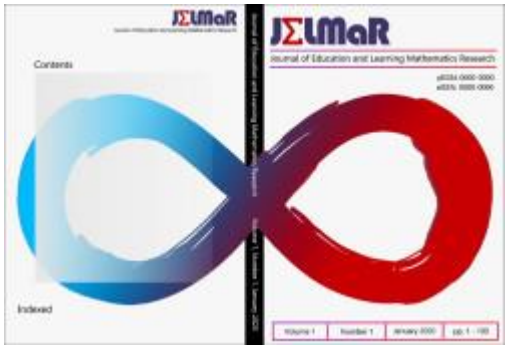

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The Influence of Team Teaching Learning Model by Mind Mapping Method on the Mathematical Problem-Solving Ability

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Abstract: *The thing that underlies the implementation of this research is the low level of proficiency of class XI students at MAN Purbalingga in terms of solving mathematical problems. In this study, the researchers decided to apply appropriate learning strategies to foster skills in solving mathematical problems, namely by using the team teaching learning model with the mind mapping method. The purpose of the research conducted by researchers is to see whether there is a significant influence or not from the application of the learning model on students' skills in solving mathematical problems. This type of research is a Quasi-Experimental Design with a quantitative approach method. A total of 394 students from all students of class XI at MAN Purbalingga became the population in this study. Thirty-eight students from XI IPA 5 were assigned to be the experimental class, and 38 others from XI IPA 6 were the control class. The data collection carried out by researchers in this study was by applying an instrument in the form of a test, namely the pretest and posttest, to weigh the students' skills in solving mathematical problems. The results of the N-Gain Test conducted in the experimental class show that the average N-Gain value in that class is 0.58, which means that the class is in the medium category. Then in the control class, it is known that the average N-Gain value is 0.28, which means that the class is in a low category. From the acquisition of the average value, it is known that the experimental class shows results that are classified as superior when compared to the average value of the control class, so it can be concluded that there is an influence with the application of the team teaching learning model with the mind mapping method on the skills of students in solving mathematical problems in class XI MAN Purbalingga.*
Keywords: Mathematical Problem Solving, Mind Mapping, Team Teaching.

PRELIMINARY

Mathematics is a branch of science that plays an essential role in many aspects of life, including improving human thinking power, so it is no stranger that from the basic education level to the upper secondary level, mathematics is one of the sciences or subjects required. In education, student's skills can be sharpened by the emergence of problems, so they can improve the various competencies they master (Sumartini, 2016). Mathematical problem-solving skills should be skills learned by students. Mathematical problem-solving ability is a skill in students to find a way out of math problems, problems in other sciences or even issues that surround everyday life (R. Soedjadi, 1994).

In learning mathematics, proficiency in solving mathematical problems is a goal that should be achieved so that students are good at making use of reasoning on properties, making simplifications with mathematical manipulation, and analyzing existing elements both in the context of mathematics or even in everyday life in the form of problem understanding skills, forming mathematical models, dealing with models and translating the solutions obtained are included in the context of solving various problems that cover everyday life (Syahril, Ravina Faradilla; Maimunah; Roza, 2021). The indicators of mathematical problem-solving skills are proficiency in interpreting problems, building problem-solving plans, completing problem-solving, and reviewing the results obtained (Purnamasari, 2019).

Based on preliminary observations that have been carried out at MAN Purbalingga, the results show that students' mathematical problem-solving skills, especially in mathematics, need to improve. Students still find difficulties in completing mathematical problem-solving questions. This is indicated by the low level of students' skills in overcoming problems related to mathematical problem-solving skills. It can be seen from several indicators of mathematical problem-solving skills that are not fulfilled during learning, namely: students need help with interpreting problems, difficulty building problem-solving plans, difficulty completing proproblem-solvingd students have difficulty seeing the results obtained.

Support for appropriate learning methods to improve mathematical problem-solving skills is, of course, very necessary to achieve the objectives of learning. The ability of a teacher to predict material needs to help students achieve learning objectives is an essential aspect of planning (Wahyudin, 2008). Several supporting factors can have an impact on students' skills in solving mathematical problems, namely: the existence of learning models/methods, the existence of intermediary media, and the learning environment. In addition to the supporting factors, there are also inhibiting factors of proficiency in problem-solving efforts, namely: giving motivation by the teacher to students with conditions of low level of cognitive skills possessed by students. One of the factors that have an impact on students' skills in solving mathematical problems is the application of the learning model/method used (Hanifa, Nur Isnaini; Akbar, Budhi; Abdullah, 2018).

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Based on preliminary observations that have been carried out at MAN Purbalingga, the results show that students' mathematical problem-solving skills, especially in mathematics, still need to improve. Based on the results of interviews with the class XI mathematics teacher, Mr. Mustofa, it is known that students still find difficulties in completing mathematical problem-solving questions. This difficulty is indicated by the low level of students' skills in overcoming problems related to mathematical problem-solving skills. It can be seen from several indicators of mathematical problem-solving skills that are not fulfilled during learning, namely: students need help with interpreting problems, difficulty building problem-solving plans, difficulty completing problem-solving, and students need help in seeing the results obtained.

Support for appropriate learning methods to improve mathematical problem-solving skills is, of course, very necessary to achieve the objectives of learning. The ability of a teacher to predict material needs to help students achieve learning objectives is an essential aspect of planning (Wahyudin, 2008). Several supporting factors can have an impact on students' skills in solving mathematical problems, namely: the existence of learning models/methods, the existence of intermediary media, and the learning environment. In addition to the supporting factors, there are also inhibiting factors of proficiency in problem-solving efforts, namely: giving motivation by the teacher to students with conditions of low level of cognitive skills possessed by students. One factor that impacts students' skills in solving mathematical problems is the application of the learning model/method used (Hanifa, Nur Isnaini; Akbar, Budhi; Abdullah, 2018).

With the correct learning model/method, the low level of proficiency in solving mathematical problems can certainly be overcome. The team teaching learning model and the mind mapping method are learning models that are thought to be appropriate to improve mathematical problem-solving skills. The selection of the learning model was due to the relationship between the procedure of the team teaching learning model and the mind mapping method with indicators of mathematical problem-solving skills.

The team teaching learning model is a strategy in learning activities involving students and teachers, usually two or even more people in the learning process, to buid a better atmosphere. With more than one teacher, students are expected to get more information and control boredom with the teacher or even with the subject being pursued (Muawiyah, 2019).

The mind mapping method is generally used as a companion in implementing the learning process by applying the team teaching model. In the learning process, the teacher can explain the concept map in advance regarding the material to be studied. If in the middle of the learning process, several students still need help understanding the material being delivered or being studied, students can freely ask the accompanying teachers.

There are several advantages of using the team teaching learning model, such as the interaction between students and teachers will be smoother, the level of understanding of the subject matter of students can increase, the emergence of cooperation between students and teachers, a little lighten the teachers in teaching, the lessons delivered can be accountable (Fikri, 2019). In the mind mapping method itself, there are several advantages, namely: being able to see the picture clearly and thoroughly, being able to see the details, there is a classification of information, giving an interesting impression and tends not to be boring, making it easier to concentrate, the process of working is fun because of the involvement of images, colors, and others and can easily remember because there are visual indicators (Agustina, 2013).

In teaching and learning activities, the team teaching learning model and mind mapping method are used with two teachers, where teacher A acts as the primary teacher and teacher B acts as a companion teacher. The stages of learning are as follows: 1) Teacher A forms several groups where each group consists of 3 to 4 students, 2) After that Teacher A gives assignments to each group that has been formed to make or work on mind mapping (concept map) with matrix material, 3) Teacher B acts by giving each group a blank sheet of paper to be used to make a mind map, 4) Each group member carries out discussion activities related to the task that has been given, 5) Students can ask questions to the teacher when encountering difficulties, 6) Teacher B monitors each group that is currently discussing, 7) Teacher A gives an opportunity to one of the groups to present the results of the mind mapping that has been completed, 8) Teacher A corrects the mind mapping if there are errors and give appreciation to the group that has presented the results of the discussion in front of the class, 9) Teacher B is allowed to provide responses to groups that have presented the results of their discussions in front of the class, 10) Teacher A explains the learning material to students, 11) Teacher B is allowed to provide information or additional material, 12) Teacher A continues the learning material, after Teacher B gives his statement, 13) Teacher A gives time to each group to ask questions about material that they don't understand, 14) Teacher A gives an explanation of material that students haven't understood, 15) Teacher B is allowed to give comments regarding material that students still cannot understand, 16) Teacher A conveys conclusions regarding the material that has been discussed and studied, 17) Teacher A presents information related to the following material, 18) Teacher A ends teaching and learning activities with thanksgiving and greetings (Asmani, 2020).

The research entitled "Effectiveness of the Mind Mapping Method in Improving Photography Learning Outcomes in Class X Multimedia Students at SMK Negeri 2 Sewon",

written by Silvia Oksa, her research results shows that 1) the application of the mind mapping method in improving learning outcomes in class subjects Photography is as follows: teacher presentations/explanations, group discussions, determining mind mapping centers and branches, giving assignments, presenting assignment results and giving awards, 2) there are significant differences in student learning outcomes between classes using non-mind methods mapping with classes that use the mind mapping method (Oksa, 2016). The similarities between this research and research conducted by the author are found in the method used, namely the mind mapping method. The difference between this research and the research conducted by the author is found in the variables where in the study, the variables used were student learning outcomes. In contrast, the variables used by the authors were mathematical problem-solving abilities.

Research the title "The Influence of Implementing Team Teaching Learning Strategies on Student Learning Outcomes in Class XII at Muhammadiyah Prambanan Vocational School in Learning Automotive Motor Theory 2", written by Arif Hari Sutopo, the results of his research indicate that there is a more considerable difference in student theory learning outcomes that are significant between experimental class students and control class students. The increase in learning outcomes before and after getting the team teaching-learning strategy equals 24.3%. The use of team teaching learning strategies positively influences students' academic learning outcomes (Sutopo, 2011). The similarity of this research with research conducted by the author is in the learning model, which both use the team teaching-learning model. The difference between this research and research conducted by the author is found in the variables used, whereas in this research, the variables are student learning outcomes. In contrast, the variables carried out by the author are mathematical problem-solving abilities.

Given the low level of mathematical problem-solving skills of class XI students at MAN Purbalingga, researchers suspect that the team teaching learning model and mind mapping method influence mathematical problem-solving skills so that researchers feel interested in conducting scientific research entitled: "The Influence of Team Teaching Learning Models by Mind Mapping Method on the Mathematical Problem Solving Ability".

METHOD

The hypothesis is a temporary answer to the formulation of the research problem. It is said so because the answer is based on a theory that is quite relevant compared to empirical facts obtained through data collection activities (Sugiyono, 2015). The hypothesis used in this study is "there is an influence of the team teaching learning model with the mind mapping method on the mathematical problem-solving skills of class XI MAN Purbalingga students".

The research conducted was classified as quantitative research using experimental methods. The applied design is Quasi-Experimental Design. The population used by the researchers in this study were all students of class XI at MAN Purbalingga. The lottery technique became the sampling technique taken by the researcher so that the results obtained for class XI IPA 5 became the experimental class and class XI IPA 6 became the control class.

The data collection technique applied by the researcher is a test instrument in the form of a pretest and posttest, which contains a set of item description questions. Pretest was given to students to test their initial mathematical problem-solving skills before receiving treatment. Posttest was given to determine the development of the student's ability to solve mathematical problems after receiving treatment.

The researcher compiled six items to measure students' mathematical problem-solving abilities. The researcher tested it on class XI IPA 1 to determine whether the test

instrument used for research could be declared valid and reliable. Application of correlation product moment on the validity test with a significance level, namely the instrument is valid if the acquisition is, while the instrument is not valid when After being tested on 19 students, with the help of the SPSS Statistics 22 application it can be said that the six items with the acquisition of scores were declared valid. Furthermore, the six items were tested for reliability to determine the consistency of the research instrument. The formula used is alpha Cronbach. If obtained, the research instrument is said to be reliable. A result of 0.926 was obtained, which proved that the item was reliable.

After the item is proven valid and reliable, then the item can be used for research. After the research data has been obtained, then proceed with the process of analyzing the research data. The data analysis applied to this study uses the Normalized Gain (N-Gain). N-Gain data is data obtained from the results of comparing the difference in scores post-test and pretest with the difference between the ideal score and pretest. The formula for calculating the N-Gain score (Wahyudi, 2017):

$$\text{N} - \text{Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

The N-Gain score criteria according to Rostina Sundayana are (Sundayana, 2016):

Table 1. Category of N-Gain Score

N-Gain Score	Category
$0{,}70 \leq \text{N} - \text{Gain} \leq 1{,}00$	High
$0{,}30 \leq \text{N} - \text{Gain} < 0{,}70$	Moderate
$0{,}00 < \text{N} - \text{Gain} < 0{,}30$	Low
$\text{N} - \text{Gain} = 0$	Constant
$-1{,}00 \leq \text{N} - \text{Gain}$	Decrease

Normality and homogeneity tests are prerequisite tests used by researchers. The normality test is carried out to obtain information regarding the data obtained whether it is normally distributed or not (Sudjana, 2005). In this study, the normality test uses the Kolmogorov-Smirnov test because the number of samples used was more than 50 people (Putri, 2020). The results of data analysis were obtained through the SPSS Version 22.0 application with the criteria if significant $(p - value) < \alpha = 0{,}05$ interpreted that the data is not normally distributed. If significant $(p - value) \geq \alpha = 0{,}05$ interpreted that the data is normally distributed. The following hypothesis is used:

H_0: normally distributed samples

H_1: samples are not normally distributed

The homogeneity test is used whether the population variants used are the same. Homogeneity test in this study using Test Levene to a significant degree of 5% (0,05). Levene was carried out to test the similarity of the variances of several existing populations (Usmadi, 2020). Researchers used the SPSS application version 22.0 to help obtain results from the homogeneity test using the Levene test. A homogeneity test is carried out when information is obtained that the data is normally distributed, with the hypothesis:

H_0 : $\sigma_1^2 = \sigma_2^2 = \sigma_3^2$

H_1 : paling sedikit ada satu σ_i^2 yang tidak sama

If (Sig) < 0,05 the data is not homogeneous, whereas if (Sig) ≥ 0,05 then the data is homogeneous (Usmadi, 2020).

Suppose the data is normally distributed and shows homogeneous variance results. In this case, the next test is carried out using the t-test or parametric statistical test (Sudjana, 2005). The t-test was carried out to obtain information on whether there was an influence on the application of the learning model team teaching by method mind mapping on students' mathematical problem-solving skills. The t-test was carried out by comparing the

sig count with an α value of 0.05. If the value (sig) < 0,05, then the hypothesis can be accepted (Thoha, 2016).

RESULTS AND DISCUSSION

The researcher started the research on 3 September 2022 and 1 October 2022. The learning process was carried out in four meetings. Learning takes place in XI IPA 5 and XI IPA 6 MAN Purbalingga. The research instrument carried out was in the form of a test, namely a pretest and a posttest. From the research that has been done, the results obtained value pretest and posttest in the experimental class and control class are as follows:

Table 2. *Pretest* and *Posttest* Score

No		*Pretest*		*Posttest*	
		E	C	E	C
1	Highest Score	68,33	66,67	96,67	86,67
2	Lowest Score	23,33	23,33	36,67	35
3	Average Score	38,55	38,95	73,86	55,97

Based on table 2 above, the results pre st in the experimental class, the highest score was 68.33, the lowest score was 23.33, and the average was 38.55. Results posttest in the experimental class, the highest score was 96.67, the lowest score was 36.67, and the average was 73.86. Next results pretest in the control class; the highest score was 66.67, the lowest score was 23.33, and the average was 38.95. Results posttest in the control class, the highest score was 86.67, the lowest score was 35, and the average was 55.97.

Analysis of research data carried out by researchers used the N-Gain Test to obtain information regarding the increase in mathematical problem-solving skills after receiving treatment. The N-Gain statistical data for the experimental class and the control class is as follows:

Table 3. N-Gain Statistic

	E	C
Number of Students	38	38
Highest Score	0,93	0,76
Lowest Score	0,17	-0,2
Average Score	0,58	0,28

The average value of the N-Gain score from the statistical data of 38 students in table 3, which was obtained in the experimental class was 0.58, the highest score was 0.93 and the lowest score was 0.17. Whereas in the control class, the average N-Gain score was 0.28, with the highest score being 0.76 and the lowest score being -0.2. The average N-Gain score obtained in the experimental class is 0.58, which, based on table 1, is included in the moderate category and is superior to the control class, which has an average N-Gain of 0.28, based on table 1. low category.

After conducting data analysis with N-Gain, the next step is conducting a prerequisite test. In this study, the prerequisite tests were carried out as normality and homogeneity tests. The results of the Normality Test can be seen in the following table:

Table 4. Test of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.

N_Gain	Experimental	.073	38	.200*	.979	38	.669
	Control	.095	38	.200*	.978	38	.629
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Based on the results of the normality test with the Kolmogorov-Smirnov test, according to table 4, the probability value (sig) in the experimental class is 0,200 > α (0,05), and the probability value (sig) in the control class 0,200 > α (0,05). Based on the research hypothesis, the hypothesis is accepted, which means that the data that has been tested is normally distributed.

In this study, researchers utilized the SPSS version 22.0 application to help find the results of the homogeneity test with the test even. Usually, when the data is known to be normally distributed, a homogeneity test is performed. The homogeneity test results are as follows:

Table 5. Test of Homogeneity of Variances

N_Gain			
Levene Statistic	df1	df2	Sig.
.044	1	74	.834

Based on the results of the homogeneity test with the Levene test, obtained information that the data is homogeneous with a sig. 0,834 higher than the value of α (0,05).

If the data is normally distributed and has a homogeneous variance, a t-test test can be carried out. The results of the independent sat-test test for the N-Gain score, which was carried out using SPSS Version 22.0, are as follows

Table 6. t-test for Equality of Means

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
N-Gain	Equal variances assumed	.044	.834	7.611	74	.000	.30889	.04058	.22802	.38975
	Equal variances not assumed			7.611	73.988	.000	.30889	.04058	.22802	.38975

Based on test results Independent Samples Test (t), the result is that sig (2-tailed) 0,000 < 0,05, which is interpreted that the H_1 is accepted. If so, then there is the influence of the

team teaching model by mind mapping method on students' mathematical problem-solving abilities. So it is proven that the treatment is in the form of a learning model team teaching by mind mapping method can affect the increase in students' mathematical problem-solving skills. Based on the research results, learning using the team teaching learning model with the mind mapping method is more effective for improving students' mathematical problem-solving abilities than the lecture method. It can be seen from the results of the simple independent test (t) test which obtained a sig (2-tailed) value of 0.000 <0.005, which means the difference in the average mathematical problem-solving abilities of students using the team teaching learning model with the mind mapping method and using the lecture method in the process of mathematics learning.

This research is supported by research that has been carried out by Arif Hari Sutopo, which explains that there is the application of learning strategies in team teaching has an impact on student learning outcomes theory (Sutopo, 2011). In addition, the research carried out by the researcher was also in line with Silvia Oksa's research which explained that between that classes applied the non-mind mapping method with the class implementing mind mapping method there are significant variations in student learning outcomes (Oksa, 2016). This research is also in line with Yusniar Wulandari's research which suggests that there is an influence of problem-based learning on the mathematical problem-solving solving skills of class VIII students at SMP N 1 Sirah Pulau Padang (Wulandari, 2016).

CONCLUSION

The conclusion that can be drawn from the research described above is that there is an influence or impact from the team teaching model by mind mapping method on the Mathematical problem-solving of class XI MAN Purbalingga students. This is evidenced by the results of the average N-Gain score in the experimental class, which is 0.58, which is classified as the medium category, while the average value in the control class is 0.28, which is classified as a low category. The results of the N-Gain values in the experimental class appear greater than the N-Gain values obtained by the control class.

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