

THE EFFECT OF THE THINKING ALOUD PAIR PROBLEM SOLVING (TAPPS) METHOD OF ABILITY MATHEMATICAL COMMUNICATION

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INFO ARTIKEL

Sejarah Artikel: (Diisi Editor)
 Diterima: 05 Desember 2025
 Direvisi: 25 Desember 2025
 Disetujui: 30 Desember 2025
 Tersedia Daring: 30 Januari 2026

Kata Kunci:

Metode, Pemecahan Masalah Berpasangan dengan Berpikir Keras (Tapps), Keterampilan Komunikasi Matematika

ABSTRAK

Kurikulum adalah rencana yang mencakup tujuan, materi pelajaran, dan bahan pembelajaran yang digunakan sebagai pedoman untuk mengatur kegiatan pembelajaran guna mencapai tujuan tertentu. Penelitian ini bertujuan untuk mengetahui pengaruh Metode Thinking Aloud Pair Problem Solving (TAPPS) terhadap kemampuan komunikasi matematika siswa di Sekolah Menengah Kejuruan Swasta HKBP Pematangsiantar. Jenis penelitian yang digunakan peneliti adalah penelitian eksperimental. Penelitian eksperimental adalah penelitian untuk mengetahui apakah ada pengaruh sesuatu yang diberikan pada subjek penelitian. Penelitian ini akan dilakukan dengan menggunakan desain studi kasus tunggal (one-shot case study), di mana satu kelompok kelas eksperimen menjadi subjek penelitian. Pada kelompok eksperimen, diterapkan perlakuan berupa penerapan Metode Pembelajaran Thinking Aloud Pair Problem Solving (TAPPS) yang dianggap berhasil. Setelah perlakuan, dilakukan evaluasi post-test dan dari hasil pengukuran tersebut, akan ditarik kesimpulan. Berdasarkan hasil analisis dan diskusi data, dapat disimpulkan bahwa terdapat pengaruh signifikan Metode Thinking Aloud Pair Problem Solving (TAPPS) terhadap kemampuan komunikasi matematika siswa pada materi Statistika di Sekolah Menengah Kejuruan Swasta HKBP Pematangsiantar. This influence can be seen from the regression equation = $-56.532 + 1.088$ with a regression coefficient of 1.088 and a determination coefficient of 91% which shows that there is a very strong relationship between the Thinking Aloud Pair Problem Solving (TAPPS) Method and students' mathematical communication skills.

ABSTRACT

Keywords:

Method, Thinking Aloud Pair Problem Solving (Tapps), Mathematical Communication Skills

The curriculum is a plan of objectives, content, and learning materials used as a guideline for organizing learning activities to achieve certain goals. This study aims to determine the Effect of Thinking Aloud Pair Problem Solving (Tapps) Method on Mathematical Communication Skills of Students of HKBP Private Vocational School Pematangsiantar. The type of research used by the researcher is experimental research. Experimental research is a research to determine whether there is an effect of something imposed on the subject of investigation. This research will be conducted using a single case study design (one-shot case study), where one group of experimental classes becomes the research subject. In the experimental group, a treatment is applied in the form of the application of the Thinking Aloud Pair Problem Solving (TAPPS) Learning Method which is considered successful. After the treatment, a post-test evaluation is carried out and from the results of the measurement, conclusions will be drawn. Based on the results of data analysis and discussion, it can be concluded that there is a significant influence of the Thinking Aloud Pair Problem Solving

(TAPPS) Method on students' mathematical communication skills in Statistics material at HKBP Private Vocational School Pematangsiantar. This influence can be seen from the regression equation = $-56.532 + 1.088$ with a regression coefficient of 1.088 and a determination coefficient of 91% which shows that there is a very strong relationship between the Thinking Aloud Pair Problem Solving (TAPPS) Method and students' mathematical communication skills

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1. Introduction

In facing the challenges of an ever-evolving era, the role of education is increasingly vital in creating a generation ready to contribute positively. Education is a key pillar in developing quality human resources. In the context of globalization and rapid technological development, critical thinking, creativity, and communication skills are crucial for students to master. Without education, change and progress cannot occur. Students are a generation we need to support and care for in every step of their journey toward maturity, so that we can develop individuals with good morals and critical thinking (Artika & Karso, 2019).

Education, as stipulated in Law No. 20 of 2003 concerning the National Education System, is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to choose spiritual religious strength, self-control, personality, intelligence, noble morals, and skills for themselves, society, and the nation. Education for human life is an absolute necessity for every individual that must be fulfilled. Basically, humans are social beings who always interact with other humans in their surroundings. Likewise, in the school environment, teaching and learning activities in the classroom are inseparable from communication, both communication between students and teachers and communication between students (Aulia et al., 2022).

The curriculum is a plan of objectives, content, and learning materials used as a guideline for organizing learning activities to achieve certain goals. Mathematics is taught at all levels of education in Indonesia, starting from elementary school, junior high school, high school, and even college. This is due to the fact that mathematics is the most basic discipline and has become the foundation for all other disciplines. According to R. Soedjadi (Fatimah et al., 2023) Four reasons why mathematics is very important to learn are as follows: (1) logical and clear thinking, (2) helping solve everyday problems, (3) learning about relationship patterns and summaries of experiences, and (4) becoming more aware of cultural progress. Therefore, in order for communication skills to be delivered well, mathematics learning must fulfill the learning components. According to Sutikno (Suharno et al., 2019) learning components include learning objectives, learning materials, learning activities, methods, media, learning resources, and evaluation.

According to NCTM (Salehha et al., 2022) there are five basic mathematical skills that are process standards, one of the important skills to pay attention to is mathematical communication skills. The National Council of Teachers of Mathematics (NCTM) sets five objectives for learning mathematics: (1) learning to communicate, (2) learning to reason, (3) learning to solve problems, (4) learning to connect ideas, and (5) creating a positive attitude. Minister of National Education Regulation Number 22 of 2006 stipulates that mathematical communication skills are one of the objectives of mathematics learning in schools. In mathematical communication, problem-solving ideas, strategies, and mathematical solutions are communicated both in writing and orally. The indicators in students' mathematical communication skills include: (1) formulating a definition of mathematical terms, (2) presenting contextual problems in the form of pictures, graphs, tables or algebra, (3) providing ideas/concepts from a problem, (4) changing everyday sentences into mathematical sentences (Setianingrum & Novitasari, 2015).

The Ministry of Education and Culture Regulation and the National Curriculum for the Indonesian National Mathematics and Natural Sciences (NCTM) have determined that mathematical communication skills are one of the mathematics learning skills that students must possess. Students can use mathematical communication skills to communicate mathematical ideas or concepts in the form of symbols, tables, graphs, or diagrams, and vice versa, so that they can clarify situations or problems and solve them. Therefore, during the learning process, students must be accustomed to giving their opinions on every question asked, as well as responding to answers given by other students both orally and in writing, so that the material being studied becomes relevant to them. Meanwhile, teachers must use mathematical communication to explain the material to their students. In an effort to assess and compare students' mathematical abilities globally, various international institutions conduct comprehensive studies to measure the quality of education in a country. One of the most influential studies is the Program for International Student Assessment (PISA).

However, in reality, mathematical communication skills in the field are still relatively low, as evidenced by the results of the 2022 PISA (Program for International Student Assessment). PISA (Program for International Student Assessment) is an international assessment of student abilities by the OECD (Organization for Economic Co-Operation and Development). One of the PISA assessments is mathematical communication. According to the latest PISA study results in 2022, Indonesia ranked 70th out of 81 countries with an average mathematical communication score of 366 (Nufus et al., 2021). These results indicate that Indonesian students' abilities in solving PISA mathematics problems, which include analysis, reasoning, communicating, solving, and interpreting problems, are still very weak, thus Indonesia's mathematical communication achievement is still relatively low (Ningrum et al., 2019),

Communication skills are classified as low, this is based on initial observations conducted on April 25, 2025 at HKBP Pematangsiantar Private Vocational School, researchers also conducted interviews with one of the mathematics teachers at HKBP Pematangsiantar Private Vocational School named Mrs. Lisbet Dewi Gontina Manalu that mathematical communication skills at the school are still very lacking, many students

cannot express daily events into mathematical symbol language, solve problems in the form of graphs, images. In addition to teacher interviews at the school, researchers also conducted observations by giving communication indicator mathematics questions to 30 students in grade XI. Researchers found that there were communication problems after being given a communication ability test with statistical material at HKBP Pematangsiantar Private Vocational School.

Students' low mathematical communication skills are caused by several factors, both internal and external. External factors refer to learning styles, models, and learning strategies. According to Darkasyi (Azwardi & Sugiarni, 2019) one of the causes of students' low mathematical communication skills is that many students are only fixated on formulas and example problems given by teachers, so students cannot analyze if given different problems. According to (Hadin et al., 2018) one factor in students' mathematical communication skills is because the implementation of learning that occurs in the classroom is still conventional and tends to be teacher-centered. According to Ariawan and Nufus (2017), one of the causes of students' low mathematical communication skills is because students are less able to communicate mathematical ideas in mathematics learning. On the other hand, internal factors refer to elements that emerge from within students such as attitudes, self-confidence, perseverance, and curiosity about mathematics (Utami & Wutsqa, 2017).

To improve communication, the appropriate method was used, namely the Thinking Aloud Pair Problem Solving (TAPPS) method. The Thinking Aloud Pair Problem Solving (TAPPS) method is an excellent alternative learning method to improve students' mathematical communication skills in this study. According to Whimbey Wimbey in Sharan's book (Jonsson et al., 2020) the TAPPS method, or what is called pair thinking aloud, focuses on problem solving and thinking methods. This method asks students to think aloud and discuss how they solve problems.

According to Suyitno in Haryanto, the Thinking Aloud Pair Problem Solving (TAPPS) learning method is a learning method where students are divided into several groups, and in each group each student works together and helps each other in solving the problems given by the teacher to each group. This method is intended to improve students' ability to solve a problem and then reveal the best solution to the existing problem to their colleagues. The idea behind the Thinking Aloud Pair Problem Solving (TAPPS) method is that conveying directly orally the solution to a problem-solving process helps improve students' ability to communicate mathematically (Ceteri et al., 2019).

In learning, students' perceptions of learning are crucial to the learning process. Student perceptions of learning are their perspectives or understanding of the material or information they receive during learning activities. They also reflect how students understand and respond to the material transferred through the learning process, particularly in learning using the Thinking Aloud Pair Problem Solving (TAPPS) method. A good and correct perception or understanding of the material will enable students to complete the lesson and achieve competencies and learning objectives.

The TAPPS method has been applied by Heti Nurhayati in her research on junior high school students in Bandung in 2012 which showed an increase in mathematical

communication skills using the TAPPS method. This increase can be seen in the data from the analysis of the quality of improvement which shows that the average gain index of the experimental class (which uses the TAPPS method) is 0.42, which means that the increase in the mathematical communication skills of experimental class students is included in the medium criteria. While the average gain index of the control class (which uses the discussion method) is 0.29, which means that the increase in the mathematical communication skills of control class students is included in the low criteria (Yuhani et al., 2018).

The TAPPS method has been applied by researchers to improve students' mathematical communication skills. Based on the parametric test, a significant value of $0.000 < \text{significance level } \alpha = 0.05$ means rejecting H_0 so that it can be concluded that there is an influence of the TAPPS learning model on students' mathematical communication skills in statistics material for class VIII of SMP Negeri 2 Dewantara.

Based on the explanation above, the TAPPS method has advantages in improving students' mathematical communication skills. This is due to the fact that each student in the group works together to solve complex problems by alternating roles. This will also improve students' conceptual understanding and actively and responsibly during the learning process. In addition, TAPPS helps students reduce their impulsive actions and encourages them to actively seek information according to their abilities rather than just passively receiving it. In the TAPPS method, the teacher instructs students to form pairs and then explains the roles played by the problem solver and the listener. The problem solver is responsible for reading the problem orally and describing the reasoning process used to solve the problem, while the listener is responsible for encouraging the problem solver to think orally and describe the steps to solve the problem. The listener can also ask questions to provide clarification and offer suggestions, but swap roles on the next problem. Students can test their abilities by reflecting real objects, pictures, and diagrams into mathematical concepts and providing answers using their own words (Miller & Maellaro, 2016).

Therefore, the researcher wants to conduct a study entitled "The Effect of the Thinking Aloud Pair Problem Solving (TAPPS) Method on the Mathematical Communication Skills of Class XI Students of HKBP Pematangsiantar Private Vocational School".

2. Method

The type of research used by the researcher is experimental research. Experimental research is a study to determine whether there is an effect from something imposed on the subject of investigation. In other words, experimental research attempts to examine the existence or absence of a causal relationship. In this study, the author used a quantitative approach. A quantitative approach is an approach that produces data in the form of numbers from test results. This study uses a Quasi-Experimental type (Pseudo-Experiment). The researcher used this method because the sample used was a regular class without changing the existing structure (Nurkhasanah et al., 2022).

This research will be conducted using a single case study design (one-shot case study), where one group of experimental class becomes the research subject. In the

experimental group, the treatment is applied in the form of the application of the Thinking Aloud Pair Problem Solving (TAPPS) Learning Method which is considered successful. After the treatment, a post-test evaluation is carried out and conclusions will be drawn from the results of the measurement. The research was conducted at SMK Swasta HKBP Pematangsiantar Jl, Jend A.Yani No.153 Pematangsiantar, Asuhan, Kec. Siantar Timur North Sumatra in class XI with the research period of the odd semester of the 2025-2026 academic year.

A population is the total number of subjects a researcher will study (Priadana, 2021). A population is a generalized area consisting of objects/subjects with certain quantities and characteristics determined by the researcher to be studied and then conclusions drawn (Miller & Maellaro, 2016). The population in this study was all 11th-grade students at HKBP Pematangsiantar Private Vocational School (Shella et al., 2018). The population can be seen in the following table:

A sample is a portion of the population's number and characteristics (Proctor, 2020). The sampling technique used in this study was Cluster Random Sampling. This Cluster Random Sampling technique randomly selects one class from the population as the experimental class. The sample in this study was one class, namely class XI TSM 1, which was given the Thinking Aloud Pair Problem Solving (TAPPS) learning method (García et al., 2019).

A research variable is an attribute, characteristic, or value of a person, object, or activity that has certain variations determined by the researcher to be studied and then conclusions drawn (Asmar & Delyana, 2022). In this study, the variables used are the independent variable (X) and the dependent variable (Y).

3. Result and Discussion

This research is a Pre-experimental research with a " *One-Shot Case Study* " design in which the research only has one class that is given *treatment*, namely learning with the *Thinking Aloud Pair Problem Solving* (TAPPS) learning method (Maharani et al., 2021). This research was conducted for approximately 1 month in the 2025/2026 academic year, at HKBP Pematangsiantar Private Vocational School (Sebayang et al., 2022). The instrument trial in this study was class XI TSM 2 which consisted of 30 students and the sample in this study was class XI TSM 1 students with a total of 30 students. Researchers applied the *Thinking Aloud Pair Problem Solving* (TAPPS) learning method to see whether there was an influence of the *Thinking Aloud Pair Problem Solving* (TAPPS) learning method on students' mathematical communication abilities (Liandes, 2021).

Table 1. Research Allocation

| No | Activity | Execution time |
|----|---|-------------------------------------|
| 1. | Observation | April 25, 2025 |
| 2. | Preparation of thesis proposal | April 28, 2025 – August 9, 2025 |
| 3. | Thesis proposal seminar | August 11, 2025 |
| 4. | Trial of questionnaire and test instruments | October 1, 2025 – October 3, 2025 |
| 5. | Mathematical communication skills Study | October 8, 2025 – October 23, 2025 |
| 6 | Research data processing | October 23, 2025 – October 26, 2025 |

The instruments used for data collection in this study were questionnaires and mathematical communication ability tests. The questionnaire instrument consisted of 20 statements for variable X and the mathematical communication ability test instrument consisted of 5 descriptive questions for variable Y. Before conducting the research, the instruments to be used were first validated by validators, namely Dr. Rick Hunter Simanungkalit, M.Pd as a mathematics lecturer at HKBP Nommensen University, Pematangsiantar and Mrs. Lestari Fani Losanna Situmorang, S.Pd as a mathematics teacher at HKBP Private Vocational School, Pematangsiantar.

Research Description

The purpose of this research was to determine whether there is an influence of the *Thinking Aloud Pair Problem Solving (TAPPS) Method* on Students' Mathematical Communication Skills in Statistics Material in Class XI of HKBP Pematangsiantar Private Vocational School in the 2025/2026 Academic Year. The data in this study are students' mathematical communication skills tests.

The Mathematics material taught in this study is Statistics for Class XI TSM 1 as a sample for treatment using the *Thinking Aloud Pair Problem Solving (TAPPS) Method* on Statistics material. After being given the treatment and the *Thinking Aloud Pair Problem Solving (TAPPS) Method*, a questionnaire was then given to implement the strategy that would be filled in by the students. In this study, researchers obtained data from the results of the mathematical communication ability test and the results of the questionnaire conducted in class XI TSM 1 (Pane, 2018). The mathematical communication ability test given was in the form of questions after implementing the *Thinking Aloud Pair Problem Solving (TAPPS) Method* while the questionnaire was given to see whether the students implemented the *Thinking Aloud Pair Problem Solving (TAPPS) Method* well. The results of the mathematical communication ability test and the results of the questionnaire were used to determine whether the *Thinking Aloud Pair Problem Solving (TAPPS) Method* had an effect on mathematical communication ability in Statistics material. The instruments used in this study were a mathematical communication ability test consisting of 5 descriptive questions, and a strategy implementation questionnaire for students

consisting of 20 statement items (Abdillah et al., 2022). The researcher conducted a trial of the mathematical communication ability test and the questionnaire for the implementation of the *Thinking Aloud Pair Problem Solving (TAPPS)* Method which would be used for data collection and sampling. After the trial was carried out, the test score data and the questionnaire score for the implementation of the *Thinking Aloud Pair Problem Solving (TAPPS) Method* were then taken. An overview of the questionnaire instrument and the mathematical communication ability test will be presented in the following table (Ariesta & Awalludin, 2021).

Table 1. Statistical Description Table

| Descriptive Statistics | | | | | |
|------------------------|----|---------|---------|-------|--------------------|
| | | Minimum | Maximum | Mean | Standard Deviation |
| QUESTIONNAIRE | 30 | 51 | 77 | 69.17 | 5,337 |
| TEST | 30 | 6 | 34 | 22.23 | 5,649 |
| Valid N (listwise) | 30 | | | | |

From the table above, it can be concluded that the descriptive statistics on the questionnaire with a sample of 30 students, has a maximum value of 77 and a minimum value of 51, an average value (mean) of 69.17 and a standard deviation value of 5.337. Meanwhile, in the mathematical communication ability test with a sample of 30 students, it has a maximum value of 34 and a minimum value of 6, an average value (mean) of 22.3 and a standard deviation value of 5.649 (Angela & Subektir, 2022).

Data Analysis Technique Test

Normality Test

The normality test is a prerequisite test that aims to determine whether data is normally distributed. The normality test is performed using the *Kolmogorov-Smirnov formula*. The decision-making criteria are as follows:

1. If the significance value (Sig) > 0.05, then the research data is distributed normally.
2. If the significance value (Sig) < 0.05, then the research data is not distributed normally.

Based on the normality test that has been carried out using the *SPSS 26.0* and *Excel programs*, the results are obtained in table 4.11. Based on calculations with *SPSS* and *Excel* in table 4.11, it can be seen that the significance value of the student perception questionnaire on the *Thinking Aloud Pair Problem Solving (TAPPS) Method* is $0.189 > 0.05$, so the data is normally distributed and for the test of students' mathematical concept understanding ability is $0.200 > 0.05$, so the test data is normally distributed (Anggo & Samparadja, 2022).

Linearity Test

To determine whether or not there is a relationship between the independent variable (X) and the dependent variable (Y), a linearity test is used. The following

considerations serve as guidelines for decision-making in the linearity test (Naryaningsih et al., 2022).

- a. If (sig.) < 0.05 then there is no linear relationship between the independent variable (X) and the dependent variable (Y)
- b. If (sig.) > 0.05 then there is a linear relationship between the independent variable (X) and the dependent variable (Y)

Based on the table, the significance result (sig.) of *the Deviation from Linearity* row is $0.707 > 0.05$, so there is a linear relationship between the independent variable (X) and the dependent variable (Y). So it can be concluded that there is a linear relationship between the *Thinking Aloud Pair Problem Solving (TAPPS)* Method and students' mathematical concept understanding ability.

Hypothesis Test Analysis

Simple Linear Regression Test Results

The strength of the relationship between the independent variable (X) and the dependent variable (Y) and the direction of the relationship between the independent variable (X) and the dependent variable (Y) is measured using a simple linear regression test (Nashihah, 2020).

Based on the simple linear regression test that was carried out using the *SPSS 26.0* and *Excel programs*, the results were obtained in table (Annisa & Siswanto, 2021).

Table 2. Simple Linear Regression Test Using SPSS

| S | Coefficients ^a | | | | |
|---|-----------------------------|---------------------|--------------|-----------------|------|
| | Unstandardized | | Standardized | | |
| P | oefficients | | oefficients | | |
| S | B | Std. Error | Beta | T | Sig. |
| S | -56,532 | 4,566 | | -12,382 | .000 |
| S | 1,089 | .065 | .954 | 16,836 | .000 |
| S | a. Dependent Variable: TEST | | | | |
| E | | | | | |
| X | | | | | |
| C | | | | <i>Standard</i> | |
| E | | <i>Coefficients</i> | <i>Error</i> | <i>t Stat</i> | |
| L | Intercept | -56.53202847 | 4.565550736 | -12,3823 | |
| | X Variable 1 | 1.088523132 | 0.064656357 | 16.83552 | |

Based on calculations using *SPSS 26.0* and *Excel* as shown in table 4.12, the values $a = -56.532$ and $b = 1.088$ were obtained, so the regression equation was obtained as follows:

$$\hat{Y} = -56,532 + 1,088X$$

Information

\hat{Y} : students' mathematical communication skills

X: Student questionnaire scores on the *Thinking Aloud Pair Problem Solving (TAPPS)* Method

From the regression equation above, the following information can be obtained:

- a. The value α of -56.532 shows that when students do not provide a perception of the *Thinking Aloud Pair Problem Solving (TAPPS)* Method ($X=0$), then the Y value is -56.532.
- b. The value, b namely the regression coefficient of 1.088, shows that the score on the questionnaire will cause an increase in the ability to understand mathematical concepts by 1.088.
- c. positive value indicates that there is a positive influence between the independent variable (X) and the dependent variable (Y).

From the explanation above, it can be concluded that the *Thinking Aloud Pair Problem Solving (TAPPS)* method has a positive influence on mathematical communication skills.

Regression Significance Test (T Test)

The t-test was conducted to test the research hypothesis regarding the influence of each independent variable partially on the dependent variable. Based on table 4.13, it was obtained that the calculated t value was 16,836. From the t distribution table with $df = 30 - 2 = 28$ and $\alpha = 0,05$ it was obtained that the t table = 2.048. Because the calculated t value $> t$ table = $16,836 > 2.048$, it can be concluded that H_a is accepted which states that there is a positive and significant influence of the *Thinking Aloud Pair Problem Solving (TAPPS)* Method on students' mathematical communication skills.

Coefficient of Determination

The coefficient of determination indicates how strong the influence of the independent variable (X) on the dependent variable (Y). Based on the calculation of the coefficient of determination that has been The percentage of the coefficient of determination shows that the contribution of the variance of the variable X (*Thinking Aloud Pair Problem Solving (TAPPS)* Method) to the variable Y (towards students' mathematical communication abilities) is 91%. Based on the results of the calculation of the coefficient of determination, it shows that the *Thinking Aloud Pair Problem Solving (TAPPS)* Method on students' mathematical concept understanding abilities has an influence of 91%.

Discussion

This research was conducted at HKBP Pematangsiantar Private Vocational School, where this research took class XI TSM 2 as the research population and took class XI TSM 2 as the research sample and the class where the researcher provided treatment.

Before conducting this research, the researcher first conducted a trial of the instrument to determine whether the test and questionnaire instruments met research standards. In this study, the instrument trial was conducted in class XI TSM 2. After the data was obtained, the test instrument was tested for validity, reliability, difficulty level, and discriminatory power, while the questionnaire instrument was tested for validity and reliability.

Based on the trial data of the students' mathematical conceptual understanding ability test and the students' perception questionnaire in the trial class with a sample size N of 30 and a significance level α of 0.05, the value obtained r *tabel* was 0.361. From the calculation of the validity of the 5 test items and the 20 questionnaire items, it was obtained that r *hitung* $> r$ *tabel* both the test instrument and the questionnaire instrument were valid and suitable for use in research (Rufaidah, 2019).

Then, from the results of the test item reliability test, the Cronbach 's Alpha value was obtained as **0.619** and the results of the questionnaire item reliability test obtained a Cronbach 's Alpha value of 0.619.

Alpha is 0.804. Research data is said to be reliable if the Chronbach's Alpha value is > 0.60, so it can be concluded that the test questions and questionnaire items obtained are in the moderate category, and 1 test question is in the easy category. Finally, based on the results of the discrimination power test, it was found that the five test questions have sufficient discrimination power (Indriani & Imanuel, 2018).

After determining that the research instrument met research standards, the researcher then conducted the research. The research implementation process was as follows: First, the researcher administered treatment to the experimental class using the *Thinking Aloud Pair Problem Solving (TAPPS)* method . After the treatment was implemented, the researcher administered the test instrument. mathematical communication skills and student perception questionnaires on whether students can follow learning well using the *Thinking Aloud Pair Problem Solving (TAPPS)* method .

After obtaining data from the research, the researcher then analyzed the research data. Before testing the hypothesis, the prerequisite tests were first carried out, namely the normality test and the linearity test. This normality test was carried out using the *SPSS 26.0* and *Excel programs* . The basis for making decisions in the normality test is that the data is declared normally distributed if the significance value (Sig) is > 0.05. Based on the calculation results, the significance value of the student's mathematical communication ability test is 0.200 and the significance of the student perception questionnaire is 0.189 because the significance value is > 0.05, so the research data is normally distributed.

After conducting the normality test, the researcher then conducted a linearity test. The linearity test was also conducted using *SPSS 26.0* and *Excel* . The basis for decision making in the linearity test is that the independent variable (X) is said to have a linear relationship with the dependent variable (Y) if the significance value in *Deviation From Linearity* > 0.05. Based on the calculation results, the significance value is 0.738 because the significance value is > 0.05, so there is a linear relationship between the independent variable (X) and the dependent variable (Y) (Rohmah & Rinaldi, 2019).

After conducting the prerequisite tests, the researchers then continued their research by conducting hypothesis tests consisting of simple linear regression analysis, t-tests, and coefficients of determination. Based on calculations in the simple linear regression analysis, the regression equation obtained was:

$$Y^{\wedge} = -56,532 + 1,088$$

Because the regression coefficient value (b) is positive, this indicates that there is a positive influence of the *Thinking Aloud Pair Problem Solving (TAPPS)* Method on students' mathematical communication abilities.

For the t-test, based on the calculation results using the program *SPSS 26.0* and *Excel* obtained a value *t hitung* of 16.836. The value *t tabel* = 2.048. Because *t hitung* > *t tabel*, it is concluded that the independent variable (X) has a significant effect on the dependent variable (Y). Based on the calculation of the coefficient of determination, the value is obtained $r^2 = 0.910$, this shows that the

variable X (*Thinking Aloud Pair Problem Solving (TAPPS)* method) has a 91% effect on the variable Y (students' mathematical communication skills) (Yanti et al., 2019).

Based on the description above, it can be concluded that there is an influence of the *Thinking Aloud Pair Problem Solving (TAPPS) Method* on students' mathematical communication skills. Therefore, the hypothesis stating that there is a positive and significant influence of *the Thinking Aloud Pair Problem Solving (TAPPS) Method* on students' mathematical communication skills in Statistics material at HKBP Pematangsiantar Private Vocational School is accepted as true.

4. Conclusion

Based on the results of data analysis and discussion, it can be concluded that there is a significant influence of the Thinking Aloud Pair Problem Solving (TAPPS) Method on students' mathematical communication skills in Statistics material at HKBP Pematangsiantar Private Vocational School. This influence can be seen from the regression equation = $-56.532 + 1.088$ with a regression coefficient of 1.088 and a large determination coefficient of 91% which indicates that there is a very strong relationship between the Thinking Aloud Pair Problem Solving (TAPPS) Method and students' mathematical communication skills.

Suggestion

Based on the results of this study, the researcher would like to provide the following suggestions:

1. For mathematics subject teachers at HKBP Pematangsiantar Private Vocational School, they can try using the Thinking Aloud Pair Problem Solving (TAPPS) Method so that the learning model used is more varied and can increase activity and improve the quality of education.
2. The Thinking Aloud Pair Problem Solving (TAPPS) method has a positive influence on students' mathematical communication skills in statistics material so that other researchers can try using the Thinking Aloud Pair Problem Solving (TAPPS) method for other mathematical materials.
3. By implementing the Thinking Aloud Pair Problem Solving (TAPPS) method, it is hoped that students will become more active in learning and can interact better with their classmates so that they can more easily understand the material in mathematics learning

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