

Differences in Mathematic Problem Solving Ability and Student Learning Independence Between Tapps Learning Models and Geogebra Software Assisted Stad at Vocational School of Al-Washliyah 2 Perdagangan

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Abstract

This study aims to determine: (1) Differences in students' mathematical problem solving abilities by applying learning Aloud Pair problem solving (TAPPS) and STAD type cooperative learning model assisted by Geogebra software and (2) the interaction between KAM and the learning model (Thinking Aloud Pair Problem Solving and cooperative learning type STAD) on mathematical problem solving abilities. This research is a quasi-experimental research. The study population was all students of class XI SMK Swasta AL-WASHLIYAH 2 PERDAGANGAN 2019/2020 academic year with a sample of class XI-TKJ who were given learning with the TAPPS model and class XI-AK who were given learning using the STAD model. Each class consists of 30 students. The research instrument used was a test of students' mathematical problem solving abilities. Data analysis was performed using two-way analysis of variance (ANOVA). The results showed that: (1) There are differences in the mathematical problem solving abilities of students who are given learning with the TAPPS model and the STAD model assisted by Geogebra software. (2) There is no interaction between the learning model and the initial mathematical ability of students' mathematical problem solving abilities.

Keywords: Mathematical Problem Solving, Learning Aloud Pair Problem Solving, STAD cooperative type, Geogebra Software

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PRELIMINARY

Mathematics is a subject that plays an important role in helping develop student potential. The importance of mathematics, based on the students' ability to do mathematics, is the foundation and main vehicle that is an absolute requirement that must be mastered in order to train students to think clearly, logically, systematically, and to have the personality and skills to solve problems in everyday life. In addition, mathematics is also full of values that can shape the personality and character needed to face the challenges of a competitive and professional era. [1]

Mathematics is studied by all students from elementary to junior high schools and even universities. Mathematics is a branch of science that is considered to be able to make a positive contribution in spurring science and technology. This is in line with Hudojo's opinion [2] that mathematics has a very essential role for other sciences, especially science and technology. So that mathematics becomes very important in an effort to improve the quality of education and the potential of students. This is in line with Coockroft (in Abdurrahman,) [3] argues that: Mathematics needs to be taught to students because (1) it is always used in all life, (2) all fields of study require appropriate metamatic skills, (3) require strong, short and clearly, (4) can be used to present information in various ways, (5) increase the ability to think logically, accuracy, and spatial awareness and (6) provide satisfaction with problem solving efforts.

From the results of the 2015 PISA tests and evaluations, the performance of Indonesian students in mathematics is still low. The average achievement score of Indonesian students for mathematics is ranked 63 out of 69 countries evaluated (OECD, 2015). The average score of the OECD countries is 490, while Indonesia's score is 386. Indonesia's ranking and average score is not much different from the results of the previous PISA tests and surveys in 2012, which is ranked 64 out of 65 evaluated countries (OECD, 2013). This shows that Indonesia's mathematics achievement is still low.

From the unsatisfactory reality above, one of the contributing factors is because of the students' low problem solving abilities. even though solving problems is a basic activity for humans. Most of life is dealing with problems. Then it is necessary to solve it. In learning at school students are often faced with problems, especially in mathematics

National Council of Teacher of Mathematics (NCTM, 2000) [4] states that in implementing mathematics learning in schools, teachers must pay attention to five mathematical abilities, namely: connections, reasoning, communication, problem solving, and representation. representations).

Saragih and Winnery [5] stated, "In the problem-solving is often found that students are only concerned with the final answer without understanding how the process if the answer is correct or not. This often results in the students' incorrect answers ". This means that in problem solving, it is often found that students only focus on the

final answer without understanding how to process the answer is correct or not. Furthermore, Yuwono revealed "the importance of problem solving in human life which underlies why problem solving is central to learning mathematics at any level". Thus the student's ability in problem solving is the most important thing.

Based on the results of field observations, it was found that the teacher while teaching still uses direct learning during the learning process. Students also seem less active during learning. When given exercises with different forms of questions, with the example questions described by the teacher, most of them were less able to work on these questions. Then from the results of interviews with mathematics teachers stated that mathematics is still one of the difficult subjects for students. After that the researcher also conducted a problem solving ability test to the students. The test of problem-solving abilities of students is also low. This is based on a test given to class X TKJ SMK Swasta Al-Washliyah 2 Trade for material on two-variable linear equation systems. The ability to solve problems is one of the goals in learning mathematics in schools because it trains how to think and reason in drawing conclusions, develop problem-solving skills, and develop the ability to convey information or communicate ideas through oral, written, pictures, graphics, maps, diagrams, etc

Efforts to improve the quality of learning that takes place in class are continuously socialized. One of the efforts made is to use the right learning approach. Murdiyasa [6] emphasized that "the right approach to learning mathematics can encourage students to gain a better understanding of mathematics so that they can be successful in learning mathematics". Through the right learning approach, it will create a combination of teaching activities carried out by teachers and learning activities carried out by students. There are many learning models that we can use in an effort to develop these two abilities, one of the learning models that are thought to be in line with the mathematical characteristics and expectations of the current curriculum is the Thinking Aloud Pair Problem Solving learning model and the STAD type cooperative learning model. the application of a variety of learning models is one of the factors that influence student activity and learning outcomes.

The cooperative learning model is a learning strategy that has recently become a concern and is recommended by educational experts to be used. First, several research results prove that the use of cooperative learning models can improve student achievement as well as improve social relationship skills, foster an attitude of accepting self-deprivation and others, and can increase self-esteem. Second, the cooperative learning model can realize students' needs in learning to think, solve problems, and integrate knowledge with skills. From these two reasons, cooperative learning is a form of learning that can improve learning systems that have had weaknesses (Trianto,) [7].

Thinking Aloud Pair Problem Solving (TAPPS) Learning Model is a renewal to improve mathematical problem solving skills. Through the Thinking Aloud Pair Problem Solving (TAPPS) Learning Method, students are directed by the teacher through problem solving questions that require students to use their cognitive structures optimally, so that students can ask themselves what is related to the material and questions, and understand where lies his strengths and weaknesses in solving these problems.

This is in accordance with what was stated Barkley [8] explained that: The thinking aloud pair problem solving (TAPPS) model involves students working in pairs with different tasks for each student, one student is the problem solver, which is tasked with solving the problems given and explaining them to listeners and the other student as listeners and when they become a problem solver, students must be able to find ideas, understand the mathematical concepts that are learned to be able to solve the problem, understand the sequence of steps that underlie their thinking, and be able to identify mistakes made. So that when students become problem solvers, students can practice their math problem solving skills.

Given the development of vocational high school students, most of them are in a transition period from the concrete phase to the formal phase so that the media can be used to direct students to think abstractly, namely media that can improve students' abilities to ideas or concepts. Graphic media are used to attract attention, clarify learning and describe facts or concepts that can be forgotten and can be shown in a concrete way and there are many things that need to be remembered by students so that the learning process is memorizing, while learning mathematics requires more understanding than memorization. The use of ICT-based media has a positive impact on student learning outcomes. A computer program that can be used in learning mathematics is Geogebra Software. *Geogebra Software* is software that is simple, easy to understand, easy to use and easy to observe by students in order to build their own knowledge. According to Hohenwarter and Fuchs (2004) Geogebra is a multipurpose software for learning mathematics in secondary schools. Geogebra software can be used as follows: (1) Geogebra for demonstration and visualization media, (2) Geogebra as a construction aid, (3) Geogebra as a tool for finding mathematical concepts, (4) Geogebra for preparing teaching materials. The use of Geogebra software as a learning medium can be used to explain mathematical concepts or it can also be used for exploration, either to be broadcast by the teacher in front of the class or students to explore using their own computers. Geogebra software in learning makes it easier and faster for students to understand the problems to be studied. In addition, the time used can also be used more by students to do various experiments and explore with various tools found in Geogebra software.

Research Methods

This research was conducted in the even semester of the 2019/2020 school year. This type of research is a quasi experiment. The sampling technique was cluster sampling and one class was selected which was given learning aloud pair problem solving assisted by Geogebra Software and the other class was given STAD type cooperative learning assisted by Geogebra Software. Each class consists of 30 students. The research instrument used was a test of mathematical communication skills. The mathematical problem solving ability test was given after giving learning with the TAPPS model in class XI-TKJ and giving learning with the STAD model in class XI-AKL

Data analysis technique

In this study, data were obtained from the results of the post-test of students' mathematical problem-solving abilities and were analyzed using the ANAVA test. Data processing begins with testing The statistical test requirements required as a basis for hypothesis testing include data normality test and variance homogeneity test. Furthermore, the two-way Anava test was carried out. All statistical calculations use the help of the SPSS 22 computer program.

Results and Discussion

Post-test of mathematical problem solving abilities was given to students in experimental class 1 and experimental class 2 with the aim of seeing students' mathematical problem solving abilities after being given treatment. The posttest results show that the posttest minimum posttest posttest students' mathematical problem solving abilities in the class learning with the Thinking Aloud Pair Problem Solving Learning model in the experimental class 1 are higher than the experimental class 2 then for the posttest mean of students' mathematical problem solving abilities in experimental class 1 is 77.50 for the experimental class 2 of 70.70. The post-test results are shown in table 1 below:

Table 1. Post-test Results of Students' Mathematical Problem Solving Ability

Class	Score Ideal	N	x_{\min}	x_{maks}	\bar{X}
Experiment Class I	100	32	55	97.5	77.50
Experiment Class II		32	50	95	70.70

Furthermore, the normality test will be carried out as a prerequisite ANAVA test to see whether the data on students' mathematical solving abilities in the two classes is normally distributed or not. This normality test was carried out using the Kolmogorov-Smirnov statistical test on both data classes with the following hypothesis testing:

H0 : Post-test data on students' mathematical problem solving abilities were normally distributed.

H1 : Post-data on students' mathematical problem solving abilities were not normally distributed.

The H0 test criterion is accepted if the probability (sig) obtained is greater than 0.05 and is rejected in other cases. To test this hypothesis, the Kolmogorov-Smirnov test was used. The summary of the results of the post-test normality is shown in table 2 below:

Table 2. Post-test Normality Test for Mathematical Problem Solving

KPM	Class	Tests of Normality					
		Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
	TAPPS	.129	32	.190	.949	32	.138
	STAD	.117	32	.200	.936	32	.058

a. Lilliefors Significance Correction

From the table above, it can be seen that the significant value of the two classes is greater than 0.05, so that H0 which states the data is normally distributed for the experimental class 1 and experiment class 2 can be accepted. In other words, the posttest data for experimental class 1 and experimental class 2 have data that is normally distributed.

Furthermore, it will be tested whether the post-test variance in the two classes is homogeneous or not. The test tool used for homogeneity is the Levene test. The hypothesis tested to determine the homogeneity of the student posttest data is as follows:

H0 : Both data have homogeneous variance (same)

Ha : Both data do not have homogeneous variance (not the same)

Results of Calculation of KPM Post-test Data Homogeneity Using SPSS 20 Software

Table 4.3. Result of Posttest Scoring Homogeneity Test Problem solving ability of experimental class 1 and experimental class 2
Test of Homogeneity of Variances

KPM			
Levene Statistics	df1	df2	Sig.
1,126	1	62	.294

Table 4.3 above shows that the suspension *posttest* Mathematical problem solving abilities of students in experimental class 1 and experimental class 2 have a sig value > 0.05, so H₀ is accepted. Thus the *posttest* suspension variance of the results of the mathematical problem-solving ability test in the experimental class 1 and the experimental class 2 comes from a population that has the same variance or one homogenous variance.

Hypothesis testing

First Hypothesis

After the prerequisite test is met, namely the sample comes from a population that is normally distributed and has a homogeneous variance, then the two-way ANOVA test is carried out to test the hypothesis.

The following is the statistical hypothesis formulation:

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

μ_1 : Average mathematical problem solving abilities students who get learning aloud pair problem solving assisted geogebra

μ_2 : Average mathematical problem solving abilities students who receive geogebra-assisted STAD type cooperative learning

The complete ANAVA test calculation results can be seen in table 4 below:

Table 4 Results of ANAKOVA Students' Mathematical Problem Solving Ability
Table 4.11. Analysis of Variance Table Using SPSS

Tests of Between-Subjects Effects						
Dependent Variable: KPM						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	
Corrected Model	9246,206a	5	1849,241	37,854	.000	
Intercept	243240,754	1	243240,754	4.979E3	.000	
Thurs	8318,650	2	4159,325	85,142	.000	
Model	331,866	1	331,866	6,793	.012	
Kam * models	15,745	2	7,873	.161	.852	
Error	2833,384	58	48,851			
Total	363506,250	64				
Corrected Total	12079,590	63				
a. R Squared = .765 (Adjusted R Squared = .745)						

Based on Table 4.4, it can be seen that the learning model is significant = 0.012 < 0.05 or H₀ is rejected. This means that there are differences in the mathematical problem solving abilities of students taught by TAPPS learning and students taught with STAD. For KAM with a significance of 0.000 < 0.05, H₀ is rejected. This means that there are differences in students' mathematical problem-solving abilities between high, medium and low initial abilities.

Second Hypothesis

The hypothesis that is proposed is interaction between KAM and learning models (Thinking Aloud Pair Problem Solving and cooperative learning type STAD) on mathematical problem solving abilities

$$H_0 : (\alpha\beta)_{ij} = 0$$

$$H_a : \text{there is at least one, } (\alpha\beta)_{ij} \neq 0 \text{ } i = 1,2,3; j = 1,2,$$

Information:

$(\alpha\beta)_{ij}$ is the interaction between learning and early mathematical abilities of students towards students' mathematical problem solving abilities.

The test criteria used:

If the sig value < 0.05 then H₀ is rejected or F_{count} ≥ F_{table}, then H₀ is rejected

If the sig value ≥ 0.05 then H₀ is accepted or F_{count} < F_{table}, then H₀ be accepted.

If it is rejected, there is an interaction between the learning factor and the student's KAM.H₀

For the full Anava test results can be seen in Table 4, the interaction between learning factors and initial mathematics ability (KAM) obtained a value of F_{count} = 0.161 with a significant 0.852 > 0.05 and F_{table} value =

3.17. This means that $F_{count} < F_{table}$. Thus H_0 is rejected. This means that there is no interaction between the learning model and the initial mathematics ability (KAM) to the students' mathematical problem solving abilities. More details in Figure 2 below:

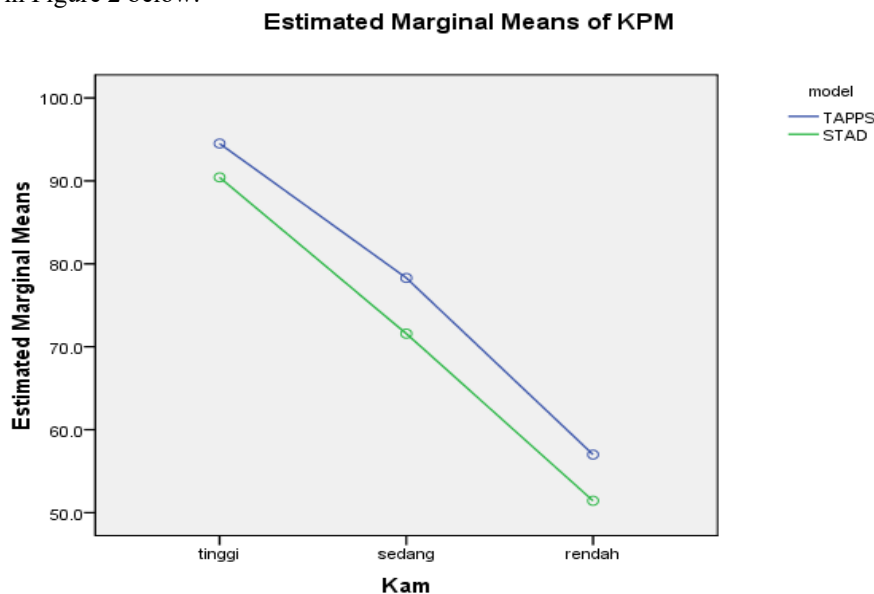


Figure 2 There is no interaction between the Learning Model and KAM on Students' Mathematical Problem Solving Ability

Figure 2 shows that the Thinking Aloud Pair Problem Solving learning model is more influential in the potential of students' mathematical problem solving abilities because the average suspension obtained in this class for each KAM category is higher than the average score in the class that received STAD learning. In other words, the learning model can affect students' mathematical problem-solving abilities at all levels of students' initial mathematics ability (KAM). So that there is no interaction between the learning model and the initial mathematical ability of students' mathematical problem solving abilities. This means that there is no joint effect between the learning model and the students' initial mathematical ability on students' mathematical problem solving abilities.

CONCLUSION

Based on the results of data analysis as described above, it is concluded that there are differences in mathematical problem solving abilities between students who are given learning Thinking Aloud Pair Problem Solving assisted by Geogebra Software and students who are given STAD learning assisted by Geogebra Software. From the results of the analysis it is also known that there is no the interaction between the learning model and the early mathematics abilities of the students' mathematical problem solving abilities.

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REFERENCES

- [1] Hasrattudin. 2015. Why You Should Study Mathematics. Medan: Perdana Publishing
- [2] Hudojo, H. 2005. Curriculum development and Mathematics Learning. UM Press: IKIP Malang
- [3] Abdurrahman, 2009. Education for Children with Learning Difficulties. Jakarta: PT Rineka Cipta
- [4] NCTM. 2000. Principles and Standards for School Mathematics. Reston, VA: NCTM.
- [5] Saragih, S, & Habeahan, Winnery.L. 2014. The Improving of Problem Solving Ability and Students' Creativity Mathematical by Using Problem Based Learning in SMP Negeri 2 Siantar. Journal of Education and Practice, vol. 5, no. 35, page: 123-132
- [6] Murdiyasa, Budi. 2015. Challenges of Global Era Mathematics Learning. Proceedings of the 2015 National Seminar on Mathematics and Mathematics Education at UMS: ISBN: 978.602.361.002.0
- [7] Trianto. 2009. Designing Progressive Innovative Learning Model. Jakarta: Kencana Prenada Media Group.
- [8] Barkley, E, (2012), Colaborative Learning Techniques, Nusa Media Publisher, Bandung.