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Mathematic Communication Ability Reviewed from Linguistic Intelligence in The Collaborative Learning by Using Think-Talk-Write (TTW) Strategy

Ninik Setiyawati[1]✉, Iwan Junaedi[2] & Sunyoto Eko Nugroho[3]

[1] MTs Al Miftah Sindangjaya, Brebes, Jawa Tengah, Indonesia
[2] Mathematics Education, Universitas Negeri Semarang, Indonesia
[3] Physical Education, Universitas Negeri Semarang, Indonesia

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Abstract

Mathematical communication ability are competencies that students must owned, but the reality shows that mathematical communication ability are still weak. One strategy that can be done to improve mathematical communication ability is a collaborative model with the TTW strategy. This study has purpose to determine the mathematical communication ability in terms of linguistic intelligence. This study applied a mixed method research with concurrent embedded design and a qualitative research as the primary method. The type of quantitative research used in this study was an experimental research with the Nonrandommized Control Group. The subjects in this study were Grade VII students of MTs Al Miftah Sindangjaya. The data analysis of Learning quality was assessed from the planning, implementation and evaluation stages. Based on data analysis, there were many variations of mathematical communication ability that found as a collaborative work of each group, such as (a) Students with high linguistic intelligence have reached all indicators of mathematical communication ability (b) Students with linguistic intelligence were able to master two indicators of mathematical communication ability well (c) Students with low linguistic intelligence were able to master one indicator of mathematical communication ability well. It can be concluded that TTW can provide good training of linguistic intelligence through collaborative learning. But, the students achievement on mathematical communication were varies tend to dependen their linguistic intelligence.

✉ Correspondence address:
K.H Hasyim Asy' ari No. 2, Sindangjaya, Kersana, Pasirpanjang, Sindangjaya, Ketanggungan, Brebes, Jawa Tengah, 52263
E-mail: niniksetiyawati0504@gmail.com

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INTRODUCTION

The basic mathematical ability that students must possess is mathematical communication skills. According to Sefiani (2016: 228) Mathematical communication skills are needed by students in conveying mathematical ideas or ideas both verbally and in writing. Junaedi (2013) explained that communication is a way of sharing ideas and clarifying understanding. The argued that through communication ideas can be reflected, improved, discussed, and developed.

Rina (2013) explained that mathematical communication is the ability of students to express mathematical ideas verbally, in writing, drawing, diagrams, using real objects, or using mathematical symbols. Minister of Education and Culture Regulation No. 58 of 2014 concerning 2013 Curriculum Middle School/ Madrasah Tsanawiyah explained that the 2013 curriculum developed the individual lives of students in religion, art, creativity, communication, values, and various dimensions of intelligence that were appropriate for a student and needed by the community, nation and mankind. Most respondents of the research conducted by Sokoine (2015) and Kulsum (2014) felt the importance of communication ability programs that were useful for improving their academic abilities.

Based on data from the Research and Development Agency (Balitbang, 2011), it is known that the results of the TIMSS survey in 2015 showed a low achievement in mathematics learning which Indonesia ranked 45 out of 50 countries. Reading and mathematics skills in The Program for International Student Assessment (PISA) in 2015 Indonesia ranked 62 and 63 out of 70 countries (OECD, 2016). This needs to be reviewed further in improving the quality of education and curriculum as well as being a reference for the academic community to improve students' mathematical and scientific achievements.

One important aspect that influences the success of learning is the form of communication used by teachers and students when interacting (Tandiling, 2011). Therefore, mathematical communication ability in the learning of mathematics is really necessary to be developed (Afrida, 2019).

From the observations made at MTs Al Miftah Sindangjaya, it is obtained that most of the students have a problem related to communicating mathematical problems such as understanding concepts and problem solving. The data shown that there were still many students who have grades below the minimum completeness standard (KKM). This indicates that mathematical conceptual understanding is still not mastered by students. One reason for the lack of students' mathematical conceptual understanding is that they are difficult to express or explain the problem solving of the mathematical problems they face.

An appropriate learning model is needed to improve students' ability to solve math problems and overcome difficulties students face. It is expected that students can be involved in the learning process implemented by the teacher. One of the learning model which suitable to the subject is collaborative learning model and the appropriate study is TTW strategy.

The collaborative learning model is a solution for students in learning difficult material by utilizing diversity in the learning environment (Anwaril, 2016). According to Anwaril (2016) the success of collaborative learning is the extent to which students question, defend and explain their ideas to other students. According to Handikawati (2016) states collaborative learning exceeds cooperative activity because it involves the collaboration of findings and results obtained rather than just new learning.

Winayati (2012) explained that TTW learning strategy starts from the involvement of students in thinking or dialogue with themselves after the process of reading the problem, then talk and share ideas with friends before writing. According to Suyanto (2016) Learning Strategies are seen to improve aspects of writing and understanding mathematical concepts.

Think Talk Write (TTW) learning strategy is a learning strategies that build precisely to think and reflect, and to organize ideas and test ideas

before students are asked to write. In addition to learning models in the process of learning mathematics there is also a thought process, since someone is said to think when that person is doing mental activities, and people who are learning mathematics must do mental activities. The ability to think of a person is influenced by the level of intelligence. Thus, the relationship between intelligence and the process of learning mathematics can be clearly visible.

According to Nur & Ferdian (2019) linguistic intelligence is defined as a skill in processing the mind well and clearly and being able to practice it when speaking, writing and reading. The purpose of developing linguistic intelligence is that children are able to communicate, both verbally and in writing well, have the ability to speak to convince others and be able to explain the language it self (Nur, 2019).

METHODS

This study applied a mixed method research with concurrent embedded design, and qualitative research as the primary method. The type of research used in this study was a quasi experimental with one group pretest posttest. The subjects in this study were MTs Al Miftah Sindangjaya students with a collaborative model with a sequential TTW strategy. The study was conducted at MTs Al Miftah Sindangjaya in grade VII using collaborative learning with TTW strategy on algebraic operating material.

The study was conducted in the second semester of the academic year of 2019/2020. The population in this study were students of grade VII MTs Al Miftah Sindangjaya. This study used one class, grade VII B as the experimental class. The sample was chosen by purposive sampling (Sugiono, 2013) based on the consideration of the researcher who also play role as the class teacher. The subjects of this study were students of the experimental class, grade VII B MTs Al Miftah Sindangjaya with 29 students.

The quality of learning was assessed from the planning, implementation, and evaluation stages. The learning is considered qualified if the results of validation, instruments of learning tools, observations, student learning outcomes with collaborative model using TTW strategy reach the minimum criteria. The determination of the quality of collaborative learning model with TTW strategy based on the achievement of learning outcomes includes the average mathematical communication ability after learning with the collaborative learning model using TTW strategy which is better than the average of mathematical communication ability of students before learning with the collaborative learning model using TTW strategy.

The mathematical communication ability were analyzed descriptively based on documents from test results and interviews with the students as respondents of this study. The validity of the data was done using a source triangulation technique, i.e. results of interview interview with students as the respondent of this study. The qualitative data analysis follows the concept of Miles and Huberman as deperiheed by Sugiono (2013) which consists of data reduction, data presentation, and drawing conclusions or verification.

RESULTS AND DISCUSSION

The linguistic intelligence questionnaire consisted of 29 respondents. The results of the student linguistic intelligence questionnaires and percentages in grade VII MTs Al Miftah Sindangjaya can be seen in detail in Table 1.

Table 1. The Data Distribution and Percentage of Students Siswa Based on Linguistic intelligence

Linguistic intelligence	N	Percentage (%)
High	7	24.14
Moderate	15	51.72
Low	7	24.14
N	29	100

The quality of learning outcomes with a collaborative model using TTW in grade VIIB MTs Al Miftah Sindangjaya. The evaluation of each validator at the planning stage can be seen in Table 2.

Table 2. The Result of Outcomes of the Assessment of leraning Instrument

Media	Average total	Category
RPP	4.2	Good
Learning material	4.12	Good
LKS	4.20	Good
TKKM	4.44	Very good
Syllabus	4.20	Good

Based on instrument validation in Table 2, the learning instruments and research instruments are included good and feasible categories for use in research, where LKS is very helpful to create the active learning process for discussion. This happenes since the teacher has implemented well and coherently following the collaborative process syntax of the TTW strategy.

The implementation of learning is considered qualified if the results of observations of the quality of learning and the implementation of learning were at least in the good category. The learning process was carried out four times. The results of the assessment of the quality of learning with collaborative learning model using the TTW strategy is presented in Table 3.

Table 3. The Result of Observation of Learning Quality

Learning quality	Average	Category
Meeting 1	3.48	Good
Meeting 2	3.65	Good
Meeting 3	3.79	Good
Meeting 4	4.21	Very Good

Based on observations of the feasibility of learning in Table 3, it was found that the average score of 3.74 was obtained. The category of the implementation of collaborative learning model using TTW strategy is good. The results of the assessment of the feasibility of collaborative learning model using the TTW strategy is presented in Table 4.

Table 4. Results of Observation of the Implementation of Learning

Implementataion	Average	Category
Meeting 1	3.41	Good
Meeting 2	3.62	Good
Meeting 3	3.82	Good
Meeting 4	4.11	Good

Based on observations of the feasibility of learning in Table 4, it was obtained an average score of 3.74. The category of the implementation of collaborative learning model using TTW strategy is considered good. Based on Table 4, it can be seen that the average quality of learning is minimal in the good category, therefore, it can be concluded that the ability of researcher to prepare and manage learning was in the good category.

The third stage is the evaluation stage, at the evaluation stage of learning assessment was done by giving a questionnaire student responses to the learning model of collaborative using TTW strategy that have been done. Based on the questionnaires of students response completed by 29 students after obtaining collaborative learning model using the TTW strategy, students who responded positively to the learning reached more than or equal to 70%. This indicated that the majority of scores of students in the learning that has been implemented were in good category.

Then, the analysis of tests of mathematical communication ability was conducted. In the normality test, obtained a significance value of 0.200 = 20%> 5%, therefore, it can be concluded that the final data was derived from populations that are normally distributed. Based on the average of completeness test, the calculation results obtained with α = 5%, dk = 29-1 = 28, obtained t_{table} = 1.701 t_{count} = 5.223. Therefore $t_{\_count} > t_{\_table}$, therefore, it can be concluded that the average score of mathematical communication ability of students in the experimental class is more than 70.

Students who achieve the classical completeness of more than 70% obtained z_{table} = 1.960, meanwhile, from calculations obtained z_{count} = 2.224. Since $z_{count} > z_{table,}$ therefore, H_0 is rejected, then, it can be interpreted that the proportion of students in the collaborative learning model usingthe TTW strategy has achieved the mastery that has exceeded 70%.

In the paired sample test, the results of the analysis obtained the value of t = 28.677 and t (0.95) (28) = 1.701, therefore, H_0 is rejected. By this result, it can be interpreted that the average of mathematical communication ability of

students after given the collaborative learning model using the TTW strategy is more than the average of mathematical communication ability of students before being given a collaborative learning model using the TTW strategy.

The Gain calculation was used to determine an increase in the mathematical communication ability given the collaborative learning model using TTW strategy. Based on the results of the calculation of the gain test, it was found that classically there is an increase in the students' mathematical communication ability. The results of classical gain calculation for students' mathematical communication abilities are listed in Table 5.

Table 5. Results of the Calculation of N-Gain Test of the Students Mathematical Communication Ability

Pre-test	Post-test	⟨g⟩	N-gain
29	81.89	0.77	High

Based on the calculations in Table 5 obtained ⟨g⟩ = 0.77. Thus, it can be interpreted that the value ⟨g⟩ lies in the range $0.7 < (g) \leq 1$, therefore, the optimized gain is in the high category. The conclusion obtained by students' mathematical communication ability in the collaborative learning model using the TTW strategy increased with a high category.

Based on the data of mathematical communication ability and interview results, it showed a different mathematical communication ability. Each subject has different mathematical communication ability. The following is the summary of the results of mathematical communication ability based on students' linguistic intelligence.

The Mathematical Communication Ability of Students Reviewed from the Linguistic Intelligence

Based on the results of the linguistic intelligence questionnaire completed by the respondents, there were 7 students with high linguistic intelligence, 7 students with moderate linguistic intelligence, and 7 students with low linguistic intelligence. The analysis of the results of mathematical communication ability based on indicators can be seen in Figure 1.

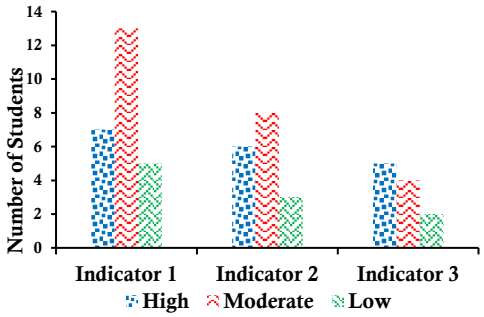

Figure 1. The Mathematical Communication Ability Based on *Linguistic Intelligence*

Figure 1 shows that students with high linguistic intelligence (LI) have mathematical communication ability that were in similar condition. Following are examples of the results of the answers of students with high linguistic intelligence can be seen in Figure 2.

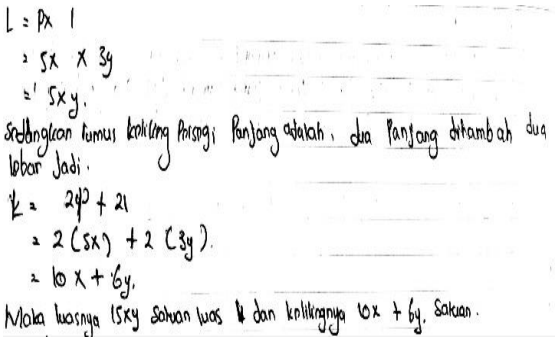

Figure 2. High LI Work Result

Figure 2 shows students with high LI in the indicator of presenting problems in the form of objects, students with high linguistic intelligence were able to present mathematical problems in the form of images correctly and completely.

In the indicator of compiling arguments and solving mathematical problems, students with high linguistic intelligence were able to arrange arguments and solve the mathematical problems correctly and completely. In the indicator of expressing the mathematical concepts from everyday problems to the form of mathematical models, students with high linguistic intelligence were able to express the

mathematical concepts from everyday problems to form the mathematical models correctly.

Students with moderate linguistic intelligence were showing a variation of mathematical communication ability. The following is an example of the results of students' answers with moderate linguistic intelligence that can be seen in Figure 3.

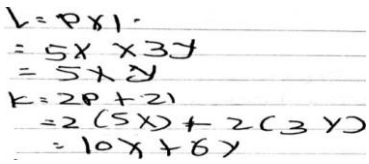

Figure 3. Moderate LI Work Result

Figure 3 shows students with being LI in the indicator of presenting problems in the form of objects, students with moderate linguistic intelligence were able to present the mathematical problems in the form of images correctly and completely.

In the indicator of compiling arguments and solving the mathematical problems, students with moderate linguistic intelligence were able to construct arguments and solve the mathematical problems correctly, however, they were still incomplete. In the indicator of expressing the mathematical concepts from everyday problems to the form of mathematical models, students with moderate linguistic intelligence were able to express the mathematical concepts from everyday problems to form the mathematical models correctly, however, they were still incomplete.

Students with low linguistic intelligence have varied communication ability. The following are examples of student answers with low linguistic intelligence can be seen in Figure 4.

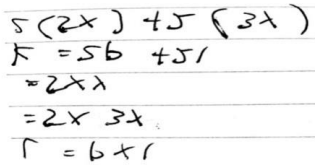

Figure 4. Low LI Work Result

Figure 3 shows students with low LI in the indicator of presenting problems in the form of objects, students with low linguistic intelligence were able to present the mathematical problems in the form of images correctly.

In the indicator of compiling arguments and solving the mathematical problems, students with low linguistic intelligence were able to construct arguments and solve the mathematical problems, however, they were still incomplete. In the indicator of expressing the mathematical concepts from everyday problems to the form of the mathematical models, students have not been able to express the mathematical concepts from everyday problems to form the mathematical models.

Based on the results of student work it can be concluded that each student in linguistic intelligence has different mathematical communication skills.

CONCLUSION

Based on the analysis and discussion, there are some conclusion can be drawn suc as (1) Students with high linguistic intelligence have reached all indicators of the mathematical communication ability (2) Students with moderate linguistic intelligence were able to master two indicators of the mathematical communication ability well (3) Students with low linguistic intelligence were able to master one indicator of the mathematical communication ability well.

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