



The mathematical problem solving ability of student on learning with Thinking Aloud Pair Problem Solving (TAPPS) model in term of student learning style

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Abstract

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The purposes of this research were to find out the mathematical problem solving ability on learning with TAPPS model and to find out how the description of mathematical problem solving ability on TAPPS model in terms of learning style. This mixed methods research used concurrent embedded design. The population in this research was eighth-grade students of SMP N 4 Kudus in the academic year of 2016/2017. The sample was chosen by using random sampling technique, it obtained that VIIIA as experimental class and VIIIB as control class. The results of the research showed that (1) the mathematical problem solving ability on learning with TAPPS model achieved classical mastery, (2) the mathematical problem solving ability on learning with TAPPS model was better than expository model, (3) the students' ability in mathematical problem solving with a visual learning style had good category at the stage of devising a plan and the other stage had enough category, otherwise students with an auditorial learning style had enough category at the stage of looking back and another stage had good category, and students with a kinesthetic learning style had good category at the stage of understanding the problem and the other stage had enough category and less category.

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1. Introduction

Mathematics is a science that is able to form and advance the attitudes and power of human mind underlying the development of modern technology. Mathematics is learned in every level of education, ranging from kindergarten, elementary school level to college. To know and create technology in the future, strong mathematics is needed early on (Peraturan Menteri Pendidikan Nasional Nomor 22 Tahun 2006). Therefore it is natural that the mathematics subject plays an important role in all areas of human life.

According to BSNP (2006), the purpose of studying mathematics is to be able to make the students have the ability, such as: (1) understanding the concept of mathematics, explaining the interconnection between concepts and applying concepts or algorithms flexibly, accurately, efficiently and appropriately, in problem solving, (2) reasoning in patterns and

traits, performing mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements, (3) solving problems including the ability to understand problems, design mathematical models, solving models and interpreting solutions obtained, (4) communicating ideas with symbols, tables, diagrams or other media to clarify circumstances or problems, (5) having an appreciation of the benefit of mathematics in life, that is to have curiosity, attention, and interested in learning mathematics, and a tenacious attitude and confidence in the solution problem. In addition, the objectives of learning mathematics according to the National Council of Teachers of Mathematics (NCTM, 2000) are: (1) learning to communicate (mathematical communication), (2) learning to reason (mathematical reasoning), (3) learning to solve problems mathematical problem solving), (4) learning to associate ideas (mathematical connections), (5) the formation of positive

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attitudes toward mathematics (positive attitudes toward mathematics).

Based on the purposes of learning mathematics, problem solving ability is one of the abilities that must be possessed by students in learning mathematics. According to Manalu, as quoted by Nugroho et al (2013), the ability to solve mathematical problems is very important for everyone, not only because most of human life will deal with the problems that need to be solved, but solving problems, especially those that are mathematical, can also help someone to improve their analytical power and to solve problems in other situations.

Students can be said to have problem solving skills if the student is able to meet the four indicators that exist in the problem solving that are the ability to understand the problem, the ability to plan the problem, the ability to solve problems, and the ability to interpret the solution. Therefore, problem solving skills are a very important part of mathematics learning.

However, in fact the ability to solve mathematical problems has not been maximally developed at the schools in Indonesia, one of them is SMP Negeri 4 Kudus. Problem-solving skills can be seen as one of the learning processes and outcomes. Based on observations and interviews with mathematics' teachers at SMP Negeri 4 Kudus, most of them said that students' mathematical problem solving skills was still not enough. According to the researcher of observation during the Praktik Pengalaman Lapangan (PPL) at SMP Negeri 4 Kudus, when students were given the story related to mathematics, the students tend not to solve the problems. This shows that students' ability in solving mathematical problems was still low. This was also affecting the final test result in first semester at the eighth grade in the academic year of 2016/2017 which showed the students' average score was only 57.31 out of standard minimum criteria (75). And then only 40 students who passed the standard minimum criteria from 313 students total.

There are several factors that influence the high and low mathematical ability of the students, including internal factors and external factors. Internal factors include the level of intelligence, students' early skills, student attitudes, talents, interests, student motivation of a lesson, activities, and ways (style) of learning. While external factors include learning environment, supporting infrastructure, teachers, and teaching methods provided. These factors are often inhibiting and

supporting the success of students, including students' learning styles.

According to Unaifah & Suprpto (2014), learning styles have an effect on opinion (2014), the reason researchers review the learning style, because each student has a different way of thinking in solving the problem, this is allegedly influenced by the learning style. This study uses the learning style of DePorter (2008) which is a visual learning style, auditorial, and kinestetik or commonly known as VAK. In relation to learning, learning style research is necessary to determine appropriate models, approaches, strategies, and learning methods to accommodate the overall learning style of the students.

Efforts to improve student's mathematical problem solving skills can use Thinking Aloud Pair Problem Solving (TAPPS) model. The TAPPS model incorporates two instructional models namely problem-solving learning model and cooperative learning model to enable students to produce excessive understanding.

One of the research that supports the selection of TAPPS model as an appropriate strategy to help students improving their mathematical problem solving skills is Handayani et al (2014) study, which concludes that the ability of mathematics communication of students of grade XI IPA SMAN 10 Padang who were using Think Aloud Pair Problem Solving (TAPPS) was better than students' mathematical communication skills who using conventional learning methods. One of the advantages of the TAPPS model based on the listener role mentioned by Stice (1987) can be concluded that the TAPPS model provides monitoring for students in practicing problem-solving strategies through pairs of activities. In addition to the hard thinking activity, TAPPS model provides an opportunity for students to practice verbal skills, thoroughness in solving problems, and foster courage to express their thoughts.

The students' mathematical problem solving skills that are still low need to be studied further. Especially when it is viewed from different learning styles of students. For that reason, there is a need for further research on students' mathematical problem solving abilities in learning with Thinking Aloud Pair Problem Solving (TAPPS) model in terms of student learning style.

The formulation of the problem in this research are: (1) Is the students' mathematical problem solving ability with TAPPS learning model can achieve mastery? (2) Is the student's mathematical

problem solving ability with TAPPS learning model better than the student with Expository learning model? (3) How is the student's mathematical problem solving ability with TAPPS learning model in terms of student learning style?

2. Methods

The research method used in this research was the combination research or mixed methods. According to Sugiyono (2016), combination research method is a research method that combines quantitative method and qualitative method to be used together in a research activity, so that the obtained data are more comprehensive, valid, reliable and objective.

The research design used concurrent embedded design (unbalanced mixture). According to Sugiyono (2016), the combination method of concurrent embedded design is a research method that combines both qualitative and quantitative research methods by mixing the two unbalanced methods. In this study, the probability of using quantitative methods was 70% and 30% for qualitative methods. Basically the study of the combination of qualitative data was used as complement of the quantitative data.

The population used in this research were the students of class VIII SMP Negeri 4 Kudus of the academic year 2016/2017. Sampling in this research was done by simple random sampling technique. It was obtained from two classes as a sample class, namely class VIII A as experimental class given learning with TAPPS model and class VIII B as a control class given learning with Expository model.

The methods used to obtain the data were questionnaires, interviews, tests, and documentation. The questionnaire method was used to know and obtain data about the students' type of learning style. Interview method was used to collect data about students' mathematical problem solving abilities with TAPPS model in terms of learning style. The test method was used to get data about students' mathematical problem solving skills either by using TAPPS model or with Expository model. Documentation method was used to obtain written data or drawings about student's list of names, number of students, photos of student activities and other data which were used for research purposes.

The steps which were undertaken in this study was taking the score of mathematics final exam

semester gasal class VIII year 2016/2017, then analyzing with two-equity test average to know that students had the same ability before the research. Before conducting the learning in the experimental class and control class, the students' were tested on mathematical problem solving skills in the experimental class to know the validity of the item, the reliability of the problem, the difficulty of the item, and the differentiator. Afterwards the learning in the experimental class and control class was carried out. At the beginning of the meeting in the experimental class at break time, a questionnaire was filled with learning style questionnaires. After conducting the learning, the students were tested on mathematical problem solving abilities in the experimental class and control class. Furthermore, the test results of students' mathematical problem solving ability were analyzed by z test and t test. z test was to find out whether the students' mathematical problem solving ability with TAPPS model reached a total of 75%, and t test to find out whether students' mathematical problem solving ability with TAPPS model was better than expository model. After it was done, the data analysis of type of learning style questionnaire of experimental class students obtained students group who have visual, auditorial, and kinesthetic learning styles. Then the subject of research was determined, ie 2 students for each learning style. Further interviews were conducted on each subject. After that, the written test subject data with interview data were compared. Lastly, making analysis to draw the conclusions and describe student's mathematical problem solving abilities with TAPPS model in terms of learning style.

3. Results and Discussion

Analysis of preliminary data is done to determine the initial state of the sample class whether it comes from the same state. The preliminary data is taken from the final test semester of mathematics at the eighth grade of SMP Negeri 4 Kudus in the academic year of 2016/2017 for experimental class, control class, and experiment class. The preliminary data analysis contain all the tests performed on preliminary data i.e. normality test, homogeneity test, and equality test of two averages.

Based on preliminary data analysis, it is known that the two sample groups have the same initial capability. Further experiments or treatment. The

treatment given in the experimental class is the learning with the TAPPS model. While in the control class is learning with expository model. After all the treatments have been done, students are given a problem-solving test. The data obtained from the test results are then tested to determine whether the results match the expected hypothesis. The result of descriptive analysis of the data test of mathematical problem solving ability on the surface area and prism volume as well as the upright peak can be seen in Table 1.

From the calculation of normality test the final data of the experimental class obtained results $X^2_{result} = 4,94$ and $X^2_{table} = 11,1$, then $X^2_{result} < X^2_{table}$ meaning that the experiment class data is normally distributed. From the calculation of normality test, the final data of the control class obtains results and , then , meaning that the control class data is normally distributed.

Homogeneity test gives results $X^2_{result} = 0,898$ and $X^2_{table} = 3,84$. Because $X^2_{result} < X^2_{table}$, the final data has the same or homogeneous variant.

Furthermore, the hypothesis test is performed by the test of completeness using one-party proportion test, this test is to find out whether the problem solving ability of mathematical students who are taught using TAPPS model can achieve classical mastery or not. In this case, it is said to fulfill classical completeness if more than 75% of the students in the class get the score at least or more than 75.

The criteria uses rejected if $Z_{result} \geq Z_{0,5-\alpha}$. Based on the results of the study, for $\alpha = 5\%$, obtained $Z_{0,5-\alpha} = 1,64$. Because $Z_{result} \geq Z_{0,5-\alpha}$ then $2,57 > 1,64$ so H_0 is rejected and H_1 is accepted. So the students' mathematical problem-solving abilities with the TAPPS model have reached a classical mastery.

To find out whether the mathematical problem solving ability of the students with TAPPS model is better than the expository model, we test the difference of two average and test the difference of two proportions. A two-averaging difference test was performed to determine whether the average mathematical problem-solving test results of the students' flat-sided learning materials taught using the TAPPS model were better than those taught using the expository model.

Criteria testing accepts H_0 if $t_{result} \geq t_{table}$ ($\alpha = 5\%$ and $dk = n_1 + n_2 - 2$). Based on the research results obtained $t_{result} = 2,098$ and $t_{table} = 1,99$. Because $t_{result} \geq t_{table}$ then H_0

rejected. So the average grade of mathematical problem solving ability of the TAPPS model class is better than the average grade of mathematical problem solving ability of the expository model class students.

Table 1. Descriptive Research Results

No	Descriptive statistics	Experiment Class	Control Class
1	Number of Students	34	34
2	Highest Value	92,72	90,9
3	Lowest Value	65,45	58,18
4	Average	83,04	80,26
5	Standard deviation	5,85	6,91
6	Variance	34,28	47,71

Whereas the difference test of two proportions are to find out whether the completion percentage of mathematical problem solving ability of building the flat side room of the students taught using TAPPS model is bigger than the students who are taught using expository model have been done.

The criterion which is used is rejected H_0 if $Z_{result} \geq Z_{0,5-\alpha}$ with significance level $\alpha = 5\%$. Based on the research results, obtained value $Z_{result} = 1,79$ and $Z_{table} = 1,64$. Because $Z_{result} > Z_{table}$ that is $1,79 > 1,64$ then H_0 rejected. So the percentage of students' completeness in the class using the TAPPS model is greater than the students in the class using the expository model.

Based on the calculation of the test difference of two mean and test difference of two proportion obtained by conclusion shows that student's mathematical problem solving ability with TAPPS model is better than student with expository model.

Filling the questionnaire learning style by the experimental class students is conducted for the purpose of classifying the learning style of students. The event was held at the first meeting on Saturday, May 6, 2017 at the first hour break. Students who followed the questionnaire as many as 33 students, because 1 student was outside the class to follow other activities. Furthermore, for one student was asked to fill out a questionnaire at second break time. Before carrying out the questionnaire, the teacher gave the direction of filling the questionnaire. After the students

completed the questionnaire of each learning style, the teacher asked again to collect the learning style questionnaire.

Data obtained from learning style questionnaires are analyzed in accordance with the learning style questionnaire assessment guidelines. The following table presents the experimental class learning outcomes in Table 2.

Based on Table 2, it is found that there are students who occupy each visual, auditorial, and kinesthetic learning style. Students who have visual learning style are 9 students (26.5%), students who have auditorial learning style are 10 students (29.4%), students who have kinesthetic learning style are 12 students (35.3%), students with a visual-kinesthetic learning style are 2 students (5.9%), and whereas students who have auditorial-kinesthetic learning style is 1 student (2.9%).

After knowing the learning styles of students, researchers determine the subject of research at the beginning of learning. Selected subjects are 20% of each learning style, 2 subjects for visual learning styles, 2 subjects for auditorial learning styles, and 2 subjects for kinesthetic learning styles.

Interviews are conducted to obtain information about student's mathematical problem solving abilities. The interview is conducted on the basis of agreement between the research subjects and the researcher on Monday, May 29, 2017 and on May 30, 2017 break time and after school, so as not to interfere with teaching and learning activities in the classroom.

At the time of the interview, the research subjects are able to explain their way of good thinking and accompany with clear reasons. So that it can obtain the information about mathematical problem solving ability of each research subject.

Analysis of mathematical problem solving abilities of each subject is based on the stages of mathematical problem solving skills that have included indicators of mathematical problem solving abilities. A summary of the problem-solving abilities of mathematical learning styles is presented in Table 3.

The description of students mathematical problem solving abilities with TAPPS model in terms of visual learning styles at the understanding stage of the problem; students with incomplete visual learning styles write down information that is known and asked, but has been able to explain the problem of using the language and sentence

itself. So students with visual learning styles are still in enough categories to understand the problem. At the planning stage of completion, students with visual learning styles are able to write the plan correctly and completely. So students with visual learning styles are including in the good category for planning the settlement. At the stage of carrying out the completion plan, students with visual learning styles are quite capable in implementing problem-solving steps and formulas that have been planned but are incomplete and incorrect. So students with visual learning styles are still in enough categories to implement the completion plan. This is in accordance with research Tiffani (2015) that someone with visual learning style write down the initial results of information processing but because the processing is less precise then result in the end is wrong. At the re-examining stage, students with visual learning styles have not done a re-examination of the plans and calculations that have been done but are able to write down the conclusions obtained. Therefore, students with visual learning styles are still in enough categories to check back.

The description of students' mathematical problem solving abilities with TAPPS model in terms of auditorial learning style at understanding comprehension stage; students with auditorial learning styles are able to write down information that is known and asked correctly and completely, also able to explain problem using language and sentence. So students with auditorial learning styles are already in good category to understand the problem. This is in accordance with Indrawati's (2017) study that a person with an auditorial learning style can correctly state what is known from the problem by using his own language. At the planning stage of completion, students with auditorial learning styles are able to write the plan correctly and completely. So students with auditorial learning styles are included in the good category for planning the settlement. At the stage of carrying out the completion plan, students with auditorial learning styles are capable in implementing well-planned and complete troubleshooting steps and formulas. So that the student with the auditorial learning style is already in the good category to implement the settlement plan. At the re-examining stage, students with auditorial learning styles have not done a re-examination of the plans and calculations that have been done but are able to write down the conclusions obtained. Therefore, students with

auditorial learning styles are still in enough categories to check again.

The description of students' mathematical problem solving abilities with the TAPPS model in terms of kinesthetic learning style at the understanding stage of the problem; students with kinesthetic learning styles are able to write down information that is known and asked correctly and completely, also able to explain the problem with the language and the sentence itself. Therefore, students with kinesthetic learning styles are already in good category to understand the problem. This is in accordance with DePorter & Hernacki (2008) that a person with a kinesthetic learning style will use his finger as a guide in reading. So he is able to name the information that is known completely. At the planning stage of completion, students with kinesthetic learning styles are able to write down plans but are incomplete. As a result, students with kinesthetic learning styles are still in the sufficient category to plan the settlement. At the stage of carrying out the completion plan, students with kinesthetic learning styles are capable of implementing problem-solving steps and formulas that have been planned but are incomplete and incorrect. As a result, students with kinesthetic learning styles are still in enough categories to implement the completion plan. At the re-examining stage, students with kinesthetic learning styles have not done a re-examination of the plans and calculations that have been done but are able to write down the conclusions obtained but incorrectly. Therefore, students with visual learning styles are still in the category of less to check back.

4. Conclusions

Based on the result of the research and discussion, it is concluded that (1) the students' ability of solving the mathematical problem by learning the model of Thinking Aloud Pair Problem Solving on the building of the flat side of the prism and the upright limas can achieve standard minimum criteria, so that at least 75% of students get score more than or equal to 75 with the percentage of completeness is 94.12%; (2) students' mathematical problem-solving abilities was taught by the Thinking Aloud Pair Problem Solving model are better than those taught by expository models; and (3) students' mathematical problem-solving skills with each learning style can be categorized (1) adequately categorized visuals at

the stage of understanding the problem, implementing a settlement plan, and re-examining, and categorizing both at the planning stage of completion; (2) auditorial categorized either at the stage of understanding the problem, planning the problem, and implementing the settlement plan, as well as sufficient categorizing at the re-check stage; and (3) kinesthetic categorized either at the stage of understanding the problem, sufficient categorization at the planning stage of completion and implementing the settlement plan, and categorized less at the re-check stage.

Table 2. Result of Question of Class VIII-A

Learning Styles	Total students
Visual	9
Auditorial	10
Kinesthetic	12
Visual-Kinesthetic	2
Auditorial-Kinesthetic	1
Total	34

Table 3. Summary of Troubleshooting Capabilities Mathematically Reviewed from Style Learning

Problem Solving Stage	Visual	Auditorial	Kinesthetic
Understanding The Problem	Enough	Good	Good
Devising a Plan	Good	Good	Enough
Carrying Out The Plan	Enough	Good	Enough
Looking Back	Enough	Enough	Less

Suggestions that can be recommended by researcher are (1) SMP Negeri 4 Kudus mathematics teacher can use TAPPS model as one of alternative learning in improving students' mathematical problem solving ability on construct of flat side side of prism and upright peak; (2) the TAPPS model should be used in other mathematical material that has the same characteristics as the flat-side building material so that students can improve their mathematical

problem solving abilities; (3) at the beginning of learning using the TAPPS model the teacher should explain the learning stage in detail to the students so that students are not confused during the learning process; and (4) in this study, the researcher finds the fact that the level of achievement of students' mathematical problem solving abilities with different learning styles have different achievements, so it is suggested to do further research that discussion to improve the ability of problem solving mathematically.

Sugiyono. (2016). *Metode Penelitian Kombinasi*. Bandung: Alfabeta.

Unaifah, F., & Suprpto, N. (2014). Profil Kemampuan Pemecahan Masalah dan Hasil Belajar Siswa pada Materi Elastisitas Ditinjau dari Gaya Belajar (Learning Style). *Jurnal Inovasi Pendidikan Fisika*, 3(2), 27-32.

References

BSNP. (2006). *Standar Isi untuk Satuan Pendidikan Dasar dan Menengah*. Jakarta: BSNP.

DePorter, B & Hernacki, M. (2008). *Quantum Learning*. Bandung: Kaifa.

Handayani, L, S., Syafriandi, & Mirna. (2014). Pengaruh Metode Think Aloud Pair Problem Solving (TAPPS) terhadap Kemampuan Komunikasi Matematika Siswa SMA. *Jurnal Pendidikan Matematika*, 3(1), 50-55.

Indrawati, R. (2017). Profil Pemecahan Masalah Matematika Ditinjau dari Gaya Belajar. *Jurnal Program Studi Pendidikan Matematika*, 3(2), 91-100.

National Council for Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.

Nugroho, A. M., Suyitno, H., & Mashuri, M. (2013). Keefektifan Model Pembelajaran Teams Games Tournament terhadap Kemampuan Pemecahan Masalah. *Unnes Journal of Mathematics Education*, 2(1), 159-165.

Peraturan Menteri Pendidikan Nasional Republik Indonesia Nomor 22 tahun 2006 tentang Standar Isi Sekolah Menengah (Decree of The Indonesian Minister of National Education Number 22, 2006)

Tiffani, H. (2015). *Profil Proses Berpikir Siswa Smp Dalam Menyelesaikan Soal Perbandingan Berdasarkan Gaya Belajar Dan Gaya Kognitif* (Undergraduate Thesis, Universitas Muhammadiyah Surakarta).

Stice, J. E. (1987). *Teaching Problem Solving*. <https://inst.eecs.berkeley.edu>. Accessed February 3th, 2017.