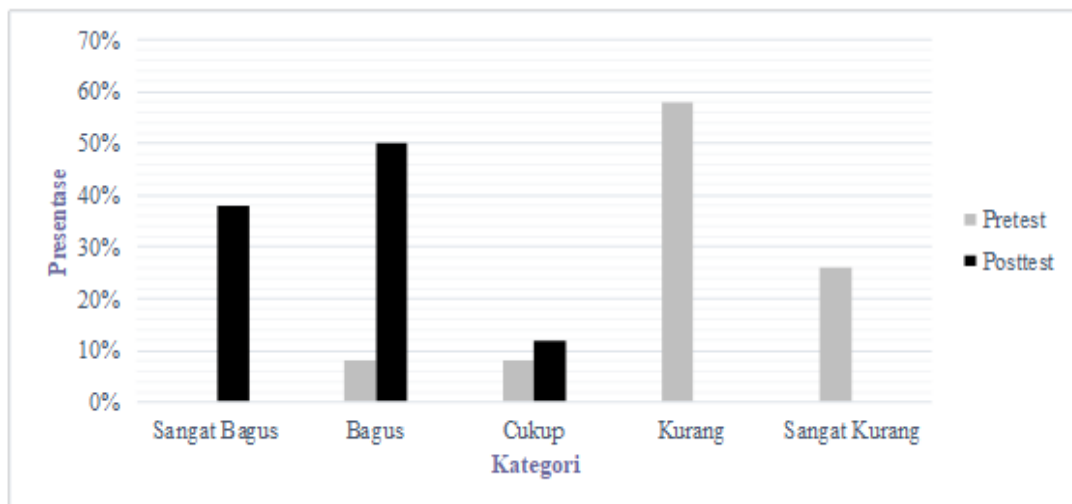
Picture 1 Absolute Frequency of Critical Thinking Ability

The results of analysis students' critical thinking skills before and after participating in learning with the *Mind mapping* Assisted *Problem based learning* model show an increase which can be seen in the results of the *posttest* or after participating in learning with the *Mind mapping* Assisted *Problem based learning* model. This increase can be seen from the number of students who are in a certain value range, in the *posttest* results the number of students who were in the high value range shows a greater number than during the *pretest*, which means that it has increased.

2) Average Similarity Test
The similarities in the initial abilities of students who received treatment using the *Mind mapping*-assisted *Problem based learning* model and those who used conventional learning can be identified through testing the average *pretest* score in

each class. After carrying out the normality test and homogeneity test of the *pretest* results data it is known that the distribution of *pretest* values is normal and homogeneous, so that the parametric test statistic is used for testing, namely the t test. The t test (Independent Samples t test) was carried out with the help of the SPSS 16.0 program, with a significance level of 5%.

Table 2 Calculation Results of *Pretest* Students' Critical Thinking Ability

Group	Average	t-test for Equality of means		
		t ht	t tb	Sig,
Exsperiment	9,8065	0,017	1,675	0,988
Control	9,8000			

Based on the table above, p = 0.988 and *t count* = 0.017. by comparing the value of p (0.988) > a (0.05) and *t count* $0,017 < t$ *table* (df50) $1,675$, it can be concluded that there is no significant difference between the *pretest* scores of the experimental class and the control class. This meant that the initial state of the students in the experimental class and the control class before learning had the same abilities.

3) Completeness Test Result
Completeness test in research using *sample t-test*. Test result *sample t-test* students' critical thinking skills can be seen in Table 3.

Table 3 Results of the Sample t-Test of Critical Thinking Ability

	t	Df	Sig. (2-tailed)
Test Value =70	2.654	26	.005

Based on the data gained in Table 4.9, it seen that the Sig. showed a result of $0.05 \leq 0.05$ meant H0 rejected, in other words, the proportion of completeness of students subjected to the *Mind mapping* Assisted *Problem based learning* model is more than 70%.

4) Average Difference Test Results
The data is normally distributed and the variance is homogeneous, the test difference in the average critical thinking ability of students who are taught with the *Mind mapping*-assisted *Problem based learning* model and students who are taught with conventional learning models, namely to find out whether the average critical thinking ability of students who are taught the *Problem based learning* model assisted by *mind mapping* is higher than students taught by conventional learning models.
Differences in increasing students' critical thinking skills in learning with the *Mind mapping* Assisted *Problem based learning* model can be known by conducting a *t-test*. The t test used is the independent sample *t-test* which is a test of the difference by comparing the *posttest* results of the control class and the experimental class. The results of the calculation of the independent sample t-test of students' critical thinking skills between the experimental class and the class can be seen in Table 4.

Table 4 *Posttest* t-test results of students' critical thinking skills

Sig. 2tailed	α	Mean		Remark
		Experiment	Control	
0,00	0,05	89.65	70.25	There is a difference in the average critical thinking ability

Based on Table 4 it showed that the significance value showed the number 0.00 <0.05. This proved that there was a difference in the average critical thinking ability of students in the experimental class and the control class after learning is carried out. In the mean box it seen that the mean experimental class showed a result of 89.65, while in the control class it showed a result

of 70.25. This shows that the average critical thinking ability of students in the experimental class is higher than the average critical thinking ability of students in the control class.

5) Experiment Class *N-Gain* Test Results
The *Gain Test* was conducted to determine the difference in the increase in students'

critical thinking skills from *pretest* to *posttest*. The results of the N-Gain test can be seen in Table 5.

Table 5 Calculation Results of the *N-Gain* Test

Aspect	Score Total	Average of Gain	Category of Gain
Critical thinking ability	12.242	0.43	Fair

Based on the data in Table 5, it seen that the average *N-Gain* of students' critical thinking skills showed a result of 0.43 which is in the medium category. The results of the N-Gain calculation for each student can be seen in Picture 2.
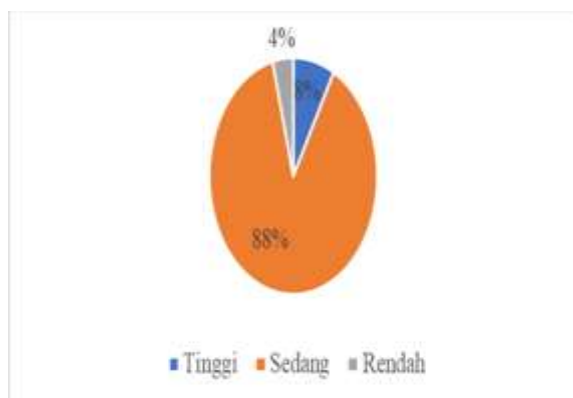
Picture 2 Experiment Class N-Gain

Based on Picture 2, it seen that in the matter of critical thinking skills, there were students who achieved a high gain score of 8%, students who achieved a moderate gain score had a percentage of 88%, and students who achieved a low gain score had a percentage of 4%. However, the gain results of experimental class students have good results because most of the students were in the medium category.

DISCUSSION

According to Falahudin (2016), critical thinking is a reflective thinking ability that focuses on patterns of decision making about what to believe and what to do. Critical thinking includes a number of cognitive skills and intellectual dispositions needed to identify, analyze and evaluate arguments effectively in order to be able to find solutions, be able to formulate and present convincing reasons to support

conclusions and be able to make rational and appropriate decisions about what to do and believe . Sari (2017) suggests that the ability to think critically is the ability to solve problems rationally according to logical stages and provide more efficient solutions.

The ability to think critically has several indicators, there are (1) providing simple explanations; (2) build basic skills; (3) concluded; (4) make further explanations; and (5) strategy and tactics. Assessment of critical thinking skills in the form of essays is by giving a score of 1-4 with the criteria provided in the assessment rubric.

Students who get a score of 1 on questions that contain indicators provide simple explanations decrease during the *posttest*. It meant that there was an increase in students who have mastered students' critical thinking skills in the first indicator. Indicators provide simple explanations containing questions related to presenting a description of the situation with the aim of students being able to provide arguments against the situation. In learning using *mind mapping*-assisted PBL, students are faced with an image or situation and then students are asked to explain the images and situations that are seen by students. For instance, students are oriented to the problem by looking at the situation of a activities carried out by the community, then students present their arguments based on the situation they see. Therefore, when faced with questions that contain a description of the situation, students know what to fill in. Therefore, the score of 4 obtained by students experienced an increase in the *posttest* compared to the *pretest*.

Students' critical thinking skills increased when the *posttest* on questions containing the second indicator, that was building basic skills. In this second indicator, students are presented with an argumentative text, then students are asked to determine which part is considered in the correct category along with the reasons. During the *pretest*, many students seemed difficult and were unable to

answer questions with maximum answers. It was seen that many students asked the meaning of the questions. When given treatment using the PBL model assisted by *mind mapping*, the teacher orients students to problems by confronting students with two different images. Next, students find out the benefits of each situation. For instance, pictures of farms and salt making. Which of the two pictures is an extractive effort, then students give their arguments related to the pictures they have chosen. Based on the learning that has been done, it becomes easier for students to encounter similar or different questions but have the same concept. Therefore, students who scored 4 on questions containing indicators of building basic skills experienced an increase in the *posttest*.

Students' critical thinking skills increased during the *posttest* on the third indicator, that was concluding. The problem presented is a statement with the aim that students can determine an appropriate conclusion accompanied by reasons. During the *pretest*, many students were unable to answer questions containing the third indicator. During treatment, students are given a problem in the form of a business situation that produces goods and services. Furthermore, students organize their learning tasks in groups, students find out through discussions with their group mates related to businesses that produce goods and services. Furthermore, students draw conclusions about businesses that produce goods and services. When students encounter a situation in the question, they will be able to answer it correctly, even though the form of the question is different from the example given. This is evident from the results of the increase in students' *posttest* in answering questions that contain indicators concluding a situation.

Students' critical thinking skills also increased during the *posttest* on the fourth indicator, that was providing further explanation. This problem presented a situation description with the aimed that students were able to determine the right

solution to solve the problem along with the reasons. Before getting treatment with the PBL model assisted by *mind mapping*, many students made mistakes in answering the *pretest* questions. When learning, students are given a problem in the form of what a person should do in order to provide good service to the community in his business field. Students convey further explanations related to what a person should do in order to provide good service to the community in his business field. Based on strengthening the fourth indicator of students' critical thinking skills, namely providing further explanation, it is easier for students to work on questions according to these indicators, so that students' *posttest* results experience an increase.

Students' critical thinking skills on the fifth indicator, that were strategies and tactics when the *pretest* were very few students who were able to answer correctly. This indicator contains the problem of formulating alternative solutions for writing certain procedures. Students tried strategies and tactics by discussing with their groups and feedback from the teacher and watching a video. Based on this situation, students were able to answer questions related to alternative problems on questions containing the fifth critical thinking ability indicator, then students who were able to answer correctly on the fifth indicator experienced an increase from *pretest* to *posttest*.

Many students asked questions related to the answers to the questions presented during the *pretest*. After being given treatment using the PBL model with *mind mapping*, in working on the *posttest* questions students no longer asked for answers to the questions presented. Students look serious working on the problems in front of them. In making *mind mapping*, students also seemed enthusiastic about working in groups to get good results.

Based on the results of the analysis of students' answers on each indicator of critical thinking skills, it stated that PBL learning with *mind mapping* is able to

improve students' critical thinking skills. This is because the PBL model with *mind mapping* was learning that provided problems for students to find solutions to. Through problems, students can do an analysis before acting and think about solutions and alternatives to a problem, then students' critical thinking skills emerge. In accordance with this research, students are faced with problems related to agrarian and extractive businesses as well as businesses in the field of goods and services. Then students are invited to carry out investigations then they were able to learn from a more real reference, not just from textbooks. Students are also invited to summarize learning and the results of investigations using *mind mapping*, so that the material studied can be remembered for a longer period of time. This is consistent with the results of research from Anindyta and Suwarjo (2014) that the *Problem based learning* (PBL) model has a positive and significant effect on the critical thinking skills of fifth grade elementary school students. Astuti (2016) in his research found that there were differences in the critical thinking abilities of students who were taught using the PBL model with students who were taught with conventional learning, besides that the interaction effect between PBL and intelligence had an effect on the level of students' critical thinking abilities. Karo-karo (2017) in his research found that

the effect of the PBL model with *Mind mapping* on students' critical thinking skills shows evidence that students can make solutions or problem solve to the problems they face in learning by using developing understanding of the material they are learning.

Based on several research results related to the PBL model and *mind mapping* which have a positive effect on students' critical thinking skills, it turns out that they are consistent with the results of this study. The results of this study showed an increase in students' critical thinking skills taught using the PBL model with *mind mapping*.

During the lesson, students follow it seriously. They were enthusiastic in conducting group investigations and in making mind maps. In making a mind map, all students seem to collaborate to get maximum results and fulfill the elements of making a good mind map. The strength in this study lied in the students' *mind mapping* in summarizing the learning material for economic activities in society. Based on the observation results, *mind mapping* made students more enthusiastic and creative in learning, because they like things related to pictures and colors or something that is interesting for children in general. In the following, one of the results of student group work in making a mind map is presented in Figure 3.
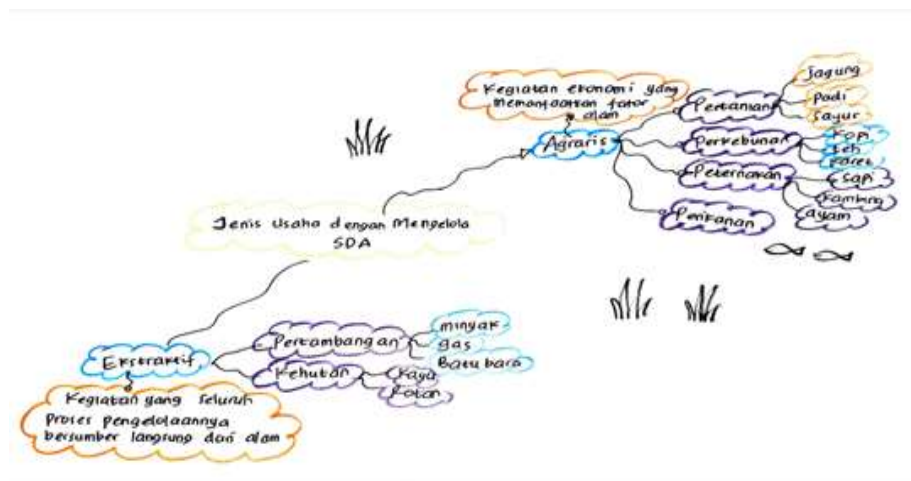
Picture 3 *Mind mapping* **of Student Discussion**

The ideal criteria that must be achieved in making a mind map are; (1) the use of paper should be plain and landscape oriented; (2) the depth of the material written in the mind map shows the inclusion of a lot of content and there is development of ideas which shows a deep understanding of the material; (3) the use of keywords is effective, meaning that all ideas are written in the form of keywords; (4) the use of more than one color, each branch should use a different color and information that is closely related has the same color; (5) design drawings should stand out and clarify ideas; and (6) the branches should all be curved, spread out in all directions, and the slope should not be too steep.

Based on the results of the discussion on making mind maps by students in Picture 3, it seen that making mind maps met the ideal criteria in indicator 1, that was the paper used is plain and landscape oriented. In indicator 2, students have written a lot of content and developed ideas from central topics, even though they are not optimal or there should be much more that can be written regarding the depth of the material. In indicator 3, students have written effective keywords or keywords that are not written in the form of long sentences and paragraphs. In indicator 4, students have used a variety of colors but information that is closely related has not been given the same color. In indicator 5, students have made designs and drawings even though students' designs and drawings have not been maximized, students have described objects related to the material type of business by managing natural resources.

CONCLUSION
There was effectiveness in using the *Problem based learning* (PBL) learning model assisted by *mind mapping* to improve critical thinking in fifth grade students at SDN Bangunharjo. The results of the trend analysis of the results of students' critical thinking skills before and after participating in learning with the *Mind mapping* Assisted *Problem based learning* model showed an increase which seen in the *posttest* results. The average similarity results show p = 0.988 and t count = 0.017 meaning that there was no significant difference between the *pretest* scores of the experimental class and the control class. This means that the initial state of the students in the experimental class and the control class before learning has the same abilities. Furthermore, the completeness test was carried out, resulting in a Sig value. showed a result of $0.05 \leq 0.05$ means that H0 rejected, in other words that the proportion of completeness of students subjected to the *Mind mapping* Assisted *Problem based learning* model is more than 70%. Meanwhile, the results of the independent t-test showed a significance value of 0.00 <0.05. This proves that there is a difference in the average critical thinking ability of students in the experimental class and the control class after learning is carried out. In the mean box it seen that the mean experimental class showed a result of 89.65, while in the control class it showed a result of 70.25. This showed that the average critical thinking ability of students in the experimental class is higher than the average critical thinking ability of students in the control class. The *n-gain* results showed an average of 0.43 with details of students who achieved a high gain score of 8%, students who achieved a moderate gain score had a percentage of 88%, and students who achieved a low gain score had a percentage of 4%. This showed that the gain results of experimental class students have good results because most of the students were in the fair category.

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