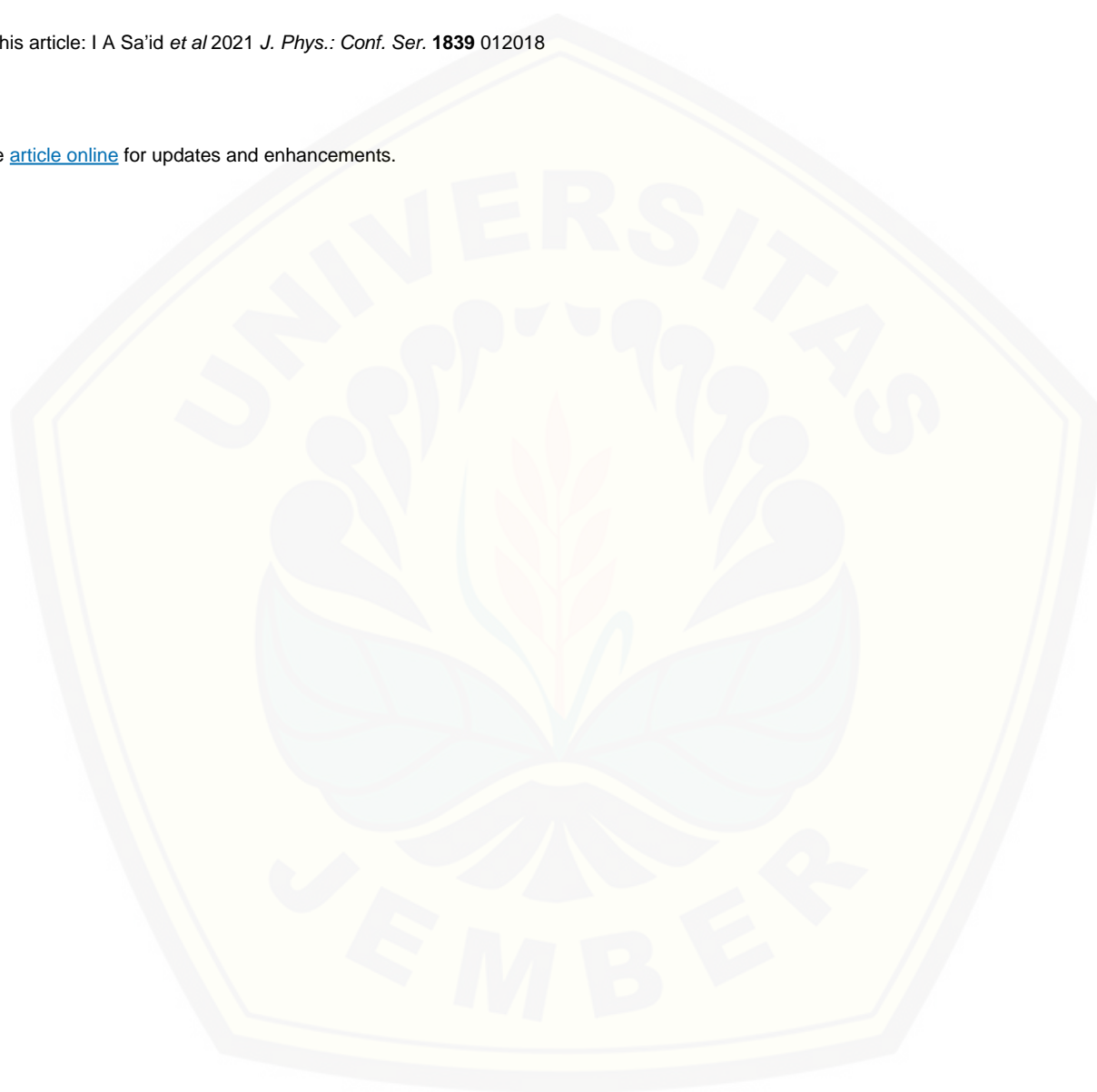


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# Development of mathematics learning tools with Realistic Mathematics Education-Jumping Task (RME-JT) and its effect on the mathematic communication skills

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**Abstract.** This research focus on the development of learning based on realistic mathematics education approach with Jumping Task questions. The develop learning are related to the real life of students, so that students can be expected to enjoy and like mathematics. The develop learning consist of lesson plan, worksheet, and learning test. This research used mixed method, both combine development and quantitative research. The model study is Thiagarajan 4D by using independent test analysis. The results showed that realistic in learning mathematics education approach-Jumping Task has a good quality practice, efektif, and fulfill the criteria of validity. On learning process using realistic mathematics education approach, the students are more active, enthusiasm and motivation so that it has a positive impact in improving students' mathematics communication. Significant value is 0.000 ( $p < 0.05$ ).

## 1. Pendahuluan

Technological and communicational developments in society have become increasingly sophisticated. Of the sophistication of the vast public can get the available information at any time and accessibly. Clearly, this change had an impact on Indonesian education. According to [1][2][3], pre-21<sup>st</sup> century, educational great for both elementary dan junior high school, students' which must be quite reading mastered, writing, and arithmetic competences. But in the 21<sup>st</sup> century the learning skills in global economic community, student need learning skills in order success at work and career. They are critical thinking and problem solving, communication, integration, and innovation.

Among the students skills in the 21st century a must be possessed is a communication. The realm of mathematical embalming lies mathematical communication. [4][5] One of the basic purposes of mathematics is to say that mathematical communication consists of both skill and ability. [6][5] Mathematical ideas can be exploited in different perspectives through communication; the thought of students can be sharpened, integrated and controlled; growth can be measured; mathematical knowledge and student development concerns are built; student reasoning can be improved; and communication between students can be intertwined.

Mathematical communication can be done by either verbally or written and also verbal include communication, explanation, describing, listening, asking, and collaborating.[7][8]. In resolving mathematical problems, students must have mathematical ability [9] and a good mathematic communication skills [10].

International Student Assessment Program Analysis (PISA)[11], A report focusing on reading, mathematics, and science found that Indonesia ranked 65 out of 69 participating countries in 2015. In solving the PISA problem as a practical problem (PISA), mathematical communication was required. In reality, mathematical problems are still difficult for learners to solve. Besides, some learners do not educate or express the symbols of mathematics. Nalole[12] added that the Netherlands has created Realistic Mathematics Education (RME) for a math presentation of something concrete.



Therefore, [13] teachers need to design mathematic materials that linked the mathematics with real problem to improve student's communication, [14] [15] and rise the positive effect which one is with apply a *Realistic Mathematics Education (RME)* approach.

As the founder of RME, Freudental communicated that mathematics is a human interest in solving the problems of everyday operations [16]. Definitions, theorems, and formulas do not begin with learning using a realistic approach. But learning begins with a contextual challenge. The real world is the source or starting point of mathematical concept creation, and it gives an impression of meaningful circumstances, discovers and expands its own mathematical constructions. [17][18][19]

*Jumping task* is the conferencing contain of problem in the learning aimed to improve the students' abilities. The problem given in *jumping task* is development and concept application [20]. Hobri [21] *Jumping task* is a give a test in higher levels than the acceptor of the task. Thus, this research assess the process and results of the development of learning tools with *Realistic Mathematic Education – Jumping Task (RME-JT)* approach and it's effect on the mathematic communication skills.

## 2. Research Methods

This research aimed to develop learning tools for Realistic mathematics education-jumping tasks and to find out the effect on students' mathematical communication skills. This research used a combination method or mixed methods. Combination research was a combination of 2 types of researches, namely development research and experimental research. The combination method served to assess the reliability of the process and the outcomes of the production of learning resources. The efficacy of the procedure using qualitative approaches and the efficacy of the findings using the experimental method. A quasi-experimental with pretest-posttest control design group was used in the quantitative process. Using SPSS tools, the data from this research was analyzed. Kolmogorov-Smirnov was used for the normality test, Levene was used for the homogeneity test and the independent sample t-test for the final analysis test.

This study used Thiagarajan's 4-D model of development that consisted of four stages, namely identifying, designing, developing, and disseminating. At SMP Plus Nurul Wafa, in class VIII B, this creation was carried out by as many as 20 students. In this study, data collection included expert confirmation from validators (two lecturers and one teacher), observation, mathematical communication skills assessments, and questionnaires.. Research data can be seen in Table 1.

**Tabel 1.** Research data

| No. | Data                            | Data Collection   |
|-----|---------------------------------|---|
| 1   | Validity                        | The learning tools said valid if fulfill the valiant criteria. The validation is done by 2 professors at FKIP Mathematics of Jember University and 1 mathematic's teacher at Junior High School Plus Nurul Wafa Jember. |
| 2   | Practicality                    | The learning tools said practice if-the assessment of.the.observation. sheet fulfill the practical .criteria. The .data acquired through interviews and analyzed the observation sheets.                                |
| 3   | Effectiveness                   | The learning tools said effective if fulfill 3 aspects include cognitive seen from the test result, psychosomatic seen from student's observation sheet, and affective seen from student's response questionnaire.      |
| 4   | Math communication ability test | The learning tools is affected by mathematic communication ability if the test of mathematics communication skill fulfill the grade of mathematics communication.   |

A quasi-experimental kind of pretest-posttest control group configuration was used in the quantitative process. There were two classes used in the experimental method, namely an experimental class and a control class. The experimental class was taught using practical task-based learning tools

realistic mathematics education-jumping, while the control class was taught using traditional learning models widely used in that school, namely direct learning and discussion.

**Tabel 2.** Experimental research methodology

|                  |       |     |       |
|------------------|-------|-----|-------|
| Eksperimen Class | $O_1$ | $X$ | $O_2$ |
| Control Class    | $O_3$ | -   | $O_4$ |

Information:

O1: The experimental class pretest

O3: The control class pretest

O2: The experimental class post-test

O4: The control class post-test

X : treatment

### 2.1 The Sample of The Research

This research sample consisted of eighth-grade students in Junior High School Plus Nurul Wafa in the 2020/2021 academic year. The research sample consisted of two classes that were selected using cluster random sampling. Class VIII A was the control class with 22 students, while class VIII B was the experimental class with 20 students. Data analysis was performed if all conditions were met [22] namely the normality test and homogeneity test. This study used an independent sample t test with the help of SPSS 2 with two-party testing. The test criteria, namely

- If the value is sig. (2-tailed) > 0.05 then  $H_0$  is accepted and  $H_a$  is rejected
- If the value is sig. (2-tailed) < 0.05 then  $H_0$  is rejected and  $H_a$  is accepted

### 2.2 Research instruments

The instruments of this research consisted of validation and observation sheets. The validation sheet was used to find out whether the lesson plans, students' workbooks, and mathematical writing ability test passed the validity category or not. Observation sheets were used to see teacher's and students' activities in the classroom and students' responses.

This development qualitative method used the 4-D development model by Thiagarajan, which consisted of define, design, develop, and disseminate stages. The quantitative method used a quasi-experimental class consisting of an experimental class and a control class. The experimental class used the learning model applied learning tools based on realistic mathematics education-jumping tasks, while the control class used a conventional learning model commonly applied in that school, namely direct learning. The design of this research used a pretest-posttest control group design. At the first meeting, a pretest was given to determine the students' initial abilities before getting the treatment. After that, the research was carried out in 3 meetings. At the end of the meeting, the students were given a post-test. The pretest and post-test used essay questions based on Realistic mathematics education-jumping tasks. This question affected students' mathematical communication skills.

## 3. Results and Discussion

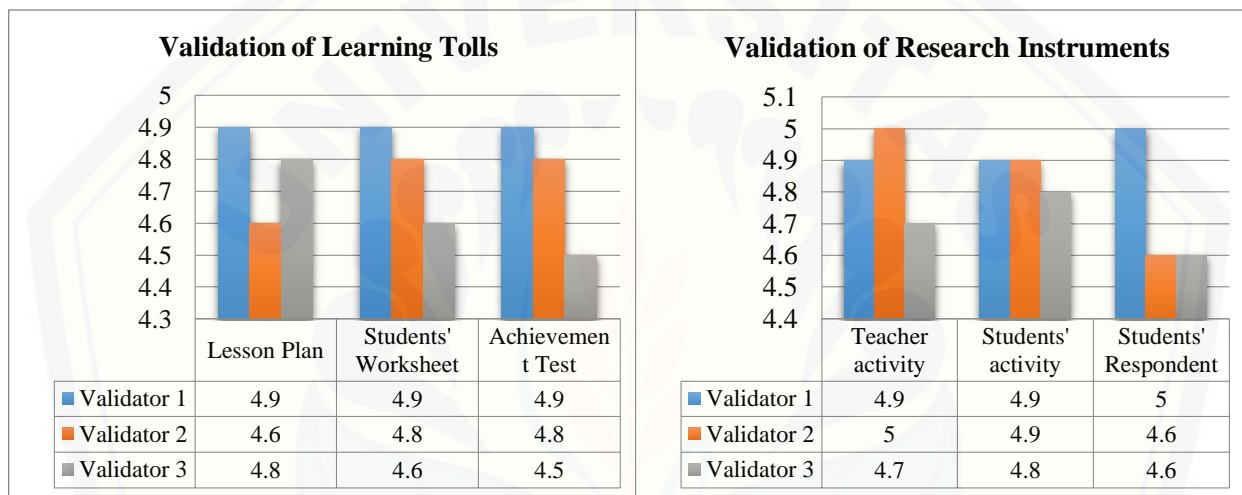
### 3.1 Results

This research was conducted on Junior High School Plus Nurul Wafa in the 2020/2021 academic year. This research used two classes, including class VIIIA as the control class and class VIII B as the experimental class.

The stages of this research were "Plan," "Do," "See." The learning tool development aimed to determine students' mathematical communication skills. The learning tool development met the validity, practicality, and effectiveness criteria and affected students' mathematical communication skills to fulfill this research's objectives. The descriptions of the validity, practicality, and effectiveness are as follows.

**The Research Instruments Validation**

Peneliti merencanakan dan merancang isi pengajaran pada tahap awal penelitian (plan), including instructional instruments and objectives and research instruments which included the observation sheets towards teacher’s activities, the observation sheets towards students’ activities, and questionnaires for students according to the purpose of this research, namely developing mathematics learning tools. Mathematics learning tools based on realistic mathematics education-jumping tasks were expected to affect students' mathematical communication skills. Furthermore, In order to get feedback, input, and improvements to learning devices and tools used in research, three validators consisting of 2 expert lecturers and a mathematics teacher were needed for this research. In carrying out the validation, texts were given as learning resources (learning tools) and testing tools which the validator would verify. Data resulting from the validation process were analyzed by calculating the average score for each component. The data from the analysis can be seen in Figures 1 and 2.

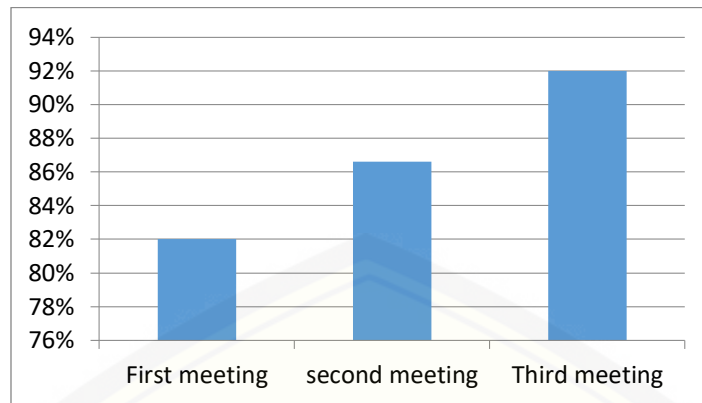


**Figure 1.** Learning tools validation outcomes

**Figure 2.** Research instrument validation results

Figure 1 and Figure 2 show that the learning tool development and research instruments showed validity criteria validated by three validators. The average value of lesson plans, worksheets, and learning outcomes tests was 4.76, 4.76, and 4.73. These results indicated that the learning tools’ validity value was at the interval  $4 \leq Va < 5$ . Based on the validity coefficient (Va) interpretation criteria, the learning tools met the validity criteria. The research instrument validation results included the observation sheet of the teacher’s activities 4.86; observation sheet of the students’ activities 4.86; and the questionnaires 4.73; These results indicated that the instrument validation value was on the criteria  $4 \leq Va < 5$ . Based on the criteria for interpretation of the validity coefficient (Va), the research instrument met the validity criteria. Thus the learning tools and research instruments were feasible to use because they met the validity criteria[23]. Nieveen stated[24] which states that a learning material (in this case, if it meets: (1) learning material established based on strong theoretical reasoning, a practical mathematics education design is said to be valid; and (2) internal consistency between components exists. Established learning materials. After carry out the validation of the learning tools and get the results that the learning devices are suitable for use, then practical analysis.

"The Do" step was the next stage. From teaching and learning practices, the practicality of learning devices was shown using learning methods built and met relevant criteria. This study took place in class VIII at Junior High School Plus Nurul Wafa. The control class became class VIIIA, and the experimental class became class VIIIB. The learning process consisted of 5 sessions, including the 1st pre-test implementation meeting, the 2nd meeting, the 3rd meeting, the 4th content distribution meeting, and the 5th post-test implementation meeting.. The results of observations of teacher activities can be seen in Figure 3.



**Figure 3.** Results of observations of the practices of teachers

In the first meeting, the teacher's activity was 82% in the good category. It was because the teacher did not master the time allocation according to the lesson plan. Besides, some students did not pay attention when the teacher explained. At the second meeting, the teacher carried out activities to convey learning objectives, motivate students to ask questions about what was understood about the problems in the students' workbooks, direct students to understand, explain, and compare existing problems on workbooks, as well as to direct students to conclude the whole material.

The percentage of teacher activity in the second meeting increased from the second meeting, namely 86.50% with a good category. At the third meeting, the teacher carried out activities to convey learning objectives, motivated students, directed students to observe objects, directed students to ask questions, understand, explain and compare the problems provided in the workbook, and conclude the whole material.

The percentage of teacher activity at the third meeting increased from the first, second, and third meetings. In the fourth meeting, the teacher carried out activities to convey learning objectives, motivated students to ask questions about what was understood about the problems in the workbooks, directed students to understand and explain the problems existing in the workbooks, asked students to compare existing problems on workbooks, as well as directed students to conclude the whole material. Before carrying out teaching and learning activities, students first carry out a pretest. As a prerequisite test in order to pick the class to be sampled, the pre-test used the normality and homogeneity test. In the following table, the results of the normality test can be seen..

**Table 3.** Pre-test Normality Test

| Class         |                 | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|---------------|-----------------|---------------------------------|----|------|--------------|----|------|
|               |                 | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| Mathematical  | Experimen Class | .118                            | 20 | .200 | .930         | 20 | .153 |
| Communication | Control Class   | .152                            | 22 | .200 | .942         | 22 | .218 |

Based on the table, the significance value of the control class was 0.200. The experimental class completed 0.200. These results indicated that the significance value was more than 0.005, which meant that the pretest result in the experimental and control classes was normally distributed. The homogeneity test can be seen in the table below.

**Table 4.** The results of the pre-test homogeneity

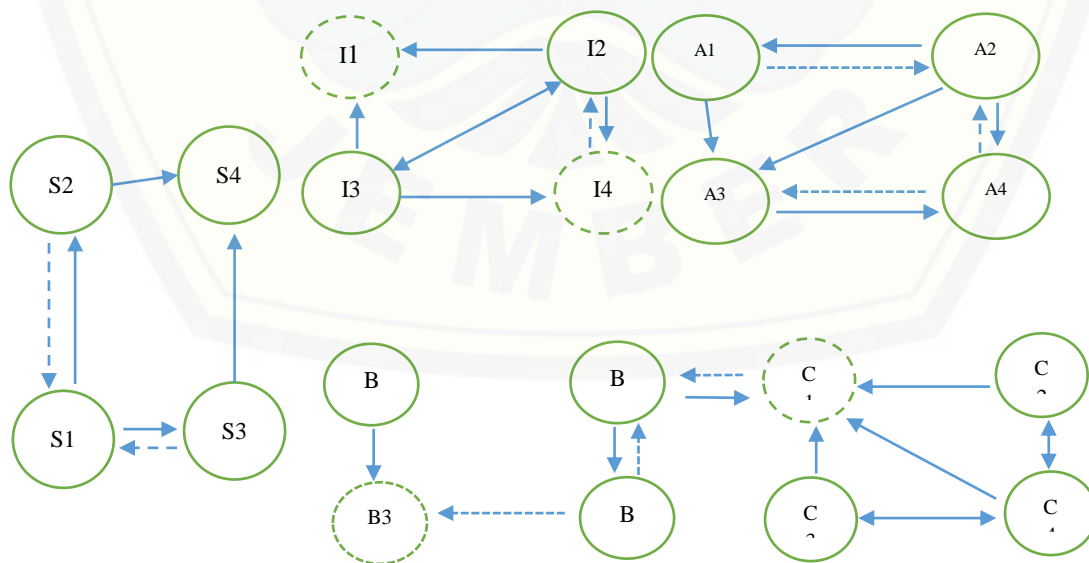
| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 3.206            | 1   | 40  | .812 |

The table above showed the significance of the homogeneity of  $0.812 \geq 0.05$ , indicating that the pre-test scores of the students were homogeneous in the experimental and control groups, with a statistical Levene's value of 3.206. The control class's teaching and learning process used a conventional model where the learning activities were teacher-centered. Students tended only to be listeners. After that, they were given practice questions. These activities could make students bored and lack enthusiasm in carrying out learning, especially mathematics. In the control class, learning used a realistic mathematics education model based on jumping tasks. Melalui pembentukan kelompok-kelompok kecil dilakukan latihan-latihan pembelajaran. Setiap kelompok terdiri dari 4 siswa. Learning with several stages, namely; (a) understand, (b) explain, (c) complete, (d) compare, and (e) conclude. For students, realistic mathematics education was acceptable because learning used contextual problems as a learning starting point. Freudental clarified that mathematics should not be communicated to learners as a ready to use instrument, but as a form of operation in the creation of mathematical concepts[25]. This research used a realistic mathematics education approach based on jumping tasks. The jumping task method has the advantage of being able to create effective learning activities among students, interaction, and collaboration [26]. Through jumping task questions, students were directed to think independently and grow together in peers [27]. The following criteria were met by the learning instruments: 1) The learning method implementation was classified as practical, 2) students had a positive response to the learning tools with Realistic mathematics education-jumping tasks.

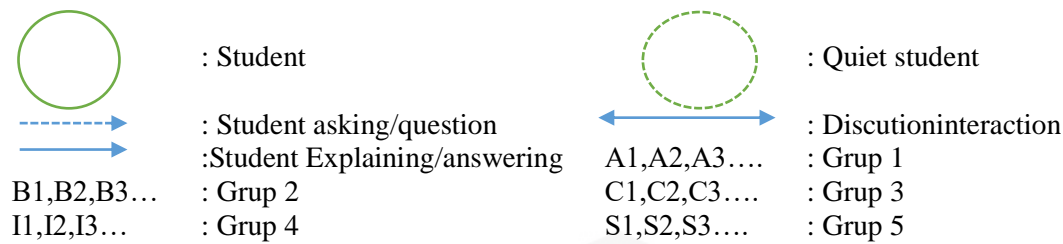
Based on the results of observations of teacher activities. Realistic mathematics education-jumping task based learning devices meet the practical category, because they can be used in the learning process. This is in line with Nieveen [24] It notes that practicality is correlated with two things, namely: (1) experts and practitioners say that it is possible to apply the learning design developed; and (2) it is possible to implement the learning design developed in the field properly and smoothly.

**The effectiveness of Methods for Learning**

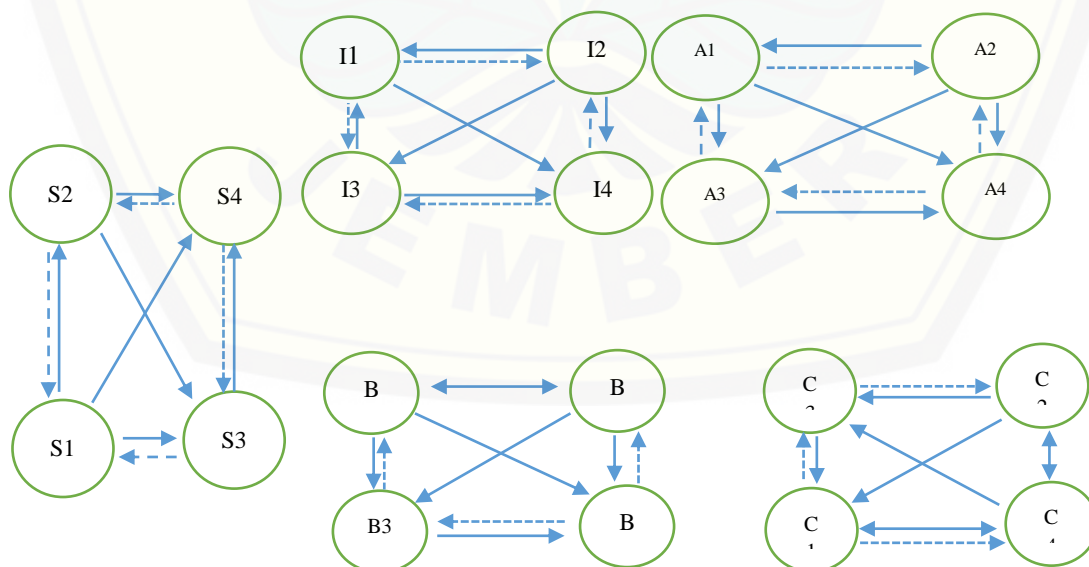
The effectiveness of learning tools is assessed through three aspects, namely, cognitive aspects, psychomotive aspects, and affective aspects. Cognitive aspects use critical thinking skills tests. Psychomotor aspects use student activity observation sheets. The affective aspect uses the student response questionnaire sheet. Student activities in the experimental class which have been divided into several groups are presented in the figure 4 .



**Figure 4.** Discussion stream for students in the experimental class session 1 Information.:



In Figure 2, it can be seen that the discussion in the experimental class at the Habibi meeting was running quite well. In group A, it was seen that student A2 was very active than the other students. Student A2 explained to all students in Group 1. It is because student A2 understood the material better than other students. Student A2 explained to all group members. Nevertheless, student A3 did not understand because they tended to passively not ask questions, so student A1 who understood the material, helped student A3 who got difficulty in understanding the material. In group B, student B2 explained to student B4 because student B3 did not get an answer. Student B3 did not understand the material and did not ask any questions. Student B1 helped to give explanation to student B3. In group B, students B1 and B2 were active. In group C, students C1 had difficulty in understanding the material and tended to be quiet. Student C2, student C3, and student C4 helped other students to understand the material. However, student C1 still could not understand, so student C1 asked group B to assume that student B2 was a close friend and more patient in explaining the material. In group S, student S1 gave explanations to student S2 and student S3. Student S4 did not ask any student, so student S2 and student S3 helped student S4 understand the material. Student S1 seemed active because he helped in providing explanations to S3 and S2 students. In group I, student I2 and student I3 understood the material better and often expressed their thoughts. Meanwhile, student I1 and student I4 tended to be quiet and passive. Students I1 and Students I4 were helped to understand the material by student I2 and student I3. From all students who were passive and quiet, only students I4 dared to ask questions. The group activity figure above showed that no student felt ignored or isolated because each member of the group had feelings of caring for each other. [28].



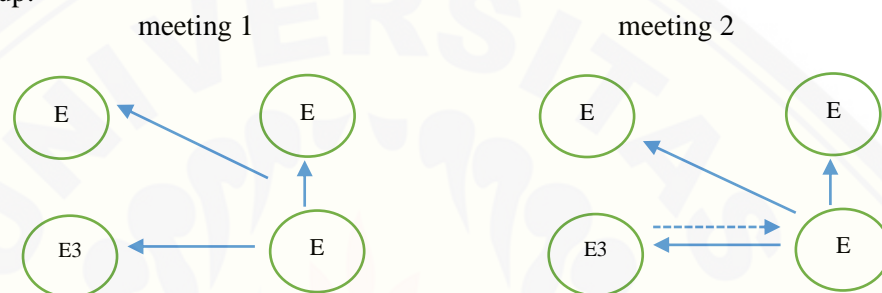
**Figure 5.** Flow of discussion of students in the experimental class meeting 2

In the next meeting (2<sup>nd</sup> meeting in figure 3), students had been able to collaborate well, and each member of the group cared about other groups' members. Group A seemed to ask questions and start



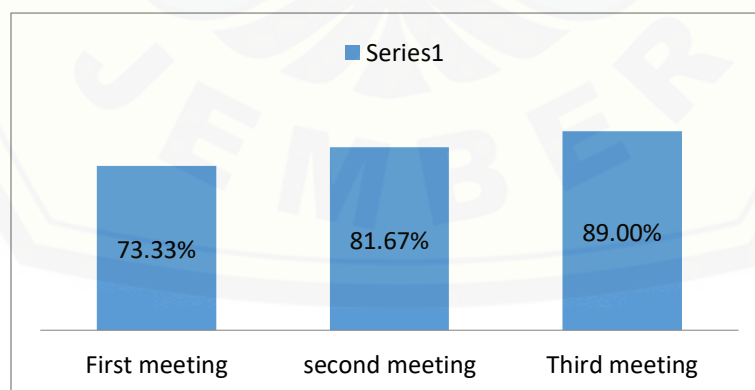
to exchange opinions with other group members. In group B, B3 students began to express their opinions when asked, even though they still needed a little direction from students B2. B3 students who were initially quiet were able to have good discussions with other students. In group C, student C1 exchanged places with student C3 so that student C3 began to understand the material and even began to dare in asking other members if there was material that still has not been understood. In group S, S4 students had the courage to ask questions. Other students welcomed this, as evidenced by helping S4 students to understand the material. In group I, student I1 and student I4, who was initially quiet, began to dare to ask questions, and student I1 could also assist student I4. Students seemed to be more active in collaborating to solve problems, care for friends, and exchange ideas with other group members [29][30]. None of the students asked other groups at this meeting because they were embarrassed. After all, they were not close friends.

In the following figure, the group discussion that occurred in the control class is shown. Taken as a sample from one group.



**Figure 6.** Flow of discussion of control class students

In group E, especially the first meeting, student E4 was more active than other students. Student E1, student E2, and student E3 did not ask questions. They just waited for an explanation from student E4. Meanwhile, student E4 was more active than the other students. There was a question and answer session for student E3 and student E4, but student E1 and student E2 were still waiting for an explanation from student E4. Meanwhile, E3 students who already understood do not help student E1 and student E2 to provide explanations. In general, The group discussions in the control class were only aimed at answering questions without consideration for group members who did not yet understand the content..



**Figure 7.** The results of observations of student activities in the experimental class

Based on the results of observations, the students' activities in the first meeting got a score of 73.33% in the good/active category, the second meeting got a score of 81.67% in the good/active category, and the third meeting got a score of 89% in the good/active category. From the results above, it can be concluded that the psychomotor aspects were categorized as good.

The results of the observation of students' activities In the class of control were only 40% active, and 60% of students were less active. Thus, It is possible to assume that most of the students were active when participating in mathematics learning using the Realistic mathematics education-Jumping task model. Furthermore, besides observing the students' activities, the observer also observed teacher activities during teaching. After the learning activity was complete, the researcher also provided questionnaires to gain the students' responses. The results of the students' responses to questionnaires were shown in Figure 8.

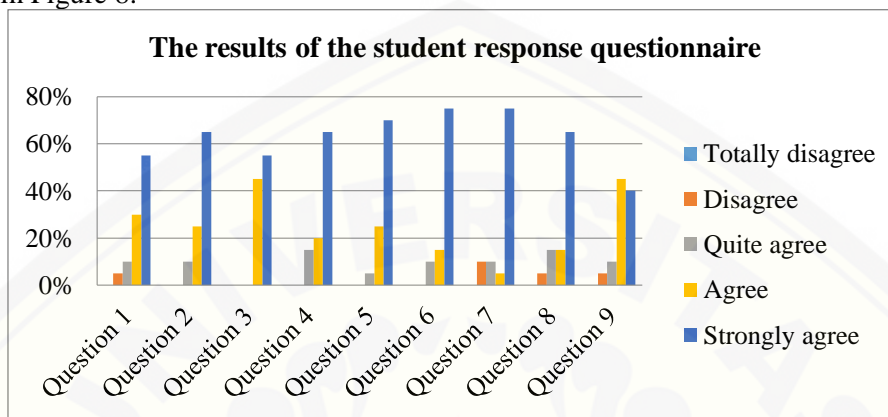


Figure 8. Student responses to learning tools

Figure 8 The outcome of the study of the responses of students to the learning resources built was shown.. The analysis results showed that many students were pleased when learning activities were based on Realistic mathematics education-jumping tasks. The average of students who answered strongly agree 62.7%, agree 25%, quite agree 9.4%, disagree 2.7%, strongly disagree 0%.

Students often chose 'agree' and 'strongly agree' options because the learning was done with much practice, understanding problems, explaining problems, solving, and comparing. Students looked happy because it could encourage them to find new ideas and communicate ideas, formulas, and peers' solutions. Students' worksheets were presented by adjusting students' character, equipped with pictures not to feel bored in solving problems and became more active. Students gave a positive response to the worksheet because it used understandable. The students' difficulties in finishing the worksheets usually occurred when they were working on story problems. Students got difficulty changing a sentence into a mathematical model because students were not used to working on story problems. Therefore, researchers compiled students' worksheets, which included questions about daily activities and based on jumping tasks so that students began to get used to the questions in the form of stories.

The learning device's effectiveness was known based on the result of the students' mathematics communication skills test, which was indicated by the post-test results..

Table 5. Description of posttest result data

| Class      | Mean  | Std. deviation | 95% Confidence Interval |       |
|------------|-------|----------------|-------------------------|-------|
|            |       |                | Lower                   | Upper |
| Experiment | 83,94 | 6,91           | 80,71                   | 87,18 |
| Control    | 69,33 | 10,82          | 64,52                   | 74,13 |

Furthermore, to determine the effect of realistic mathematics education-jumping task approach on students' mathematics communication skills, the independent sample t-test was performed. The results of the independent sample t-test are shown in Table 4

**Table 6.** The results of the t-test calculation

|       | t                           | df        | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |          |
|-------|-----------------------------|-----------|-----------------|-----------------|-----------------------|---|----------|
|       |                             |           |                 |                 |                       | Lower                                     | Upper    |
| Hasil | Equal variances assumed     | 5.15<br>6 | .000            | 14.61950        | 2.83565               | 8.88845                                   | 20.35055 |
|       | Equal variances not assumed | 5.26<br>3 | 36.04<br>8      | .000            | 14.61950              | 2.77803                                   | 8.98565  |

The results of the independent sample t-test in Table 5 indicated that the significant value was  $<0.05$ . So learning tools using a realistic mathematics education-jumping task approach affected students' mathematical communication skills. The following was one of the students' answers. The figure of student's answers.

\*Diketahui :

- Ali membeli 2 bungkus suwir suwir dan 4 kotak prot tape dengan harga Rp.120.000,00.
- Zainal membeli 3 suwir suwir sengkang dan 2 box prot tape dengan harga Rp.100.000.
- Santi ingin membeli suwir suwir dan prot tape dengan jenis yang sama dengan uang Rp.100.000.

\*Ditanya :  
kemungkinan banyak bungkus suwir suwir dan prot tape yang dapat dibeli ?

\*Jawab  
Membuat Permisalan :  
x adalah harga 1 bungkus suwir-suwir.  
y adalah harga 1 bungkus kotak prot tape.

\*Membuat Model Matematika.  
• Ali membeli 2 bungkus suwir suwir dan 4 kotak prot tape dengan harga Rp.120.000,00.  
 $2x + 4y = 120.000$  ... persamaan 1  
• Zainal membeli 3 suwir suwir sengkang dan 2 box prot tape dengan harga Rp.100.000  
 $3x + 2y = 100.000$  ... persamaan 2  
Jadi, SPLDV dari permasalahan tersebut adalah

$$\begin{cases} 2x + 4y = 120.000 \\ 3x + 2y = 100.000 \end{cases} = \text{Sistem persamaan linier dua variabel}$$

dengan persamaan pertama dua x ditambah empat y sama dengan seratus dua puluh ribu. Dan persamaan kedua tiga x ditambah dua y sama dengan seratus ribu.

\*Menyelesaikan SPLDV.  
Menentukan variabel mana yang akan dieliminasi terlebih dahulu. kali ini kita akan menghilangkan x terlebih dahulu, dan supaya kita temukan nilai y.

$$\begin{array}{r} 2x + 4y = 120.000 \quad | \times 2 | 4x + 8y = 240.000 \\ 3x + 2y = 100.000 \quad | \times 4 | 12x + 8y = 400.000 \\ \hline -8x \quad \quad \quad = -160.000 \\ -8x / -8 \quad \quad = -160.000 / -8 \\ \quad \quad \quad \quad \quad = 20.000 \end{array}$$

Nilai x adalah 20.000  
Jadi, harga satu bungkus suwir suwir adalah Rp.20.000.

Menghilangkan x terlebih dahulu, dan supaya kita temukan nilai y.

$$\begin{array}{r} 2x + 4y = 120.000 \quad | \times 3 | 6x + 12y = 360.000 \\ 3x + 2y = 100.000 \quad | \times 2 | 6x + 4y = 200.000 \\ \hline \quad \quad \quad 8y = 160.000 \\ \quad \quad \quad 8y \quad \quad = 160.000 / 8 \\ \quad \quad \quad \quad \quad y = 20.000 \end{array}$$

Nilai y adalah 20.000  
Jadi, harga satu box prot tape adalah Rp.20.000

Students write down problem information

Write an example

Write a mathematical model of the problem

Write down the completion steps and write down the math symbols

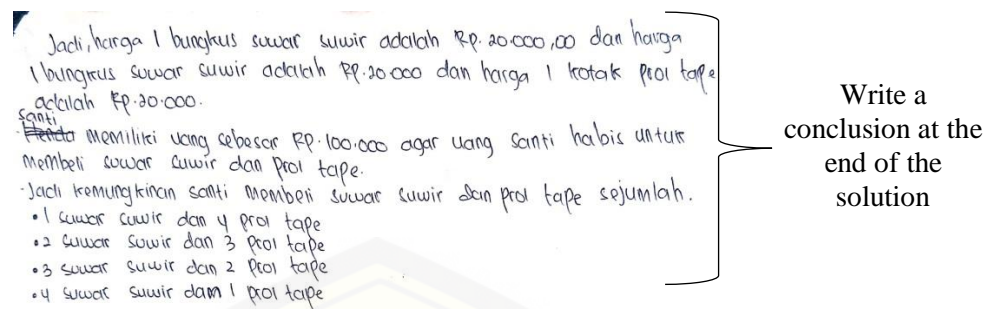


Figure 9. Students' answers according to mathematics communication indicators

The above figure indicates that these students had expertise in mathematical communication because three indicators were met [31] (5 sub-indicators). The following were the results of the interview process between the teacher and students.

- Teacher : Are the questions given difficult? (if difficult) explain how you find it difficult?  
 Students : In my opinion, this question is difficult because it is in the form of a story problem.  
 Teacher : Do you understand the problem you were working on earlier?  
 Students : Not at first. But when I read the matter more closely I can understand that  
 Teacher : What information do you know in this question?  
 Ali bought 2 packs of suwar-suwir and 4 boxes of prol tape at a price of IDR 120,000  
 Students : Zainal bought 3 Suwar-suwir and 2 boxes of prol tape at a price of Rp. 100,000  
 Santi wanted to buy Suwar-suwir and prol tape of the same type, but he only brought Rp100,000  
 Teacher : Did you write on the answer sheet during the test? If not why don't you write it down?  
 Students : I did not write down "I'll bring Rp100,000 to buy vegetables", because I wasn't careful  
 Teacher : How do you sort and model the problem in that problem?  
 First, identify the problem  
 x is the price of 1 pack of suwar suwir  
 y is the price of 1 box prol tape  
 Ali bought 2 packs of suwar-suwir and 4 boxes of prol tape at a price of IDR 120,000  
 Students :  $2x + 4y = 120.000$   
 Zainal bought 3 Suwar-suwir and 2 boxes of prol tape at a price of Rp. 100,000  
 $3x + 4y = 100.000$   
 $\begin{cases} 2x + 4y = 120.000 \\ 3x + 4y = 100.000 \end{cases}$   
 Teacher : After you made an example of the problem, did it make it easier for you to work on the problem?  
 Students : Yes, because you can find out the math equation of the problem.  
 Teacher : What solution method did you use to solve the problem?  
 Students : I use mixed methods  
 Teacher : Why did you use this method of settlement?  
 Students : because it is easy, the first uses the elimination method the second uses the substitution method  
 Teacher : Can you explain how to solve the problem using the method you used?  
 Yes, firstly using the elimination method  
 Omitting x to find y  
 $2x + 4y = 120.000 \mid \times 2 \mid 4x + 8y = 240.000$   
 Students :  $3x + 2y = 100.000 \mid \times 4 \mid 12x + 8y = 400.000$   


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$$\begin{array}{r} -8x \qquad = -160.000 \\ -8x/-8 \qquad = -160.000/-8 \end{array}$$

$$x = 20.000$$

The value of x is 20.000

So, the price of a pack of suwar-suwir is Rp20.000

The second uses the substitution method.

substitutes  $x = 20.000$  into equation 1

$$2(20.000) + 4y = 120.000$$

$$40.000 + 4y = 120.000$$

$$4y = 120.000 - 40.000$$

$$4y = 80.000$$

$$4y/4 = 80.000/4$$

$$y = 20.000$$

The value of y is 20.000

So, the price of a box of prol tape is Rp.20.000

So, the possibility of Hendra buying suwar-suwir and prol tape a number.

1 suwar-shir and 4 prol tape.

2suwar-suwir and 3 prol tape.

3suwar-suwir and 2 prol tape.

4suwar-shirds and 1 prol tape

Teacher : Are you sure that is the correct answer? Explain why!

Students : Yes, because I have found the x and y values after that I am looking for the possibility to buy suwar-suwir and prol tape

Teacher : Can you conclude the result from solving the problem?

- • Write down what you know
- • Writing down what was asked
- • Make an example

Students : 

- • Create mathematical models
- • Omitting y to find x
- • Omitting x to find y
- • Look for possible purchases

Teacher : Are you familiar with the use of math symbols when solving problems? If you understand, explain what this mathematical symbol means? (pointing to a math symbol) and if you don't understand, explain why did you use that symbol?

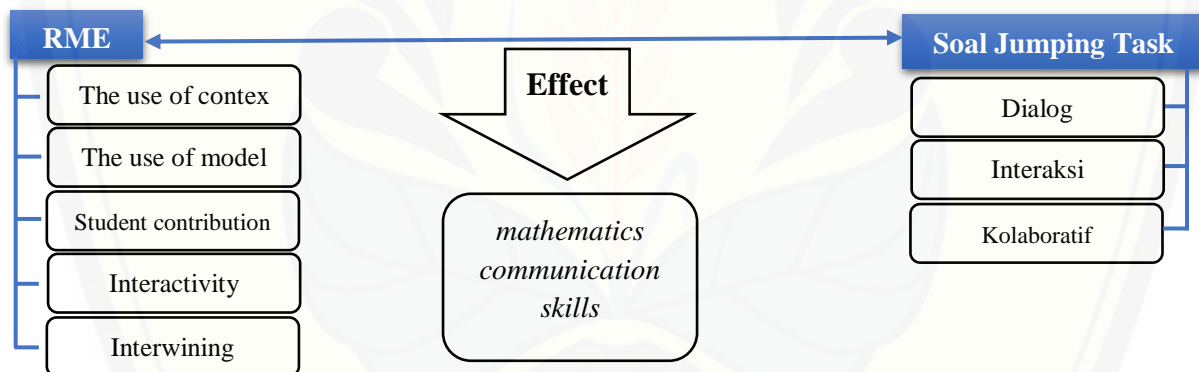
Students : Two-variable Linear Equation System with the first equation two x plus four y equals one hundred and twenty thousand. And the second equation three x plus two y equals one hundred thousand.

### 3.2 Discussion

Statistical test analysis used SPSS software. A pre-requisite test, namely the normality test and the homogeneity test, was carried out before the analysis test. The normality test used the Kolmogorov-Smirnov test in the experimental class with a value of 0.125, and in the control class 0.69 the value was  $<0.05$ , the data were normally distributed, Although the Levene homogeneity test had a value of  $0.111 > 0.055$ , so the data was homogeneous. The learning tools could be said as effective because it could be proved by 1) The completeness of the classical learning outcomes, 2) the outcomes of student activities were classified as active during the teaching learning period, 3) there was a substantial increase in the mathematical communication skills of students in the experimental class. The results of observations of the learning process's application got a value of 82%; 86.6%; 92%; the results of observations of student activities with a value of 73.3%; 81.67%; 89%. Based on the students' responses to the questionnaires, it was found that 62.7% of the students gave positive responses to learning tools with a realistic mathematics education-jumping task approach. The learning tools met the following requirements on the basis of the above data: 1) the implementation of the learning

process was graded as functional, 2) students had a positive response to the learning tools with realistic mathematics education-jumping tasks. Because the data were normally distributed and homogeneous, it used the parametric independent sample t-test with a value of  $0.000 < 0.05$ . These findings revealed significant differences between the control class and the experimental class in the mathematical communication skills of students. These findings also showed that the experimental class had a substantial increase.

The development of the mathematic learning tools with realistic mathematics education has been done by other researcher. On this research the learning tools that developed include the implementation of lesson plan , the student worksheet , and the test of mathematical communication skills. The differences in this research is using jumping task which jumping task is learning method that characterized by giving students a problem or challenging duty with hope that students will work together to find solution for the problem or tasks through a dialog, interaction and collaboration performed effectively and efficiently by a teacher. The tools developed include a lesson plan . The lesson plan consists of preliminary tasks, key activities and closing activities in math learning with the Realistic Mathematics Education-Jumping Task (RME-JT).. Second is student worksheet . The student's worksheet is a learning device as an object in the process of learning. In this research the student worksheet of learning activities consistent with the realistic mathematics education and jumping task. Third is math communication skills tests . math communication skills tests is an evaluation tool of learning activity include of essay that contain of the issues associated with student problems in daily life. The test also contain a similar test with jumping test. The relationship of RME-JT with the student's ability in mathematical communication is showed in figure 10.



**Figure 10.** Relationship between RME-JT and mathematics communication skills

The development of a mathematics learning device with Realistic Mathematics Education-Jumping Task has a superior using an approach in convey the material and the student is more practiced in its reason with jumping task. In addition, this development may also know the impact on the skills of student's mathematics communication. Unlike previous research [32]<sup>[33]</sup>.

#### 4. Conclusion

The results showed that the mathematics learning device met the standards of validity, practicality, and efficacy using the realistic mathematics education-jumping task method.. Valid criteria are based on the assessment of the Composed of 2 validators, mathematics lecturers and 1 mathematics subject teacher. The criteria for practicality of learning devices are measured by the instrument of the teacher's activity Learning Observation sheet. The results of observations indicate that the learning properties are practical because they can be used in the course of learning,. learning devices meet the effective criteria, namely student activeness at least active, more than 75% of students complete, student response is positive. This learning device can also affect students' mathematical communication skills with a significant value is 0.000.

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