

The Analysis of Student's Mathematical Communication Ability on The Ethno-Mathematics Based Thinking Aloud Pairs Problem Solving (TAPPS) Learning

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Article Info

History Articles

Received:
August 2018
Accepted:
September 2018
Published:
April 2019

Keywords:
ethno-mathematics,
mathematical
communication,
TAPPS

DOI
<https://doi.org/10.15294/jpe.v8i2.26222>

Abstract

This research aims to (1) find out the quality the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS) learning (2) discover the pattern of mathematic communication ability the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS) learning. This research uses mixed method type with concurrent embedded design. Quantitative and qualitative research runs together which the qualitative research is as the primer method. The qualitative learning is assessed from (1) planning and preparation, (2) classroom environment and instruction, and (3) evaluation (professional responsibility) stages. The result of this studies shows that the qualitative learning the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS) is a good categorized. The pattern of student's mathematic communication with upper group is a student who can explain their ideas and situation in written language appropriately. Students who can express their ideas and situation on the facing problem in mathematics model appropriately and correctly. A student who can use the mathematical formula correctly to solve the problem. The pattern of student's mathematic communication with medium group is a student who can explain the ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem into mathematic mode appropriately and correctly. The student who is not able to use the formula to face the problem. The pattern of student's mathematic communication with lower group is student who can express their ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem into mathematic model appropriately and correctly. A student who is not able to use the mathematical formula correctly to solve the problem.

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INTRODUCTION

The mathematical communication ability is the most important ability to be mastered for the students. Through mathematic communication, students can organize and compose their mathematical thinking both spoken and written language which brings students understanding mathematical concepts deeply. According to Baroody (1993) there are two reasons that make mathematic communication essential for mathematic subject; mathematic as language and learning mathematic as a social activity. Mathematic is not the only tool for thinking, but also as a tool to communicate ideas clearly and precisely. Mathematic as a social activity can be seen from the interaction between student's, teacher and others.

NCTM (1991) explains that mathematical communication is the student ability to describe algorithm and the unique way to solve the problems. The student's ability is to construct and to explain the graphical phenomena of the real world, words/sentences, equation, table, and physically, or the student's ability to conjecture the hypothesis about picture geometry.

Regarding to NCTM (2000), communication means a way to share the thought and clarifying the understanding. Through communication, ideas can be as an object of reflection, refection, discussion and disposition.

In the reality has shown that mathematic subject runs by conventional approach and focusing on achieving the target sub-subject or following the book as the compulsory guidance. In the learning process, the teacher never gives a chance to the students to communicate their ideas, to explain and to do the exercises. In point of fact, the teacher never invites the students to explore and train their mathematical ability as the ability of mathematical communication. Besides that, the students are lack of motivation in the process of learning because the teacher never uses a variety learning model.

According to Baroody (1993), Mathematics learning using the conventional

approach, the student's communication ability is limited in the short verbal answering to the various type questions asked by the teacher. Regarding to Brenner (1998), the mathematic communication students in the California lower is caused two groups of student using a different language. This is also happened in MTs NU Ungaran. Based on the result of interviews by researcher on mathematics teacher in MTs NU Ungaran is shown that students face a problem to solve contextual problem, with the result that the examination faces contextual question, many students gets a lower score under the minimum criteria of learning mastery. This can be seen when the teacher gives a story question to students, many of them is failed to modify a story question into a mathematical model. Furthermore, when the teacher asks students to explain a mathematics problem in the class, they are afraid and less confidence to express their ideas. The fearfulness tends student to think mathematics negatively, to be lazy to do the exercises, and passive in the mathematics learning process. As a result, it does not work to get the aim of the mathematics learning process following Decree of The Minister of National Education No. 22 Year 2016, students are able to communicate their ideas using symbol, table, diagram, or other media to explain the condition or problem. Vygotsky argues that the social interaction is individual interaction with other people the most important factor to encourage or to trigger a personal cognitive development. (Schunk, 2012)

In that case, we need a mathematic learning process that can increase the student's mathematic ability, which indicated the fulfillment of the mathematical communication ability indicators in Juandi (2007). The mathematic learning process can develop the mathematic communication ability is Thinking Aloud Pair Problem Solving (TAPPS), the ethno-mathematics of TAPPS. This strategy focuses on working in pair to solve the problem like Stice said (1987). The ethno-mathematics of TAPPS is carried the structured collaboration of several students. This strategy is aimed to escalate student's ability to solve a problem then disclosed

to another student to find the best solution. This theory according to Bruner because by using this theory the learning can be actualized to help student understanding the abstract of mathematic concept and studies. This theory helps students to see how the facts no relationship, can be connected with each other and using the information they have. This kind of learning experience can be exemplified to other intuitive discovery learning experience. As a result, the ethno-mathematics of TAPPS can simplify students to communicate their mathematical ideas. This can be seen in the Table 1.

Table 1. The Implementation of TAPPS

The implementation of TAPPS	The trained mathematical communication ability
The two students work in teams and alternately changing as a role play as a problem solver and listener	Expressing their ideas about the problem discussed.
Students, who can solve the problem, take the role-play as a listener	Using a right pattern to solve the problem
A problem solver works to express spoken language and confirming the result of their thought about the solution about the problem given, while the listener works to listen the explanation.	To a problem solver: describe the ideas and situation verbally To the listener: listen seriously when students describe their opinion until they can understand it
A problem solver and listener exchanging the role-play	Expressing their ideas and situation verbally

In this research will be applied a learning model the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS). It is one of the mathematic learning models used cooperatively which each student has a different role model as a problem solver and a listener, associating mathematic learning material following local wisdom. TAPPS strategy is aimed to develop the student's ability to solve a problem then revealed to another student finding the best solution. Dalam Whimbey & Lochhead (1999) said that the background of TAPPS ideas conveys the solution in spoken language directly from a problem solving process in order to develop student's ability thinking analytic. It is similar to the Robbins Study (2011) and Rochmad Study (2012).

The ethno-mathematics can be defined that a special ways used by a group of cultures or the certain community in mathematical activities. (Rachmawati, 2012).

D'Ambrosio (1985) explains the Etna-mathematics helping us to understand how mathematic continued to be adopted and to be used in every place and time because the materials describing their local culture directly reflecting in daily life.

The results is likes Kucuk study (2013), Rosa, M., & Orey, D. C. (2008) and Rosa, M., & Orey, D. C. (2013). Culture is referred here following the norm value or general rules implied in the society, trust and the norm of recognized in the various tribal societies are the same of nationality (Hammond, 2000).

TAPPS provide students to recognize and to communicate their mathematic ideas connected with the local wisdom where they live. Indonesia has various culture for every region as their identity. However, Indonesia people have to be proud and care to their own culture. By involving the elements of culture in the learning process, it will increase the motivation to learn and being love to student's local wisdom. It is following Fauzi's Research (2018), Kadir (2013) and Tandilling (2012) associating learning process to the real life can develop the mathematic communication ability.

METHODS

This research uses a mixed method a concurrent embedded version which combines quantities and qualitative method together. According to Creswell (2004), the study concurrent embedded version applies collecting the qualitative data and quantitative data at once. This research is started collecting qualitative data through students of VIII MTs NU Ungaran. The next step, the researcher gives the treatment to students using the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS). In this step, the data are collected; qualitative and quantitative data. Qualitative data is about the quality of learning implementation and

quantitative data is about the result of test mathematic communication.

The technique of collecting data used in this research is test and non-test technique. Techniques test is used to get student's work result, whereas technique non-test uses the observation method. The qualitative data analysis in this research is initial condition the student's ability of mathematical communication doing the exercises before the researcher starts the learning process. The qualitative data analysis is also used after students learning the ethno-mathematics of TAPPS through the final test of communication mathematic.

RESULTS AND DISCUSSION

This research measures the quality of learning using quality domain regarding to Danielson (2003). The stages include: (1) planning and preparation, (2) classroom environment and instruction, and (3) evaluation (professional responsibility). The research result of quality learning using the ethno-mathematics of TAPPS is held in the class VIII 1 MTs NU Ungaran, District of Semarang. The research plan stages have validated every learning instrument that can be seen in the Table 2 below.

Table 2. The Assessment Result of Learning Instrument

Instrument	Score avarage	Category
Lesson plan	4.06	Very good
Teaching supplements	4.00	Good
Exercise sheets Book	3.92	Good
Test of mathematic communication ability	4.04	Very good

The implementation stage of learning is shown the quality if the result observation on learning quality and implementation of learning having the minimum score at good. It is held 5 meetings. The Assessment Result of Learning Instrument the ethno-mathematics of Thinking Aloud Pairs Problem Solving (TAPPS) can be seen in the Table 3.

Based on the observation result on the quality learning in the Table 3 is obtained the average score 3.83 that can be concluded category on the learning quality the ethno-mathematics of TAPPS is decent. The implementation of

learning result using the ethno-mathematics of TAPPS can be seen in the Figure 1.

Table 3. The Assessment Result of Learning Quality

Learning quality	Average score	Category
Meeting 1	3.50	Good
Meeting 2	3.68	Good
Meeting 3	3.77	Good
Meeting 4	3.95	Good
Meeting 5	4.23	Very good

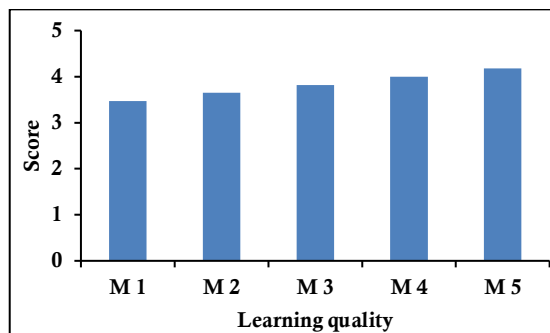


Figure 1. The Implementasi of Learning Result

Based on the implementation of learning result in the Figure 1 is obtained the average score 3.82 that can be concluded category the implementation of learning using the ethno-mathematics of TAPPS is good.

The third stage is evaluation. Evaluation phase is given a questionnaire response to students through the ethno-mathematics of TAPPS and analyze results of student's mathematic ability. Students give a positive response to the learning reaching more or equal to 70%. This proves that many student's asses the learning process running properly.

In this evaluation phase, the researcher analyzes the result of mathematic communication ability. The researcher gives Test of Mathematic Communication Ability before and after using the ethno-mathematics of TAPPS learning model. The result of mathematic communication ability is obtained with the average score 35.98. While the average score of mathematic communication ability after using the ethno-mathematics of TAPPS is 76.44. From the result test, the competence test is obtained students result getting minimum score 70 exceeding 75%.

The researcher conducted pair-test and an improved test before and after learning process using the ethno-mathematics of TAPPS model. The result of trial test is obtained the average of mathematic communication ability better than before learning process. The increment of average score mathematic communication ability following normalized gain test in the medium category.

Based on the qualitative learning assessment result the ethno-mathematics of TAPPS model in the planning, implementation and assessment stage with domains to measure the success of learning process like Danielson said (2013), it can be concluded that the learning quality of the ethno-mathematics of TAPPS model is good.

Table 4. Results of Gain Calculation on Students' Mathematical Communication Ability

Pre-test	Pos-test	$\langle g \rangle$	Gain
35.98	76.44	0.63	Medium

Based on the calculation Table 4, $\langle g \rangle = 0.63$. It shows that the value (g) lies the range $0.3 \leq \langle g \rangle < 0.7$. As a result, gain optimized can be categorized as medium, it is like Hake criterias (1998). We can conclude that the student's mathematic communication the ethno-mathematics of TAPPS model can be categorized as medium.

The student's mathematic communication ability the ethno-mathematics of TAPPS model can be grouped to be three levels; upper, middle and lower group. The three characteristics in the student's mathematic communication ability are different following the indicator of mastery mathematics communication indicator level. The student characteristic with upper group is a student who can explain their ideas and situation in written language appropriately. Students who can express their ideas and situation on the facing problem in mathematics model appropriately and correctly. A student who can use the mathematical formula correctly to solve the problem.

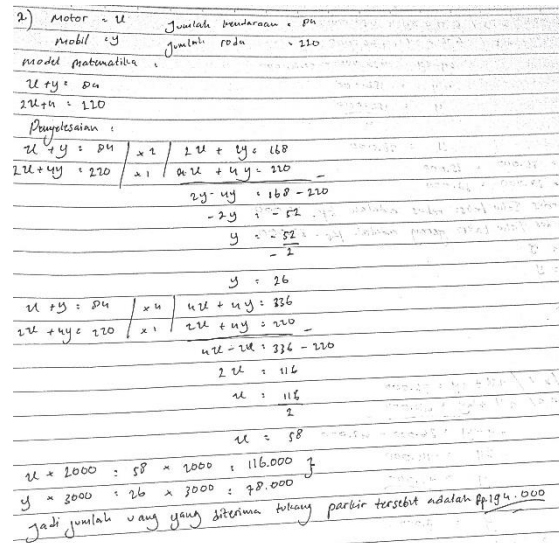


Figure 2. The Example of Students Work Result Mathematical Communication Ability

The Figure 2 is result of the student work sheet in upper group. From Figure 2, it can be seen that students can explain their ideas and situation in written correctly, student can express ideas and situation from the problem into a mathematical model properly and correctly, students can use the formula correctly to solve the problem.

The student characteristic with medium group is a student who can explain the ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem into mathematic mode appropriately and correctly. The student who is not able to use the formula to face the problem. And the student characteristic with lower is student who can express their ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem into mathematic model appropriately and correctly. A student who is not able to use the mathematical formula correctly to solve the problem.

A pattern of student's mathematic communication ability after getting the treatment of the ethno-mathematics of TAPPS is different for each group. Student's mathematic communication ability upper group is good, but we still have to care giving an innovative learning process. Students with the medium group should

be more cared with calculated carefully. Whereas for students with lower group needs more special caring and guiding in order not to give up on trying and error and facilitating them with various communication exercises.

The result of this research is better rather than Wijaya's research (2014), it shows that TAPPS is not effective in term of student's mathematic ability. It has a good result for this research because the researcher adds the ethno-mathematics element in the TAPPS associating learning materials and local culture. As can be seen student gives a positive response through the learning process and student's mathematic communication increasing.

CONCLUSION

Based on the result of this studies, it can be conclude the qualitative learning process on the ethno-mathematics Thinking Aloud Pairs Problem Solving (TAPPS) through student's mathematic communication ability can be a good categorized.

The pattern of student's mathematic communication with upper group is a student who can explain their ideas and situation in written language appropriately. Students who can express their ideas and situation on the facing problem in mathematics model appropriately and correctly. A student who can use the mathematical formula correctly to solve the problem.

The model of student's mathematic communication with medium group is a student who can explain the ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem into mathematic mode appropriately and correctly. The student who is not able to use the formula to face the problem.

The pattern of student's mathematic communication with lower group is student who can express their ideas and situation in written language appropriately. A student who can express their ideas and situation facing the problem intro mathematic model appropriately and correctly. A student who is not able to use the

mathematical formula correctly to solve the problem.

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