

## THE EFFECT OF MOTIVATION TOWARDS MATHEMATICAL COMMUNICATION IN MATHEMATICS LEARNING WITH BRAIN-BASED LEARNING MODEL

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### Abstract

This research is motivated by the importance of students' learning motivation and the low of high school students' mathematical communication skills in learning mathematics. The purpose of this study was to determine the effect of learning motivation on the high school students' mathematical communication skills in learning mathematics with the Brain-Based Learning model. This research is mixed-method research with concurrent triangulation strategies. The population in this study were all class XI in SMA 1 Rengasdengklok on Kabupaten Karawang and the sample was one class. Data was collected by providing tests, observations, questionnaires, and interviews. The test used is a description test, while the motivation scale uses a Likert Scale. The data was analyzed by normality test and simple linear regression. The results of this study indicate that there is an influence of learning motivation on mathematical communication skills in the application of the Brain-Based Learning model with a percentage of 56.8%.

**Keywords:** Brain-based leaning; mathematical communication; motivation.

### Abstrak

Penelitian ini dilatarbelakangi pentingnya motivasi belajar siswa dan masih rendahnya kemampuan komunikasi matematis siswa SMA dalam pembelajaran matematika. Tujuan dari penelitian ini untuk mengetahui pengaruh motivasi belajar terhadap kemampuan komunikasi matematis siswa SMA dalam pembelajaran matematika dengan model Brain Based Learning. Penelitian ini merupakan penelitian mixed-method dengan strategi triangulasi konkuren. Populasi dalam penelitian ini adalah seluruh kelas XI di SMAN 1 Rengasdengklok Kabupaten Karawang dan sampel yang diambil sebanyak satu kelas. Pengumpulan data dengan pemberian tes, observasi, angket, dan wawancara. Tes yang digunakan adalah tes uraian, sedangkan skala motivasi menggunakan Skala Likert. Analisis data yang digunakan adalah: uji normalitas dan regresi linear sederhana. Hasil penelitian ini menunjukkan bahwa terdapat pengaruh motivasi belajar terhadap kemampuan komunikasi matematis dalam penerapan model pembelajaran Brain Based Learning dengan persentase sebesar 56,8%.

**Keywords:** Brain-based leaning; motivasi; komunikasi matematis.



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### INTRODUCTION

Mathematics is one of the main subjects in school. The learning objectives of mathematics formulated by the National Council of Teachers of Mathematics (2000) are to develop students' ability to solve mathematical

problems, mathematical reasoning, and mathematical communication. Based on these objectives, mathematical communication skills is one of the abilities that students must have in learning mathematics. This ability is important for students so that students

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can communicate, tell, explain an idea they have to other students. With the communication process in learning, students can exchange ideas with other students or with their teacher, and an active learning process will be created. According to Asnawati (2017), students need to be accustomed to learn to provide arguments for each answer and provide responses to answers given by others, so that what is being studied becomes more meaningful to them.

Communication skills must be possessed by students in learning mathematics to interact with their environment. In fact, the research conducted by Azizah & Maulana (2018) shows that the results of tests on mathematical communication skills of high school students have not yet reached mastery scores. This is in line with the results of limited observations at a high school in Karawang District which shows that there are problems with mathematical communication skills in 11th-grade students during mathematics learning. In sequence material, students have not been able to determine the sequence of numbers including arithmetic and geometric sequences. Students also have not been able to explain their answers about annuity questions into mathematical language and explain their reasons. Furthermore, in the limit of algebraic function material, students are still unable to connect and read the graph of a function to determine the value of the right limit and the left limit. Then, students cannot explain the problem of the function limit by converting it into graphical form. In discussing, students look confused in expressing their own opinions about the concept of limits. And the lack of courage of students to ask questions.

One of the factors that influence the students' achievement in learning mathematics is the student's motivation in learning mathematics. Motivation in learning mathematics is very influential in the students' learning process to the students' learning outcomes (Solikah, 2012). The success or failure of learning activities depends on the motivation of students in accepting learning, it is difficult to succeed if learning without motivation (Sabrina & Yamin, 2017). Learning motivation can affect the process of student learning activities on student achievement (Panggabean, 2018). Motivation can be divided into intrinsic motivation and extrinsic motivation. Intrinsic motivation is that motivation comes from within the individual. Extrinsic motivation is a motivation that comes from the outside of the individual. Extrinsic motivation is more inclined to reinforce from outside which influences learning mathematics (Dewi & Khaerunnisa, 2019). Intrinsic motivation is difficult to emerge in the learning process but extrinsic motivation is not, because the encouragement from outside, such as motivation from the teachers, adds the encouragement to students to actively study by creating a learning atmosphere that is liked by students. For example, the selection of learning models that can motivate students in learning mathematics.

One of the learning models that can increase student motivation and mathematical communication skills is the Brain-Based Learning (BBL) model. According to (Kartikaningtyas et al., 2018), in BBL, teachers must motivate, support, and guide students in the process so a positive learning environment can be developed. BBL is learning that creates conducive classroom conditions by developing the

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student's brain to work naturally in the learning process (Jensen, 2008). BBL also facilitates students to optimize students' brain in learning mathematics. Students need a positive environment for a good learning process, so learning can run smoothly and has an impact on student achievement in learning mathematics. There are three main strategies that can be developed in learning with this Brain-Based Learning model (Andriani, 2020). First, relaxed alertness, which is seeking a situation where students can be "alert but relaxed". This is useful for eliminating students' fear while keeping the environment interesting and challenging for them. Second, orchestrated immersion, which is creating a learning environment that really makes students feel like they have entered an educational experience directly. Third, active processing, which is an activity that allows students to actively view, consolidate, and internalize incoming information. Previous research on BBL in mathematics learning shows that BBL significantly influences students' achievement (Gozuyesila & Dikicib, 2014). Based on these explanations, it can be seen that the Brain-Based Learning (BBL) model has the potential to develop student motivation and communication skills. The purpose of this study was to determine the effect of learning motivation in mathematics learning using the Brain-Based Learning (BBL) model.

## **METHOD**

This research is mixed-method research with concurrent triangulation strategies. Mixed method research is research that uses a qualitative and quantitative approach. A mixed-method with concurrent triangulation strategies is a mixed method that uses research

procedures that bring together or unite qualitative and quantitative data to obtain an analysis that is supported by research problems (Creswell, 2010). The population in this study were all 11th-grade students in SMAN 1 Rengasdengklok in the 2018-2019 academic year. Sampel dalam penelitian ini yaitu siswa kelas XI MIPA 6.

In mixed methods research, the combination of qualitative and quantitative focuses on data collection techniques. Based on the concurrent triangulation strategy, the data collection was carried out by tests, motivational scales, interviews, and observations. The instruments used in this study were a mathematical communication skill test with 4 questions, a motivation scale, interview guidelines, and an observation sheet. Quantitative data obtained from test results and motivation scale. To analyze the data in this study, SPSS software version 23.0 for Windows was used. The statistical analysis conducted was a normality test and a simple linear regression. Qualitative data were obtained from observations and interviews. The data is processed and analyzed with the following steps: collecting and processing information, reading the complete information obtained, making detailed descriptions of the information based on the case and context, arranging patterns and looking for relationships between information obtained by category, interpreting and developing the natural generalization of this information both for researchers and other relevant cases to this research, and collect data narratively. In analyzing the criteria of students' motivation in mathematics learning that applies the Brain-Based Learning (BBL) model, used the percentage descriptive analysis criteria proposed by

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Riduwan (Mastuinda et al., 2020), presented in Table 1.

Table 1. Descriptive analysis criteria

| Percentage | Criteria     |
|------------|--------------|
| 76% - 100% | Very Good    |
| 51% - 75%  | Good         |
| 26% - 50%  | Almost       |
| 0% - 25%   | Not Too Good |

## RESULT AND DISCUSSION

The results obtained are mathematical communication test scores, the motivation scale, interviews, and observations at the time of the study. The data from the tests obtained in this study are the results of pretest and posttest students' mathematical communication skills on linear program material. From the results of the pretest and posttest, it can be seen that there is a large difference in the maximum, minimum, and mean scores. The results are shown in Table 2.

Table 2. Statistic description

| Score    | N  | Min | Max | Mean  |
|----------|----|-----|-----|-------|
| Pretest  | 36 | 4   | 9   | 6.36  |
| Posttest | 36 | 29  | 33  | 31.72 |

Table 3. t-test output of the effect of learning motivation on students' mathematical communication skills

| Model      | Coefficients <sup>a</sup>   |            |                          |       | t    | Sig. |
|------------|-----------------------------|------------|--------------------------|-------|------|------|
|            | Unstandardized Coefficients |            | Standardized Coefficient |       |      |      |
|            | B                           | Std. Error | Beta                     |       |      |      |
| (Constant) | -.553                       | 4.608      |                          | -.120 | .905 |      |
| Motivation | .278                        | .042       | .754                     | 6.687 | .000 |      |

Based on Table 3, the regression equation is  $Y' = -0.553 + 0.278X$ . That is, if students' learning motivation is 0 then students' mathematical communication skills are negative, which is  $-0.553$ . The value of the regression coefficient of the learning motivation variable is positive, which is  $0.278$ . It means that for every increase

Table 2 shows that the minimum pretest score is 4 and for the posttest is 29, so the difference is 25. The maximum pretest score is 9 and for the posttest is 33, so the difference is 24. The mean pretest score is 6.36 and for the posttest is 31.72, so the difference is 25.36. Thus, the learning process affects the test results of students' communication skills. The result of the motivation scale based on the acquisition of the percentage of each indicator is in the range of 51% - 75% with a good category. Based on the results of calculations with statistical tests through the SPSS program version 23.0 for Windows using the normality test, the probability value is 0.200, so it can be said that the sample class is normally distributed. This linear regression analysis was conducted to find out the significant affection of students' learning motivation towards the students' mathematical communication skills. The results of the analysis can be seen in Table 3.

in students' learning motivation by 1, students' mathematical communication skills increase by 0.278. Because the value of the regression coefficient is positive, it can be said that learning motivation has a positive effect on students' mathematical communication skills. Furthermore, the t-value is 6.687 with a significance of 0.000. Based on

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the significance of  $0.000 < 0.05$ , the result of the hypothesis test is rejecting  $H_0$ . Based on the t-test, the t-value is 6,687, and the t-critical value is 2,032. It turns out that  $-t\text{-value} < -t\text{-critical value}$  or  $t\text{-value} > t\text{-critical value} = -6.687 < -2.032$  or  $6.687 > 2.032$ , then  $H_0$  is rejected. The results of the hypothesis test show that  $H_0$  is rejected, which means there is a significant influence on learning motivation on

students' mathematical communication skills in the application of the Brain-Based Learning model. The percentage of the effect of learning motivation on students' mathematical communication skills in the application of the Brain-Based Learning model was 56.8%. This is indicated by the results of data analysis which produce the R square value of 0.568 that is presented in Table 4.

Table 4. Percentage of the influence of learning motivation on students' mathematical communication skills

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .754 <sup>a</sup> | .568     | .555              | 2.171                      |

a. Predictors: (Constant), Motivation  
b. Dependent Variable: Posttest

The material used in this research is a linear program with two variables that includes explaining the notion of a linear program with two variables, explaining the linear inequality system with two variables, explaining the optimum value, and explaining the application of a linear program in daily life. In the learning process, students are given student worksheets. The students' learning process in class is done by grouping students into 6 groups, each group consisting of 6 students. At the first meeting, the learning process with the Brain-Based Learning (BBL) model, students look enthusiastic to starting the learning process. The most impressive part for students is the incubation and memory entry stage (the teacher asks students to re-read the material and the results of its work on literature and worksheets while listening to music). At this stage students look comfortable in learning and re-reading. The following fragments of interviews with students:

Researcher :What do you think about this learning of linear

programs that happened so far?

Student : It's fun and makes me more quickly understand the material.

Researcher : What do you like the most?

Student : When listening to music while working on problems.

The problem faced by the teacher in the BBL model is the lack of learning time because the learning steps of the BBL model have many steps that require more time than ordinary learning. For this reason, the teacher must be able to use the time as much as possible. Besides, the difficulty of learning mathematics with this model also lies in the selection of music to be played, because the music used to understand the material must be following the students; character and daily lives. The results of this study indicate that there is an influence of learning motivation on communication

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skills in the application of the Brain-Based Learning (BBL) model. This is following the study of (Triana & Zubainur, 2019), which conclude that the Brain-Based Learning model can develop the mathematical communication skills of 10<sup>th</sup>-grade students.

Fun learning activities will encourage students to learn or master the studied material. The Brain-Based Learning model is a learning approach by empowering brain function so that learning is more fun (Solihah et al., 2021). That way, students can be more active in the learning process in the classroom so that they can develop their mathematical communication skills. In this learning, music is one of the students' needs so that students feel more comfortable and happier in learning participation. Based on McClelland's theory (Ridha, 2020), if needs that have been developed are good, so they can also produce good achievements.

Based on the previous description, the results of students' mathematical abilities show that some students still

don't get maximum score from each problem, which means that each indicator of mathematical communication skills has not been maximally fulfilled. The indicators of mathematical communication skills (Ariawan & Nufus, 2017) are as follows: (1) Modeling situations by using the writing, either concretely, images, graphics, or other methods of algebra. (2) Explain mathematical ideas or situations in writing. (3) Re-expressing a mathematical description in their own language. These indicators are not yet reflected by the students who are seen in the students' answers.

Problem test on students' mathematical communication skills item number 1 is related to indicators compiling arguments/explanations into daily language. The problem given is in the form of presenting the problem related to the linear inequality with two variables and then the students give their arguments for the problem which is the linear inequality with two variables or not. Student's answers can be seen in Figure 1 and Figure 2

1a)  $2x + 0y + 3z \leq 0$  bukan merupakan pertidaksamaan dua variabel karena memiliki 3 variabel yaitu  $x, y, z$  dan nilai  $y=0$  tidak terpenuhi syarat  $y \neq 0$ .

1b)  $-2x + y > 10$  merupakan pertidaksamaan dua variabel karena memiliki variabel 2 yaitu  $x$  dan  $y$

Figure 1. Student's answer

1. a.  $2x + 0y + 3z \leq 0$   
Bukan merupakan pertidaksamaan dua variabel, karena terdiri dari 3 variabel yaitu variabel  $x, y$  dan  $z$  kemudian nilai variabel  $y=0$  tidak memenuhi syarat variabel  $\neq 0$

b.  $-2x + y > 10$   
Merupakan pertidaksamaan dua variabel, karena terdiri dari variabel  $x$  dan  $y$ , variabel  $x$  dan  $y$  memenuhi syarat  $x$  dan  $y \neq 0$  dan diikuti tanda  $>$  yang merupakan pertidaksamaan dengan nilai  $c = 10$

Figure 2. Student's answer

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Student's answer in Figure 1 is the answer of the student in the low category. The student has not mastered indicators of the ability to arrange arguments into daily language, it can be seen in the student's answer who has not been able to explain opinions accurately about which is the linear inequality with the two variables of the problem displayed in their language. Furthermore, Figure 2 is the student's answer who is in the high category. The student has mastered the ability to arrange arguments/explanations into daily language, it can be seen that the student's answer can reveal groups that are linear inequalities with two variables from the problem presented by expressing them into their arguments using their language. The student's answer is said to be correct if the student says  $2x + 0y + 3z \leq 0$  is not a linear inequality in two variables and gives reasons because the inequality has three variables, which are  $x$ ,  $y$ , and  $z$ .

Then, the student can determine whether the variables in the inequality meet the  $x \neq 0$  conditions. Furthermore, the student can state that  $-2x + y > 0$  is a linear inequality in two variables and gives reasons because the inequality only has two variables, which are  $x$  and  $y$ . Then, the student can determine the variables in the inequality meet the requirements of  $x \neq 0$  and  $y \neq 0$  and the value of  $c$  meets the requirements of  $c \neq 0$ .

The 2nd test item of students' mathematical communication skills problem is related to the graph of the linear inequality system function with two variables. The questions given to students are presented in the form of a function graph. Next, students connect the function graph to express the linear inequality system with two variables on the function graph. Student's answers can be seen in Figure 3 and Figure 4

Figure 3. Student's answer

Figure 4. Student's answer

The student's answer in Figure 3 is the answer of the student who is in the low category. The student has not mastered the ability indicator, which is

connecting graphs of functions into mathematical ideas and solve them. It can be seen in the student's answer where the student can register the

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equations of the linear inequality system and write it down, but the student writes it incomplete in the question section 2a. Then Figure 4 is the answer of student who is in the high category. The student has mastered the ability to connect graph of function into mathematical ideas and solve them, it can be seen in student's answer where the student can read graph of a function and register the equations of each linear inequality system. The student's answer is correct if the student can relate the linear inequality system contained in Figure 2a into mathematical ideas correctly, i.e. by writing the inequalities as:

$$\begin{cases} 2x - y \leq 6 \\ 5x + y \geq 5 \\ x \geq 0 \\ 2 \leq y \leq 4 \end{cases}$$

Next, the student's answer is correct if the student can relate the linear inequality system contained in Figure 2b into mathematical ideas correctly, i.e. by writing the inequalities as:

$$\begin{cases} x + y \leq 2 \\ -3x + 2y \geq 6 \\ 3 \leq x \leq 4 \end{cases}$$

Next, the students' mathematical communication skills test item number 3 is used to determine the achievement of mathematical communication skills indicators, namely explaining the mathematical situation in writing with pictures and algebra. The problem given to students is in Bahasa, here is the translation: "Children under five are advised by doctors to consume a lot of calcium and iron at least 60 grams and 30 grams. A capsule contains 5 grams of calcium and 2 grams of iron, while a tablet contains 2 grams of calcium and 2 grams of iron. If the price of a capsule is Rp1,000.00 and the price of a tablet is

Rp800.00. Determine the minimum cost to be incurred for the toddler". Student's answers can be seen in Figure 5 and Figure 6.

3). Diketahui :

X adalah kapsul dan Y adalah tablet

Sistem Pertidaksamaan linear:

$$5x + 2y \geq 60 \text{ dan } 2x + 2y \geq 30$$

fungsi tujuan  $f(x,y) = 1000x + 800y$

fungsi kendala

kalsium  $5x + 2y \geq 60$

$$K_1 = \frac{5}{2} = 2,5$$

Zat besi  $2x + 2y \geq 30$

$$K_2 = \frac{2}{2} = 1$$

Analisis

$$1 < 1,25 < 2,5$$

$$K_1 < K \text{ tujuan} < K_2$$

Mencari titik Potong

$$\begin{array}{r} 5x + 2y = 60 \\ 2x + 2y = 30 \\ \hline 3x = 30 \\ x = \frac{30}{3} = 10 \end{array}$$

$$\begin{array}{r} 2x + 2y = 30 \\ 2(10) + 2y = 30 \\ 2y = 30 - 20 \\ y = 5 \end{array}$$

Titik Potong (10,5)

$$f(x,y) = 1000x + 800y$$

$$= 1000(10) + 800(5)$$

$$= 10000 + 4000$$

$$= 14000$$

Figure 5. Student's answer

3. Diketahui

x adalah Kapsul  
y adalah tablet

|          | Kapsul  | Tablet | Batas minimal |
|----------|---------|--------|---------------|
| Kalsium  | 5 gram  | 2 gram | 60 gram       |
| Zat besi | 2 gram  | 2 gram | 30 gram       |
| Harga    | Rp 1000 | Rp 800 |               |

Sehingga sistem pertidaksamaan dapat ditulis

$$5x + 2y \geq 60$$

$$2x + 2y \geq 30$$

fungsi tujuan  $f(x,y) = 1000x + 800y$

Jawab

\* Fungsi tujuan untuk mencari nilai minimum, maka

$$f(x,y) = 1000x + 800y \text{ atau } f(x,y) = 10x + 8y$$

$$K_1 = \frac{10}{5} = 2,5$$

\* Fungsi kendala

kalsium  $5x + 2y \geq 60$

$$K_1 = \frac{5}{2} = 2,5$$

\* Zat besi  $2x + 2y \geq 30$

$$K_2 = \frac{2}{2} = 1$$

\* Analisis :  $1 < 1,25 < 2,5$

$$K_1 < K \text{ tujuan} < K_2$$

\* Nilai minimum berada pada titik Potong

$$\begin{array}{r} 5x + 2y = 60 \\ 2x + 2y = 30 \\ \hline 3x = 30 \\ x = \frac{30}{3} = 10 \end{array}$$

$$\begin{array}{r} 2x + 2y = 30 \\ 2(10) + 2y = 30 \\ 2y = 30 - 20 \\ y = 5 \end{array}$$

Titik Potong (10,5)

\*  $f(x,y) = 1000x + 800y$

$$= 1000(10) + 800(5)$$

$$= 10.000 + 4000$$

$$= 14.000$$

Jadi biaya minimal yang harus dikeluarkan untuk buah tersebut adalah Rp 14.000

Figure 6. Student's answer

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The student's answer in Figure 5 is the answers to the low student. The student's answer only slightly reflects the achievement of mathematical communication indicators, namely explaining the mathematical situation in algebraic writing. It can be seen in the student's answer, where the student can only describe the known problems in the language of mathematics but cannot conclude the problem. Then the student's answer in Figure 6 is the answer of the student who is in the high category. The student's answer can already show the achievement of mathematical communication indicators, namely explaining the mathematical situation in writing with pictures and algebra. It can be seen from the student's ability to describe problems in mathematical form and the student can also describe problems in algebraic form. The student's answer is correct if the student can solve the problem with the right steps to determine the minimum cost to be incurred for the toddler. The student can determine the correct example for  $x$ -variable and  $y$ -variable, i.e.  $x$ -variable for capsules and  $y$ -variable for tablets. In the first step, the student determines the function of the minimum value of  $f(x,y) = 1000x + 800y$  with  $k_t = \frac{10}{8} = 1,25$ . In the second step, the student can determine the constraint function for calcium and iron, with the calcium constraint function:  $5x + 2y \geq 60$  with  $k_1 = \frac{5}{2} = 2,5$  and the iron constraint function:  $2x + 2y \geq 30$  with  $k_2 = \frac{2}{2} = 1$ . In the third step, the student can analyze the values of  $k_1$ ,  $k_2$ , and  $k_{objectives}$  to determine the minimum costs that must be incurred, that is  $1 < 1,25 < 2,5$  ( $k_1 < k_{objectives} < k_2$ ), and determine the value of  $x$ -variable and  $y$ -variable by elimination-substitution for

inequalities of the calcium constraint function and the iron constraint function. Next, the values of  $x = 10$  and  $y = 5$  are substituted into the function of the minimum value of  $f(x,y)_{\min} = 1,000x + 800y$  so that the student can write the conclusion of the minimum value that must be issued for the toddler, that is 14.000.

The students' mathematical communication skills test (number 4) with indicators of mathematical communication skills, namely stating daily events into mathematical language. The question given to students is in Bahasa, here is the translation: "To make 1 liter of type A drink, we need 2 cans of soda and 1 can of milk, while to make 1 liter of type B, we need 2 cans of soda and 3 cans of milk. There are 40 cans of soda and 30 cans of milk. If 1 liter of type A drink sells for Rp30,000.00 and 1 liter of type B drink sells for Rp50,000.00, state what is the maximum income from the sale of both types of drinks!" Student's answers can be seen in Figure 7.

$$\begin{aligned}
 &4). \text{ A adalah minuman A} \\
 &\quad \text{B adalah minuman B} \\
 &\text{Sistem Pertidaksamaan} \\
 &\quad 2A + 2B \leq 40 \\
 &\quad A + 3B \leq 30 \\
 &\quad A \geq 0 \\
 &\quad B \geq 0 \\
 &f(x,y) = 30.000x + 50.000y \\
 &f(x,y) = 3A + 5B \\
 &\text{Pada Pertidaksamaan} \\
 &\quad 2A + 2B \leq 40 \\
 &\quad A + 3B \leq 30 \quad + \\
 &\quad \hline
 &\quad 3A + 5B = 70
 \end{aligned}$$

Figure 7. Student's answer

The student's answer in Figure 7 is the low student's answer. The answer only slightly reflects the indicator of mathematical communication skills, namely expressing daily events in the

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language of mathematics. It can be seen that students explain the problem bywriting it into mathematical language, but do not conclude clearly in

determining the maximum profit. And then, for the next student's answer can be seen in Figure 8.

4. Diketahui  
A adalah minuman A  
B adalah minuman B

|       | Minuman A | Minuman B | Jumlah |
|-------|-----------|-----------|--------|
| Susu  | 2         | 2         | 40     |
| Soda  | 1         | 3         | 30     |
| Harga | 30.000    | 50.000    |        |

Sehingga sistem pertidaksamaan dapat ditulis  
 $2A + 2B \leq 40$   
 $A + 3B \leq 30$   
 $A \geq 0$   
 $B \geq 0$   
 fungsi tujuan  $f(x,y) = 30.000x + 50.000y$

Jawab  
 fungsi tujuan untuk Mencari pendapatan maksimum  
 $f(x,y) = 30.000x + 50.000y$  atau  
 $f(x,y) = 3A + 5B$   
 Pada sistem pertidaksamaan dapat kita ketahui bahwa  
 $2A + 2B \leq 40$   
 $A + 3B \leq 30$  +  
 $3A + 5B \leq 70$

Jadi Besar pendapatan maksimum sebesar  
 Rp 700.000,00

Figure 8. Student's answer

The student's answer in Figure 8 is the answer of the high category students. The student's answer reflects the indicator of mathematical communication skills, namely expressing daily events in the language of mathematics. It can be seen in the student who can elaborate on the mathematical statements contained in the problem in determining the mathematical model of a linear inequality system and solve it into mathematical language. The student's answer is correct if the student can state the given contextual problem into a mathematical model to determine the maximum income correctly. The students can state the inequality  $2A + 2B \leq 40$  for the first inequality (1) and  $A + 3B \leq 30$  for the second inequality (2) with  $A \geq 0$  and  $B \geq 0$ . Then, the student can determine the function of the max value, that is  $f(A,B) = 30.000A + 50.000B$  or  $f(A,B) = 3A + 5B$  (in the tens of

thousands value). To determine the maximum income by using inequalities (1) and (2), that is  $3A + 5B = 70$ , so that the student can determine the conclusion of the maximum income obtained by writing down the value of 70 in the tens of thousands value (70 x 10,000) which is Rp700.000.

Mathematics learning using the Brain-Based Learning model shows that students' learning motivation affects students' mathematical communication skills. Several studies about the Brain-Based Learning model show that this learning model makes a positive contribution to mathematics learning. Lestari (2014) stated that the mathematical connection skills and mathematical critical thinking skills of students who receive Brain-Based Learning is better than students who receive direct learning. Adiansha et al., (2018) concluded that the Brain-Based Learning model has a better influence on students' mathematical communication skills than the

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Expository model. Pugalee (2011) said that in learning, students need to be accustomed to giving arguments for each answer and also giving responses to others' answers so that what is being learned becomes more meaningful for them. Mathematical communication skills of students can be developed by providing opportunities for students to give oral or written arguments, ask questions, answer questions, and conduct a good discussion in small groups or classes.

### CONCLUSION AND SUGGESTION

Based on the explanation of the results and discussion, it is concluded that there is an influence of learning motivation on the mathematical communication skills of high school students in learning mathematics with the Brain-Based Learning (BBL) model. The percentage of influence is 56.8% with a good category on the learning motivation. Mathematical communication skills based on test scores indicate that more than 50% of students have achieved a minimum completeness score. In the learning process, it can be seen that students can communicate the problems they face when they encounter difficulties in understanding the material. In addition, students also dare to express their opinions and explain their work in front of the teacher and their friends.

From the results, it is recommended that teachers should always motivate students in the process of learning mathematics with any learning model and observe the process of students' answers because the teacher will still find the wrong result due to calculation errors. Besides, further researchers are advised to apply the Brain-Based Learning model to different mathematical materials and

grade levels to improve mathematical and affective abilities that are different from this study.

### REFERENCES

- Adiansha, A. A., Sumantri, M. S., & Makmuri, M. (2018). Pengaruh model brain based learning terhadap kemampuan komunikasi matematis siswa ditinjau dari kreativitas. *Premiere Educandum : Jurnal Pendidikan Dasar dan Pembelajaran*, 8(2), 127. <https://doi.org/10.25273/pe.v8i2.2905>
- Andriani, S. (2020). Upaya Peningkatan Kemampuan Komunikasi Matematis Siswa. *Journal On Teacher Education Research & Learning in Faculty of Education*, 2, 39–48.
- Ariawan, R., & Nufus, H. (2017). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematis Siswa. *Jurnal THEOREMS (The Original Research of Mathematics)*, 1(2), 82–92. <https://doi.org/10.37905/aksara.7.2.463-474.2021>
- Asnawati, S. (2017). Peningkatan kemampuan komunikasi matematis siswa smp dengan pembelajaran kooperatif tipe teams-gamestournaments. *Euclid*, 3(2).
- Azizah, S. N., & Maulana, D. P. (2018). Analisis kemampuan komunikasi matematis pada siswa SMA. *Jurnal pendidikan matematika*. 2(10), 222-228.
- Creswell, J. W. (2010). *Research Desain Pendekatan Kualitatif, Kuantitatif, dan Mixed*. Yogyakarta : Pustaka Pelajar.
- Dewi, V. R. S., & Khaerunnisa, E. (2019). *Karakteristik Motivasi*

DOI: <https://doi.org/10.24127/ajpm.v10i2.3488>

- Ekstrinsik dan Intrinsik Siswa SMP dalam Belajar Matematika. Jurnal Penelitian Pengajaran Matematika. 1(2)*, 116–128.
- Gozuyesila, E., & Dikicib, A. (2014). The effect of brain based learning on academic achievement: a meta-analytical study. *Educational Sciences: Theory & Practice, 14*, 642–8.
- Jensen, E. (2008). Brain-Based Learning, terj. Narulita Yusron (Yogyakarta: Pustaka Belajar) p, 12.
- Kartikaningtyas, V., Kusmayadi, T. A., & Riyadi, R. (2018). The effect of brain based learning with contextual approach viewed from adversity quotient. *Journal of Physics: Conference Series, 1022(1)*, 12014.
- Lestari, E. (2014). Implementasi Brain-Based Learning Untuk Meningkatkan Kemampuan Koneksi Dan Kemampuan Berpikir Kritis Serta Motivasi Belajar Siswa Smp. *Jurnal Pendidikan UNSIKA, 2(1)*, 1042–1055. [http://jurnal.upi.edu/file/6-yani\\_ramdhana-edi.pdf](http://jurnal.upi.edu/file/6-yani_ramdhana-edi.pdf)
- Mastuinda, Zulkifli, & Febrialismanto. (2020). Persepsi Guru Tentang Penggunaan Loose Parts Dalam Pembelajaran Di PAUD Se-Kecamatan Tampan Kota Pekanbaru. *Jurnal Review Pendidikan dan Pengajaran, 3(1)*, 90–96.
- National Council of Teachers of Mathematics. (2000). Principles and Standards for School Mathematics. *United States of America : The National Council of Teachers of Mathematics, Inc.*
- Panggabean, T. Y. (2018). Upaya Guru Memotivasi Siswa Pad Proses Pembelajaran Ips Kelas Viii Smp Negeri 5 Pontianak. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa, 7(9)*, 1–9.
- Pugalee, D. A. (2011). Using Comunication to Develop Student Mathematical Literacy. *Mathematics Teaching in the Middle School, 6(5)*, 296-299.
- Ridha, M. (2020). Teori Motivasi Mcclelland dan Implikasinya dalam Pembelajaran PAI. *Palapa, 8(1)*, 1–16. <https://doi.org/10.36088/palapa.v8i1.673>
- Sabrina, R., & Yamin, F. M. (2017). Faktor-Faktor Penyebab Rendahnya Motivasi Belajar Siswa Dalam Proses Pembelajaran Matematika Di Kelas V Sd Negeri Garot Geuceu Aceh Besar. *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar, 2(4)*, 108–118. <https://bit.ly/3xiiZKm>
- Solihah, S., Amam, A., & Zakiah, N. E. (2021). Meningkatkan Kemampuan Komunikasi Matematik Serta Self Confidence Siswa Dengan Menggunakan Model Brain-Based Learning. *Teorema: Teori dan Riset Matematika, 6(November 2020)*, 48–58.
- Solikah, M. (2012). Pengaruh kecemasan siswa pada matematika dan motivasi belajar terhadap prestasi belajar matematika. *MATHEdunesa, 1(1)*, 1–8.
- Triana, M., & Zubainur, C. M. (2019). Students' Mathematical Communication Ability through the Brain-Based Learning Approach Using Autograph. *Journal of Research and Advances in Mathematics Education, 4(1)*, 1–10.