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Mathematical communication ability of 7th grade in SAVI learning with elaborated feedback

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Abstract

Mathematical communication ability is important to communicate ideas and improve students' understanding. The purpose of this study was to examine the effectiveness of SAVI learning with elaborating feedback towards the students' achievement of mathematical communication abilities; and to describe how to students' achievement of mathematical communication abilities with elaborated feedback. The population of this study is 7th-grade students in one of the junior high schools in the city of Semarang year 2018/2019. Sampling by simple random sampling techniques and subject selection with purposive sampling technique. The results of the study showed that SAVI learning with elaborated feedback is effective in the students' achievement of mathematical communication abilities. Description of students' mathematical communication abilities, namely (a) high group subject have mastered four indicators of mathematical communication; (b) medium group subject have mastered three indicators of mathematical communication, and (c) the low group subject have mastered 2 and 3 indicators of mathematical communication.

1. Introduction

Mathematical communication ability is one of the most important abilities in learning mathematics, as stated in the National Council of Teachers of Mathematics (NCTM, 2000) that the five standard abilities that must be possessed in learning mathematics are problem-solving, reasoning and proof, connections communication and representation. Baroody in Ansari (2016) states two important reasons why mathematical communication needs to be developed. First, mathematics as langue mathematics as a means of problem-solving and communicating ideas, second mathematics learning as a social activity, mathematical as a means of communication that can improve mathematical understanding. Hodiyanto (2017) revealed the importance of mathematical communication namely, through the communication process, students can exchange ideas, clarify the understanding and knowledge gained in learning.

Mathematical communication ability in Indonesia is still relatively low. This can be seen from the OECD (2018) 2015 PISA results, where Indonesia is ranked 6th out of 72 countries, with a mathematical competency point of 368. Although the point has increased from the previous year, the results are still below the standard International.

Based on the result of interviews with teachers of math 7th grades, obtained information that the communication ability of mathematical learners is still low. This can be known based on the difficulties experienced by students. The students often have difficulty in working on the exercise of story form, identifying and writing what is known in the problem, difficulties in communicating their ideas based on problems, and are confused when asked to state the problem in the form of mathematical ideas.

Assessment is an important part that cannot be separated from the learning process. According to Arends in Hikmasari et al. (2017) teachers are responsible for the assessment and evaluation of their students in the class. The assessment has an important role for students as well as teachers. For students, assessments can be used as evaluations and benchmarks for achieving success, while for teachers,

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assessment can be used as benchmarks to what extent learning objectives are achieved. Formative assessment in learning can be a measuring tool to determine the development of mathematical communication ability of students. In the implementation of formative assessments, it is necessary to have feedback and follow up. According to Sumarmo (2016), feedback serves to provide information provided to students and is intended to change thinking or behavior to improve the learning process.

In the process of learning mathematics that has been done so far has not implemented complete learning. Where the teacher only applies main learning and formative tests without any feedback and follow-up from the formative tests. Based on the results of an interview with a 7th-grade mathematics teacher of a state junior high school in Semarang, mathematics learning has implemented formative testing but has not yet implemented the feedback and follow-up.

Based on data of the Junior High School National Examination results from Puspendik (2018) in the 2017/2018 year it was found that the average mathematical score in one of the junior high schools in Semarang was 45.46. The math value is still relatively low. Mastery of National Examination mathematics at one of the junior high school on geometry and measurement material is also relatively low both in the education units, districts/cities, provinces, and national levels. The following is the percentage of material mastery in one of the junior high schools in Semarang in the academic year 2017/2018.

Table 1. Percentage of mastery of UN material in one of the junior high schools in Semarang in the Academic Year 2017/2018

Material	Education units	Districts/Cities	Provinces	National Levels
Numbers	45.83%	51.68%	43.64%	39.71%
Algebra	56.76%	62.40%	54.96%	51.24%
Geometry and measurements	42.51%	50.78%	45.23%	42.27%
Statistics and Opportunities	61.30%	66.60%	60.86%	55.60%

Based on data from Puspendik (2018), the percentage of geometry and measurement material absorption reaches 42-50%. Therefore, this research was conducted with geometry material in the form of the quadrilaterals. Based on the description above it can be concluded that the mathematical communication ability of students on geometry material is not optimal. For this reason, needed learning which can optimize students' mathematical communication ability. One learning model that can provide opportunities for students to develop and explore aspects of mathematical communication ability optimally is the SAVI learning model *(Somatic, Auditory, Visualization, and Intellectual)*.

SAVI is a learning model that emphasizes learning by utilizing all the senses possessed by students. According to Meier (2002), There are four elements in SAVI learning, namely Somatis (learning by moving and doing), Auditory (learning by speaking), Visual (learning by observing and describing) and Intellectual (learning to solve problems). According to Rosalina & Pertiwi (2018), the advantage of SAVI learning is to train students to more actively complete the exercises for building self-confidence and be effectively applied to mathematics learning. This is confirmed by Rini *et al.* (2017) that SAVI learning with the Flash media can improve students' mathematical communication ability. And the research of Magfiroh et al. (2017) which states that SAVI learning can improve students' mathematical communication ability.

At the end of this study, the learning will be given feedback in the form of elaborated feedback with a follow-up in the form of remedial learning and enrichment. Elaborated feedback is a general form of feedback that can be in the form of explaining why the answer is correct and allows students to review part of an order (Shute, 2007). Bown (2017) states that elaborated feedback significantly increases comprehension of online reading in low-ability readers.

Based on the background of the problem described, the problems of this study are, (1) whether SAVI learning with elaborated feedback is effective in achieving students 'mathematical communication abilities? (2) how is the description of students' mathematical communication ability in learning SAVI with elaborated feedback?.

The purpose of this study are as follows, (1) examine the effectiveness of SAVI learning with elaborating feedback towards the students' achievement of mathematical communication abilities, (2) describe how to students' achievement of mathematical communication abilities with elaborated feedback.

In this research, the indicator of mathematical communication ability used is the written mathematical communication indicator from Sumarmo as follows. (1) describe or represent real objects, drawings and diagrams in the form of mathematical ideas or symbols; (2) Explain ideas, situations and mathematical relations in writing using real objects, pictures, graphics, and algebraic expressions; (3) stating everyday events in language or mathematical symbols or composing mathematical models of events; (4) constructing conjectures, compiling arguments, formulating definitions and generalizations; (5) re-express a description of a mathematical paragraph in own language.

The hypotheses used in this study are as follows, (1) the average mathematical communication ability of students with SAVI learning models with elaborated feedback is more than to 65; (2) students in classes taught by using the learning model of SAVI with elaborated feedback complete in proportion, if more than 75% of total number of students' participating in SAVI learning with elaborated feedback reaches a score more than 65; (3) the average mathematical communication ability of students who get SAVI model learning with elaborated feedback are more than the average mathematical communication ability of students who get PBL learning.

2. Methods

The method used in this research is mix methods. According to Sugiyono (2016: 475) mix method is a study that combines quantitative and qualitative research to be used together to obtain more comprehensive, valid, reliable, and objective data. The research design used a sequential explanatory. The population in this study were 7th-grade students of one of the junior high schools in Semarang in the 2018/2019 academic year. From this population, samples were taken by simple random sampling technique, which took samples randomly without any strata differences in the population. Class VII A was chosen as the experimental class, class VII G as a control class, and class VII D as a test class. The experimental class will get SAVI learning with elaborated feedback, and the control class will get PBL learning. The subjects in this study were selected using a purposive sampling technique, which is a sampling technique with certain considerations.

Data collection techniques in this study are (1) documentation to obtain preliminary data ; (2) written tests to measure students' mathematical communication ability; (3) interviews to get deeper data from mathematical communication ability test results of students. Quantitative data analysis is used to test whether SAVI learning with elaborated feedback is effective in the achievement of mathematical communication abilities. While qualitative data analysis is used to describe the mathematical communication ability of students in SAVI learning with elaborated feedback. This qualitative data was obtained through interviews with six research subjects who obtained SAVI learning with elaborated feedback. The six subjects are two subjects of students with mathematical communication ability of the high group, two subject with mathematical communication ability of the medium group subjects, and two subjects with mathematical communication ability of the low group.

3. Results & Discussion

Preliminary data were obtained from the Middle exam of Semester 2. Based on the preliminary data, it was found that the two classes came from a normal distribution, homogeneous distribution and there was no average difference between the two classes

Before testing the research hypothesis, the data were tested for normality using the Kolmogorov Smirnov test with a significance level of 0.05. The results obtained that experimental and control data come from the normal distribution. Then the homogeneity of the data is tested by using the leavens test, the results are that both data are homogeneous.

Calculation of hypothesis 1 test uses the one-party average test (right party) and uses the t-test. The analyzed data are the results of the mathematical communication ability test of the experimental class. Based on the calculation results obtained $t_{count} = 5{,}091$ and $t_{table} = t_{(0,95)(32)} = 1{,}69955$ with a

significant level of 0.05. Because $t_{count} = 5{,}091 > 1{,}69955 = t_{table}$, H_0 it was rejected. So H_1 accepted, it means that the average mathematical communication ability of students who take SAVI learning with elaborated feedback is more than 65.

Hypothesis 2 test uses the proportion test of one party, namely the proportion test of the right party using z test. Testing this hypothesis uses the results of the experimental class communication ability test. Based on the calculation results obtained $z_{count} = 1{,}6872$, and $z_{table} = 1{,}645$ with a significant level of 0.05. Because $z_{count} = 1{,}6872 > 1{,}645 = z_{table}$, then H_0 was rejected, so H_1 was accepted, meaning that the percentage of completeness of students' mathematical communication ability test results in the learning of SAVI models with elaborated feedback that scored more than to 65 reached 75%.

Based on the results of hypotheses 1 and 2, it was found that SAVI model learning with elaborated feedback can improve students' mathematical abilities. This is in accordance with Pulungan research (2017) which states that the implementation of the SAVI model in learning improves students' mathematical communication ability. This is because SAVI learning with elaborated feedback emphasizes learning by involving the senses that students have. With the help of teaching prop and student worksheet, namely, LKPD is invited to discover the concept of learning in a fun and interesting way, so that students are more active in learning. This is accordance with the study of Andrianti et al. (2016) which states that learning SAVI model makes students give positive responses because mathematics learning is more fun, besides LKPD makes students discuss and use their intellectuals to think. Research Maulida et al. (2017) and Iskandar et al. (2016) in his study also stated that the SAVI model makes students more active in learning, and increases understanding of learning material.

At the end of the lesson, students are given elaborated feedback in the form of hints/prompts which is a form of feedback that guides students to find the correct strategy or strategies that must be carried out next or in the form of examples strategy. By providing elaborated feedback students will find out how the results of the process at the time of formative tests, so that they will better understand the material. Mattheiss et al. (2017) in his study stated that elaborated feedback can improve reading ability for low-ability readers. After getting feedback students are given follow-up in the form of remedial learning and enrichment. Learners who have not completed the formative test given remedial teaching and learning, and students who have been completed given enrichment teaching and learning. This is accordance with the study of Nugraheni *et al.* (2017) which states that the provision of the formative test in the form of remedial learning can make students mastered mathematical communication indicators that have not been achieved before.

The calculation of hypothesis 3 test uses the right difference test result on average test using the t-test. Based on the calculation results obtained $t_{count} = 2{,}1588$ and $t_{table} = 2{,}001$ with $\alpha = 5\%, dk = 32 + 29 - 1 = 59$ and opportunities $(1 - \alpha = 0{,}95)$ because $t_{count} = 2{,}1588 > 2{,}001 = t_{tablel}$then H_0 was rejected. So H_1 was accepted, it means that the average mathematical communication ability of students who get SAVI learning with elaborated feedback is more than the students who get PBL learning. This is accordance with a research by Farokhah et al. (2017), Zainuddin et al. (2017), and Khasanah et al. (2018) which states that the average mathematical communication abilities of the experimental class that obtained the SAVI model learning are more than the average of the control class.

Based on the description above, it can be concluded that SAVI learning with elaborated feedback is effective towards the achievement of students' mathematical communication ability because it meets the criteria. The same thing was stated by Siregar (2018) who stated that the SAVI learning model was effective in improving the mathematical communication ability of students in Padangsidimpun 4 of Junior High School.

The selection of research subjects is grouped according to standard deviations according to Arikunto (2013) which divides classes into three groups, high, medium, and low. In this study, the results of tests of mathematical communication ability of students were analyzed on average and standard deviations, so that three groups were obtained based on their communication ability. Following class grouping according to Arikunto (2013)

Table 2. Classification of Mathematical Communication Ability Classes

Classification	Interval

High	$x > (\bar{x} + s)$
Medium	$(\bar{x} - s) \leq (\bar{x} + s)$
Low	$x < (\bar{x} - s)$

From the calculation according to the table above, the results of the analysis of 32 students in class VII A, obtained information on 5 students in the high group, 24 students in the medium group, and 3 students in the low group. Then two research subjects were taken from each group. The following selected research subjects can be seen in the following table.

Table 3. Research Subjects

Subject	Category
E-22	High
E-30	High
E-10	Medium
E-20	Medium
E-26	Low
E-13	Low

Next, the six subjects were interviewed to ensure the data obtained was valid. The technique used is the triangulation technique.

3.1. Mathematical communication ability of high group students

The results of the analysis of the mathematical communication abilities of the subject in the high group are included in the good category because they can meet four of the five indicators of mathematical communication ability. In indicators describing or representing real objects, pictures and diagrams in the form of mathematical ideas or symbols, the subject E- 22 has been made a relevant story and its elements in full. E- 30 subjects make stories and determine their elements less logically, so it can be concluded that both subjects can fulfill this indicator well. This is supported by research Mukhoyyaroh *et al.* (2017) which states that students in the high and medium groups can meet indicators of the ability to represent mathematical ideas in writing.

In indicators explaining ideas, situations and mathematical relations in writing using real objects, pictures, graphics, and algebraic expressions, subjects E-22 and E-30 have been explained and translate the problem site in the form of images very well. On indicators stating daily events in mathematical language or symbols or composing mathematical models of an event, subjects E-22 and E-30 mention the information clearly and completely, determine strategies for solving the problem to find mathematical models in a coherent and precise manner, and make conclusions well. So it can be concluded that both subjects can meet this indicator well.

On indicators constructing conjectures, compiling arguments, formulating problems and generalizations, subjects E-22 and E-30 give information that is known clearly and completely, determine the resolution strategy correctly, make guesses correctly, but have not been compile the reasons of guess correctly. So it can be concluded that both subjects have been can meet the indicators to make the conjecture well. On indicators re-expressing a description of a mathematical paragraph in their language, the subject E-22 rewrite the statement in its language, but it is not appropriate. While E-30 subjects have not been expressing a statement in their language, and the answers are still fixated on the question text. So it can be concluded that the two subjects have not been can meet this indicator properly.

The findings in this study describe that subject with mathematical communication ability of the high group can reach four indicators of mathematical communication ability. Both subjects can paint pictures in the form of mathematical ideas, and state everyday events in mathematical models well.

3.2. Mathematical communication ability of medium group students

The results of mathematical communication ability analysis of the subject in the medium group are included in the category quite well, being able to meet three of the five indicators of mathematical communication ability. In indicators describing or representing real objects, drawings, and diagrams in

the form of mathematical ideas or symbols subjects, E-10 has been made relevant story questions and their elements completely and logically. Subject E-20 has been made a story problem that is relevant to its elements completely and logically. So it can be concluded that both subjects can meet this indicator well.

In the indicators explaining ideas, situations and mathematical relations in writing using real objects, pictures, graphics, and expressions algebra, subjects E-10 and E-20 explain and translate the situation in a matter of the exaggerated form of pictures correctly, complete with the description. So it can be concluded that both subjects can meet this indicator very well. For indicators expressed a daily occurrence in the language of mathematical symbols or construct a mathematical model of an event, the subject of the E-10 write information in a clear and complete, has not been devising a proper strategy in accomplishing m a mistake, so it has not created mathematical models asked about. While the E-20 subject writes information clearly and completely, determine problem-solving strategies, but has not been changed in the right mathematical model. So it can be concluded that the two subjects have not been able to meet this indicator properly.

On indicators constructing conjectures, compiling arguments, formulating definitions and generalizations, subjects E-10 and E-20 write information that is known clearly and completely, determine the right strategy, arrange the correct conjecture, and make the right ideas, but has not been made the right reasons from the answers. So it can be concluded that both subjects have been able to meet this indicator well. On indicators re-expressing a mathematical description or paragraph in their language, subject E-10 can restate statements in their language but is not yet right. While E-20 subjects have not been restating paragraphs in their language, and are still fixated on the question text.

The findings in this study describe that students with mathematical communication ability in the medium group can master three indicators of mathematical communication ability. Students can explain mathematical ideas with pictures and arrange conjectures well, and still have difficulty in expressing everyday events in mathematical models.

3.3. Mathematical communication ability of low group students

The results of the analysis mathematical communication ability test of the low group subject can be said have mathematical communication ability that is not good. This is because one subject can meet two indicators mathematical communication ability, and the else subject meets the three indicators of mathematical communication ability.

In indicator describe or represents a real object, picture, diagram in the form of ideas or mathematical symbols, the subject of the E-26 make a relevant story about the measurements along with a complete but less logical. The E-13 subject makes relevant stories and their elements, but not yet complete with the question of story. So it can be concluded that the two subjects have not been able to master this indicator well. In the indicators explaining ideas, situations and mathematical relations in writing using real objects, pictures, graphics, and algebraic expressions, subjects E-26 and 13 explain the problem situation in an outline correctly, although it is incomplete. So it can be concluded that both subjects can meet this indicator well.

In indicators stating everyday events in language or mathematical symbols or composing mathematical models of events, subjects E-26 write information that is known clearly and precisely, have not been devised appropriate strategies to find mathematical models. While the subject of the E-13 writes information known to the clearly and precisely, determine the problem-solving strategies well, but has not been converted into a mathematical model. Research by Rini *et al.* (2017) states that group students are already able to identify problems well. So it can be concluded that the two subjects have not been able to meet this indicator properly.

In the indicators constructing conjectures, compiling arguments, formulating definitions and generalizations, subjects E-26 and E-13 determine information clearly and completely, determine problem-solving strategies in a coherent and complete, and draw conclusions and conjectures correctly, but have not been compile the right reasons from the answers obtained. So it can be concluded that both subjects can master this indicator well. On the indicator re-expressing a description of the mathematical paragraphs in their language, subjects E-26 and E-13 have not been re-expressing statements in their language, both are still fixated on the language of the problem.

The findings in this study describe that students with mathematical communication abilities of the low group can master at least two indicators of mathematical communication. Students still have difficulty in stating daily events in mathematical models and stating mathematical statements in their language.

Based on the results and discussion of quantitative and qualitative data, the combined data analysis obtained the following data

Table 4. Test Results of Mathematical Communication Capabilities Based on High, Medium, and Low Groups.

Group	Many students	Many students with grades > 65	Many students with a value of < 65
High	5	5	0
Medium	24	23	1
Low	3	0	3

Based on the table above, it can be seen that the mathematical communication ability of students who get SAVI learning with elaborated feedback is good enough. This can be seen from the low group there are only three students who have not met the completeness limit, with a value of 50, 56, and 60. Although it still does not meet the completeness limit, the value in the low group is not too far from the minimum completeness limit. Whereas in the medium group there is only one student who has not met the completeness criteria, with a value of 64. In this medium group only one point adrift of the minimum completeness limit. The average test score of mathematical communication ability in the students who can SAVI learning with elaborated feedback class was 73.125. Based on the description above, it can be concluded that qualitative data supports quantitative data because it can reach a minimum completeness limit of 65

4. Conclusions

Based on the discussions that have been made by researchers, the following conclusions are obtained. (1) SAVI learning model with elaborated feedback effective towards on the achievement of students' mathematical communication ability; (2) Students with communication ability high group can meet the four mathematical communication indicators well. Students can paint pictures in the form of mathematical ideas, and state everyday events in mathematical models and still have difficulty in re-expressing mathematical statements in their language; (3) Students with mathematical communication ability in the medium group can meet three mathematical communication indicators. Students can explain mathematical ideas with pictures and arrange conjectures well, and still have difficulty in expressing everyday events in mathematical models; (4) Students with mathematical communication ability of the lower groups can meet three and two indicators of mathematical communication ability. Students still have difficulty in stating daily events in mathematical models and stating mathematical statements in their language.

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