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The Effect of Problem Based Learning Models on the Mathematical Dispositions of Class VIII Students of SMP Negeri 5 Stabat

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ABSTRACT

The purpose of this research is to investigate: (1) how students' mathematical dispositions differ depending on whether they were taught using a Problem-Based Learning model or an Ordinary Learning model; (2) how the mathematical dispositions of students are affected by the relationship between the learning style and Previous Students' Ability. This study is a quantitative investigation employing procedures that are semi experimental. The instruments of this research are problem solving ability tests and student disposition questionnaires. The participants in this research project are all 222 students enrolled in class VIII at SMP Negeri 5 Stabat during the academic year 2022/2023. There are a total of 222 individuals. The method of sampling utilized for this investigation was a straightforward random sampling method, and the total number of students comprising the sample was calculated using the Issac and Michael formula. Essay examinations and questionnaires were the research tools that were utilized in this investigation. A Two Way ANOVA was utilized in the analysis of the results. The findings of the research indicate the following: (1) the mathematical disposition of students in the class that uses problem-based learning is higher than that of students in the class that uses ordinary learning; (2) there is no interaction between the learning model and early mathematical abilities (high, medium, and low) on students' mathematical dispositions.

A. INTRODUCTION

According to Sumarmo (2013), the development of the affective domain component in mathematics learning requires independence, which will then form a strong tendency that is also called a mathematical disposition, which consists of desire, awareness, dedication, and a strong tendency in students. In accordance with this statement, it is important to instill a mathematical disposition in students because it is in accordance with the importance of instilling a mathematical disposition in students. Think of statistically positive things to do, and do those things based on your faith, your piety, and your noble character.

Students' attitudes toward mathematics are one of the aspects that contribute to the overall effectiveness of their educational endeavors. Students need to have a mindset that enables them to persevere in the face of difficulties that are more difficult, take responsibility for their own education, and cultivate excellent habits in mathematics. The mathematical dispositions of students can be observed during the process of teaching and learning mathematics by observing the students' desire to alter techniques, reflect, and analyze in order to find solutions.

According to Agung (2019), students who have a high level of mathematical disposition have greater average higher-level thinking skills than students who have a medium level of disposition or a low level of disposition. This finding is based on an examination of students' degrees of mathematical disposition.

According to Polking (1998), this dispositional attitude is formulated in several indicators, which are as follows: (1) confidence in using mathematics, solving problems, giving reasons, and communicating ideas; (2) flexibility in investigating mathematical ideas and trying to find alternative methods of solving problems; (3) diligence in completing math assignments; (4) interest, curiosity, and creativity in completing math assignments; (5) tends to monitor, reflect on one's own appearance and reevaluate it; and (6) tends to reevaluate one's own appearance

The mathematical dispositions of students continue to be deficient, as evidenced by the facts on the ground. Table 1 displays the findings of the survey that was conducted on the same day, which was the 20th of August, 2022. These findings are based on the responses that were received.

Table 1. Level of Students' Mathematical Disposition

Questionnaire Score Level	Criteria	Many Students	Presentation of Number of Students	Average Student Mathematical Disposition
0% - 24,99%	Low	0	0%	42% (Not enough)
25% - 49,99%	Not enough	22	71%	
50% - 74,99%	Currently	9	29%	
75% - 100%	Tall	0	0%	
$\sum$		31	100%	

After analyzing the results of the students' mathematical disposition questionnaire, based on Table 2. it can be seen that the average student's mathematical disposition is 42% and is categorized as "less". The criteria used are based on Yuanari (2011) with the criteria: "Low, Less, Medium, High".

Table 2. Categories of Mathematical Dispositions

Questionnaire Score Level	Criteria
0% - 24,99%	Low
25% - 49,99%	Not enough
50% - 74,99%	Currently
75% - 100%	Tall

A mathematics teacher at Stabat 5 Public Middle School was interviewed, and the results showed that students' mathematical dispositions are still lacking. It can be seen that students do not have self-confidence when they are given a problem to solve in class. This was reinforced by the findings of the interview. Finding answers, these students do not want to try other methods of solving, are less interested and have less curiosity in learning mathematics, and students have not been able to solve problems properly if given problems that are different from examples, and students are also not aware of the application of mathematics in everyday life - everyday seen from class learning that still only applies abstract questions and does not understand the existence of the application of mathematics. Because of this, pupils tend to have a negative attitude about mathematics.

The students' Early Mathematics Ability in mathematics (KAM) is another factor that contributes to the initial ability is for the teacher to know before he starts with the lesson, because in this way it can be seen whether the students have the knowledge which is a prerequisite for participating in learning. The extent to which the students already know what material will be presented. Whereas, the ability to do fundamental mathematical operations is ranked on a scale from high to medium to low. According to Syahputra (2016), who believes that early mathematical talents can be categorized into three categories—high, medium, and low—the aforementioned phrases can be used to describe these levels. Early mathematics abilities can contribute to students' mathematical problem solving abilities and mathematical dispositions and become prerequisites needed by students in order to participate in the teaching and learning process. This is because early mathematical abilities can contribute to students' mathematical problem solving abilities and mathematical dispositions.

The goal of classifying students into different groups according to their early mathematical capabilities is to investigate the extent to which the method of instruction and students' beginning mathematical capabilities have an impact on the growth of students' problem-solving skills and their attitudes toward mathematics. This aligns with the viewpoint of Tandiling (2013), which states that students' initial capability to learn new concepts is dependent on the prior knowledge and existing cognitive structures they already possess. Furthermore, Hudojo (2005) suggests that concepts can be understood through the relationship between their interactions with other concepts. This is due to the fact that in the process of learning mathematics, learning principles must first be selected, so that when learning mathematics can proceed smoothly, for example learning concepts. It is difficult for that person to comprehend concept B if they do not first have a knowledge of concept A.

This is due to the fact that the content has been organized in such a way that it is constructed so that if a person has difficulty with the first material, they will immediately have difficulty with the material that comes after it. And the converse is also true: pupils who have a strong initial ability can understand what is being taught in the subsequent topics. Students who enter the learning process with moderate or low starting math skills require additional time in order to assimilate new information.

This indicates that the original capability of mathematics serves as the foundation for the learning process, which ultimately results in the development of new abilities that are in line with the aims of the learning. Therefore, the state of students at the beginning of the teaching and learning process has an influence on having entertainment and the desire for learning objectives, which are the starting point in the teaching and learning process. This is because the beginning of the teaching and learning process is the point at which the teaching and learning process begins.

According to Rusefendi (2005), every student possesses a unique set of capabilities; there are students who are smart, students who are moderately smart, and students who are not very smart. This skill is not just inherited (inherited), but it can also be influenced by one's surrounding environment. Consequently, the selection of the learning environment, in particular the learning model, is very crucial to take into consideration. This implies that the learning model selection ought to be able to develop the varied mathematical capabilities of the students.

kids that enter school with excellent initial ability generally have better learning outcomes than other kids. This occurs as a result of the initial capabilities they possess being able to support them in the process of developing new knowledge. On the other hand, it will be more challenging for students who have average or below-average ability to assimilate new information. However, if the learning model that is employed by the teacher is fascinating and enjoyable, then there is no reason to believe that the students' cognitive levels will prevent them from closing the learning gap or improving their ability to solve problems in an appropriate manner.

As a consequence of the findings of the observations, it has come to our attention that the mathematics instructor at SMP Negeri 5 Stabat utilizes direct learning. It is common practice to discontinue teaching during the learning process. where the instructor takes an active part in the process of explaining the content to the students in front of the class. In addition, the teacher's attention to students' mathematical dispositions and their capacity to solve problems is still insufficient in the process of teaching and learning mathematics. In addition, teachers still do not provide students with opportunity to be more active in class, which results in students being less engaged in the learning process.

The preceding explanation leads one to the conclusion that developing kids' problem-solving skills and mathematical attitudes is an area that should receive significant attention. Teachers should select learning models that lead to greater problem-solving abilities and mathematical dispositions in their pupils in order to improve the students' problem-solving abilities and attitudes toward mathematics.

The researcher in this study decided that the problem-based learning model, also known as the PBM, was the most appropriate model to promote the training of students' problem-solving abilities as well as their mathematical dispositions. It is intended that through problem-based learning, also known as PBM, it would be possible to provide fascinating new solutions and an atmosphere such that it will be possible to strengthen problem-solving abilities and mathematical dispositions.

According to Sumantri (2016), problem-based learning refers to an educational setting in which problems serve as the primary vehicle for both instruction and the acquisition of knowledge. This means that pupils are provided with feedback in the form of problems before they actually learn anything. The problem-based learning concept was initially presented to the public for the first time in the early 1970s at the School of Medicine of McMaster University in Ontario, Canada.

According to Sermatan (2018), the problem-based learning paradigm entails working through stages of problem-solving in order to assist and direct students in locating answers to problems that they themselves have created. Students are supposed to be encouraged to be able to solve difficulties when presented with problems of this nature. Students are supposed to learn to solve these problems in a fair and impartial manner as part of the problem-based learning process, which utilizes a learning paradigm that poses a genuine problem as a hard and exciting learning opportunity.

According to Mulyatiningsih (2012), issue-based learning is a form of education in which content is conveyed to students through the presentation of a problem, the asking of questions, the facilitation of investigations, and the initiation of conversation. A learning technique known as problem-based learning involves the presentation of real-world situations to students in order to pique their interest and motivate them to study. Students participate in problem-based learning classes by working together in groups to find solutions to challenges that are relevant to the actual world (Kemendikbud, 2013).

A learning model that educates and develops students' problem-solving skills that are directed to students' actual life situations, and that stimulates higher-order thinking skills, is called the problem-based learning model. Students can develop their critical thinking and problem-solving abilities through the application of real-world scenarios as the basis for their classroom studies.

In accordance with the findings of the research that was carried out by Andi Yunarni Yusri (2018), the conclusions that he drew from his study were that the problem-based learning model had an impact on the students' mathematical problem-solving abilities, as evidenced by the fact that 15 individuals achieved satisfactory scores, which indicates that 44.1% of students scored in the range of 55.00-69, 99. There were 17 students that received passing grades, which indicates that 50 percent of the class received a score in the range of 70.00 to 84.99. In addition to that, there were two students who received very high marks, which means that 5.9% of the total student body received scores in the range of 85.00 to 100.

According to the findings of the assessment of the students' ability to solve mathematical problems, at this point in the process, students are able to understand the problem, and students are able to write down what is known and what is asked in an appropriate manner. When it comes to the ability to plan how to solve a problem, only a select few pupils are capable of accurately planning a solution by drawing images (formulas) depending on the issue at hand. At the stage of solving the problem in accordance with the plan, the majority of the students were able to follow out the plan by writing down the solutions in a manner that was both complete and accurate. Students are able to comprehend the results produced at the re-examining step by drawing the relevant inferences.

Students' mathematical problem-solving abilities after participating in learning (posttest) in an experimental class taught using a problem-based learning model in class VII A SMP PGRI (equivalent) Sunggu Minasa on set material obtained an average value of 77.55 with a standard deviation of 10.667, as stated by Sitti Rahmah Tahir (2020), who also stated the findings of her research. The data that was collected yielded a value of 80.00 as its median, with 80 serving as its mode. The lowest value that may be earned by students is a score of 50, and the highest value that can be obtained by students is a score of 94. The range of values, or the range, is 44. According to the frequency distribution, the maximum value is reached in the 70 interval, which ranges from 00-84.99, with a high category consisting of 16 pupils. Students who receive the lowest scores fall into the range of 40.00-54.99, which has a low category consisting of 2 students. On the other hand, students who receive the greatest scores fall into the range of 85.00-100.00, which has a very high category consisting of 8 students.

The magnitude of the concentration of data from the posttest results reveals that the average score of students who took part in problem-based learning classes was significantly higher than the average score of students who took part in direct learning classes, with an average of 77.55 for students who took part in problem-based learning classes and 61.35 for students who took part in direct learning classes. After the posttest, the results of the achievement of indicators of students' ability to solve mathematical problems showed that the achievement of each indicator in the problem-based learning class was higher than that of the direct learning class. The percentage of achievement indicators in the problem understanding indicator is greater in the problem-based learning class than it is in the direct learning class. In the problem-based learning class, it is 84%, while in the direct learning class, it is 83%. The percentage of students that reach the problem-solving planning indicators is 65.5% in the class that uses problem-based learning, while it is only 53.5% in the class that uses direct learning. In the problem-based learning class, the proportion of students who achieved the indicator according to plan was 83%, while the percentage of students who achieved the indicator in the direct learning class was only 60.75%. The gap between the problem-based learning class and the direct learning class in terms of the percentage of students who are able to understand the results is the widest. In the problem-based learning class, 73.5% of students are able to solve mathematical issues, but only 44% of students in the direct learning class can do so.

Based on some of the explanations above, this research needs to be done, and researchers are interested in conducting research with the title The Effect of Problem-Based Learning Models on the Mathematical Disposition of Class VIII Students of SMP Negeri 5 Stabat.

B. RESEARCH METHODS

This research is an investigation carried out in the style of a quasi-experimental design. This study was carried out at SMP Negeri 5 Stabat in the district of Langkat in the province of North Sumatra. During the second semester of the academic year 2022-2023, this investigation was carried out. This particular school was selected by the researcher because, to the best of their knowledge, no other investigation of this kind had ever been conducted there. In addition, the teaching of mathematics at Stabat 5 Public Middle School has, up until this point, followed the traditional model, with teachers taking the lead in students' education and students behaving in a submissive manner, waiting all the time for instructions from their instructors, and rarely engaging in peer-to-peer or teacher-to-student dialogue. In addition, there are issues concerning the students' attitudes. The students in class VIII at SMP Negeri 5 Stabat made up the entirety of this study's population. Class VIII-1, which has a total of 31 students and will serve as an experimental class that will be treated using a problem-based learning model, and class VIII-2, which also has a total of 31 students and will serve as a control class that will be treated using a conventional model, were chosen as the classes to serve as the sample for this study. The opinions of knowledgeable professionals, such as lecturers and teachers, were solicited for the purpose of validating learning materials and research instruments. More specifically, the lecturer and two mathematics teachers from SMP Negeri 5 Stabat were consulted for this purpose. A student disposition questionnaire will serve as the research tool for this study.

C. RESULT AND DISCUSSION

The lowest score (x_min), the highest score (x_max), the average score (), and the standard deviation (SD) as for the formula : $S = \sqrt{\frac{\sum X^2}{N} - \left(\frac{\sum X}{N}\right)^2}$,were produced for both the experimental group and the control group based on the data from the results of the mathematical disposition questionnaire, as shown in Table 3 below. The experimental group was given the opportunity to participate in the study.

Table 3. Summary of Mathematical Disposition Questionnaire Result Data

Class	Ideal Score	Questionnaire Data			
		x_{min}	x_{maks}	$\bar{x}$	SD
Experiment (Problem Based Learning)	100	54	79	70,52	5,70
Control (Ordinary Learning)		50	75	67,61	5,64

According to Table 3, the minimum score on the students' mathematical disposition questionnaire in the experimental group is higher (54) than the score on the same questionnaire in the control group (50), and the maximum score on the same questionnaire in the experimental group is also higher (79) than the score on the same questionnaire in the control class (75). Similarly, the average value of the students' mathematical disposition questionnaire for the experimental group was higher (70.52 points) than the average value for the control group (67.61 points).

Table 4, which may be found below, provides a description of the findings of the mathematical disposition questionnaire, which was based on the respondent's starting ability in mathematics.

Table 4. Description of the Mathematical Disposition Questionnaire based on KAM

KAM category	Grade Point Average	
	Problem Based Learning (Experiment)	Ordinary Learning (Control)
Tall	77,71	73,86
Currently	70,05	67,74
Low	60,25	58,40

An average difference test, which in this case is the two-way ANOVA test, the purpose of the two-way ANOVA test is to find out whether there is an influence of the various criteria being tested on the desired results. By using the 2-way ANOVA technique, we can compare several averages from several categories or groups for one treatment variable that can be found in table 5 below, will be carried out in order to determine whether or not there is a significant difference between the mathematical dispositions of students who are taught using the problem-based learning model and students who are taught using conventional learning as a whole.

Table 5. Calculation results of the two-way ANOVA on the results of the Mathematical Disposition Questionnaire

Tests of Between-Subjects Effects					
Dependent Variable: DisposisiMatematis					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1634.298[a]	5	326.860	41.762	.000
Intercept	198709.566	1	198709.566	25388.487	.000
Learning model	79.486	1	79.486	10.156	.002
Early Mathematical Ability	1490.226	2	745.113	95.201	.000
Learning Model * Early Mathematical Ability	8.899	2	4.450	.569	.570
Error	438.298	56	7.827		
Total	297945.000	62			
Corrected Total	2072.597	61			
a. R Squared = .789 (Adjusted R Squared = .770)					

When compared to 0.05, it is evident that the significance value for the learning model is 0.002, and when this value is compared to Table 5, it is also evident that sig is less than 0.05. As a result, statistical hypothesis 2's H_0 has been disproved, while H_a has been verified. This indicates that the students in the Problem-Based Learning (PBM) class had a more positive attitude toward mathematics than those in the Ordinary Learning class. To put it another way, the mathematical dispositions of students are significantly affected by the difference between the problem-based learning paradigm and the traditional learning model.Any natural or man-made impact that causes an event to occur and can be estimated or estimated in a given direction is considered to be an influence (Sudjana, 2005). Measurement due to influences that cause scores or data values to be more inclined in one particular direction than in another direction is an example of influence. In this instance, it indicates that there is a considerable influence between the problem-based learning model and the ordinary learning model on the mathematical dispositions of the students who participate in the study.In addition, the significance value for KAM for the learning model is 0.570, which means that the null hypothesis for test number four, H_0, is accepted. This indicates that there is no interaction between the mathematical learning model and the students' beginning mathematical competence on the students' mathematical dispositions.

DISCUSSION

The mathematical disposition is broken down into seven subcategories, which are self-confidence, flexibility, perseverance, curiosity, reflection, application, and appreciation. Self-confidence is the first subcategory, followed by flexible, and then persevere.

In terms of the mathematical disposition markers, they are consistent with Vygotsky's theory, which places an emphasis on the social components of the learning process. Vygotsky was of the opinion that children benefit intellectually and creatively by engaging in social activity with their peers because it stimulates the formation of new ideas. According to Vygotsky, students can be categorized into two distinct stages of development: the level of development that has already occurred and the level of growth that has the potential to occur. The individual's current degree of intellectual functioning and his or her capacity to acquire particular things on their own are both determined by the individual's actual level of development. Individuals also have a level of potential development, which Lev Vygotsky defines as the level that an individual can function at or attain with the assistance of other people, such as instructors, parents, or classmates who are further along in their development. Individuals also have a level of potential development. Individuals also have a level of potential development. (Arends, 2012).

D. CONCLUSION AND SUGGESTIONS

There are several conclusions related to the implementation of learning using problem-based learning models and direct learning models on the problem-solving abilities and mathematical disposition of students at Stabat 5 State Junior High School, namely:There is a difference in the influence between the problem-based learning model and the direct learning model on students' mathematical problem solving abilities. There is a difference in the influence between the problem-based learning model and the direct learning model on students' mathematical disposition. There is no interaction between initial mathematics abilities (high, medium and low) and learning models on students' mathematical problem solving abilities at SMP Negeri 5 Stabat. There is no interaction between initial mathematics abilities (high, medium and low) and learning models on students' mathematical disposition at Stabat 5 State Junior High School.

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