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**Research Article**

# Management Development of Student Worksheets to Improve Teacher Communication Skills : A Case Study on Self-Efficacy and Student Achievement

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**Abstract**

This study is a development research that aims to find out how the results of the development of problem-based Student Worksheets to improve students' mathematical communication skills and self-efficacy. This research was started from a preliminary study, Student Worksheets preparation, Student Worksheets validation, initial field trials, and field trials. The subjects of this study were students of Junior High Islamic School MTs Negeri 2 Bandar Lampung in the 2015/2016 academic period with a total of 120 students with heterogeneous mathematical abilities. Research data were obtained through mathematical communication tests and self-efficacy scales. The effectiveness test was conducted to determine the effect of Student Worksheets on mathematical communication skills and attitude analysis was carried out to determine the tendency of students' self-efficacy. The results of the preliminary study indicate the need to develop a problem-based Student Worksheet. Preparation of Student Worksheets begins by preparing a Student Worksheet and all its components based on the Student Worksheets preparation guidelines. The validation results show that the Student Worksheet has met the standards for content, suitability and design. Field trial results show that Student Worksheet is included in the good category. Field test results show that the aspect of students' mathematical communication is quite good because more than 75% of students have met the minimum completeness criteria and Self-efficacy of students tends not yet to show changes.

**Keywords**

problem-based student worksheets, mathematical communication, self-efficacy

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## Introduction

Mathematical learning not only requires students to simply understand the topic of chapter being learned, but also learn with understanding and actively builds new knowledge from previous experience and knowledge. To realize this, the National Council of Teachers of Mathematics (Agus & Haninda, 2018) establishes five skills that students need to have through mathematics learning, mathematical communication; mathematical reasoning and proof; mathematical problem solving; mathematical connections; and mathematical representation (Andini & Yunianta, 2018).

Understanding teacher management is a process that is passed by a teacher starting from the pre-service period usually consisting of the stages of planning, selection, training process, and development, the process of evaluating achievement and promotion and the process of dismissal and/or retirement (Hartinah et al., 2019). The teacher is a noble and good job. In this profession teaches the nation's children to be smart. Therefore a teacher must have a good management so that he is successful in teaching lessons to his students (Huda, Tsani, Syazali, Umam, & Jermsittiparsert, 2020).

According to Anggoro, (2015), the students often mistakes in solving story problems. Many students have difficulty understanding language with the situation in the problem, and not trained in communicating ideas/ ideas verbally. Meanwhile according to Anggoro, (2016) proof of error occurs in the prerequisite aspects where students can't change the story questions in the form of mathematical models (Haryani, 2017). Learning mathematics are very important for students, because mathematics is a communication tool that very powerful, thorough, and not confusing. Mathematical communication skills need to be developed so students are able to communicate ideas and can formulate solutions the mathematical problems (Anwar, Choirudin, Ningsih, Dewi, & Maseleno, 2019).

There are psychological aspects that contribute to one's success in solving mathematical problems well (Kesumawati & Octaria, 2019). The psychological aspect is self-efficacy towards mathematics. Several studies conducted by (Kristanto, 2017), (Kusuma, 2017), and (Kusumawati & Nayazik, 2018) stated that the development of self-efficacy is important to support students' mathematics learning achievement. Besides having an impact on motivation, self-efficacy can support students' mathematical communication skills(Akbar & Komarudin, 2018). Self-efficacy means controlling the situation of students in solving mathematical problems until find a solution independently. In addition, students become confident in their mathematical abilities so that they are optimistic to solve mathematical problems (Muhamad Syazali, 2015).

The 2013 student-centered curriculum, which is student-centered learning uses the Problem Based Learning (PBL) model, allows students to try to solve their own problems, then can be more active in expressing opinions, help each other, and

share opinions in solving problems. These conditions require development in terms of teaching and learning activities in the form of Student Worksheets (Holidun, Masykur, Suherman, & Putra, 2018).

Teacher management is very important, things like that can't be separated from the changing view of human resources (Muhamad Syazali et al., 2019). Where then was labor considered as a fact of production, but now it is considered as a partner to achieve organizational goals (Sriyakul, Umam, Jermsittiparsert, et al., 2019). The next management is about assessment and evaluation (Habibi et al., 2019). Basically every year the teacher will get an assessment from the principal. The aim is as an objective consideration material in the development of civil servants (Hartinah et al., 2019).

Student Worksheets are one of the important roles in providing assignments that relevant to the topic being taught, maximize the ability of students' understanding by learning resources (Diani, Irwandani, et al., 2019). Student Worksheets contain tasks that help students to understand communication skills and self-efficacy. However, the facts show that Student Worksheets today are still not as effective as Student Worksheets (Diani, Herliantari, Irwandani, Saregar, & Umam, 2019).

Based on the results of an interview from a mathematics teacher at MTs Negeri 2 Bandar Lampung, the topic in Student Worksheets is presented briefly without an explanation or a structured step in finding basic concepts so that most students still have difficulty in expressing problems in mathematical models, and finally students are unable to solve the problem (Lestari et al., 2019). Some students have turned to ask the teacher related answers, because they have not been able to represent mathematical ideas in writing, especially when the problem given is slightly modified (Rahmi Ramadhani, Umam, Abdurrahman, & Syazali, 2019). Furthermore, the availability of Student Worksheets used can be said to be less able to guide students (Sriyakul, Umam, & Jermsittiparsert, 2019a).

By implementing PBL, students are expected to improve their mathematical communication skills, self-efficacy, and have a good confidence in their ability to solve mathematical problems. Based on the explanation presented, a research on "Management Development of Student Worksheets to Improve Teacher Communication Skills: A Case Study on Self-Efficacy and Student Achievement" is needed.

**Problem Based Learning (PBL) Model**

The Problem Based Learning (PBL) Model is one of the innovative learning models that provide active learning conditions. PBL models are considered capable, because the problems of users are problems that are commonly faced by students in everyday life. The PBL Model needs to use Student Worksheets so the stages of learning remain directed and effective. Mathematical communication skills are integrated into Student Worksheets so students are able to think logically

and able to analyze in-depth abstract subject topic (Sagala, Umam, Thahir, Saregar, & Wardani, 2019).

The problem-based learning model starts from the student's orientation to the problem, organizes students to learn, guides individual and group investigations, develops and presents their work, and analyzes and evaluates the problem solving process. This problem based model learning is integrated with Student Worksheet (Rahmawati et al., 2019).

The first phase, teacher explains the learning objectives and the things needed during the lesson and motivates students. It will build students' emotions in the classroom (Huda et al., 2019). By general assessment of positive emotions, students will be more confident in expressing their ideas. In addition, verbal persuasion by the teacher can also build student confidence. At this stage students will also connect real objects, images, and ideas into mathematics. As well as the motivation and learning objectives explained by the teacher will make students have expectations or goals that students want to achieve after participating in learning (Komala Sari, Syazali, & Farida, 2016).

The second is teacher organizes students to learn, guides individual and group investigations. In this phase, teacher divides students into heterogeneous groups and give Student Worksheets (Sumarni et al., 2019). Then, students discuss with group members to solve the problems in Student Worksheet. In the discussion activity, students are required to communicate their ideas into mathematical symbols and picture illustrations as well as with logical explanations, this will certainly develop ideas, situations, and mathematical relations verbally and in writing (Sriyakul, Umam, & Jermsittiparsert, 2019b). During the discussion too, students can exchange ideas, and know the abilities of themselves and their group members (Rahmi Ramadhani et al., 2019). Students are also trained to express opinions in their groups, so their verbal abilities also increase (Syahrir et al., 2018).

The third phase is developing and presenting the work. In this stage, several groups present the results of the discussion in front of the class. Through this learning process, students will be actively involved and given the opportunity to express their ideas and opinions (Sriyakul, Umam, Jermsittiparsert, et al., 2019). This activity includes reading, written mathematics presentations, and making statements that relevant to the learning topic information (M. Syazali et al., 2019).

The fourth phase is analyzing and evaluating problem solving process. In this phase, the teacher helps students reflect or evaluate and clarify the results of the discussion, then they conclude the topic that has been learned. This stage has also stimulated students to make conjectures, formulate arguments, formulate definitions and generalizations; explain and make questions about mathematics.

**Research Problem**

During the learning process in class communication occurs between teacher and students, between students and students, also between students and other learning

resources. Communication provides an opportunity for students to explain, make guesses, defend ideas, both orally and in writing that can stimulate a deeper understanding of knowledge of mathematical concepts. People will not understand the concepts and solutions of a mathematical problem or might misinterpret them if the concepts and solutions are not communicated using appropriate mathematical language (Rajindra et al., 2019).

There are two important reasons why communication is one of the focuses in learning mathematics. First, mathematics is basically a language for mathematics itself. Mathematics is not only a thinking tool that helps students to find patterns, solve problems, and draw conclusions, but also tools to communicate students' thoughts about various ideas clearly, precisely and concisely. Second, learning and teaching mathematics are a social activity that involves at least two parties, namely the teacher and students. It is important for students to express their thoughts and ideas in the learning process by communicating them to others through language, because basically the exchange of experiences and ideas is a learning process.

## Method

### Research Design

This type of research is research and development (R&D) which follows the steps of the Borg & Gall method and refers to the procedure with some modifications. The steps of this research development are explained in Figure 1:

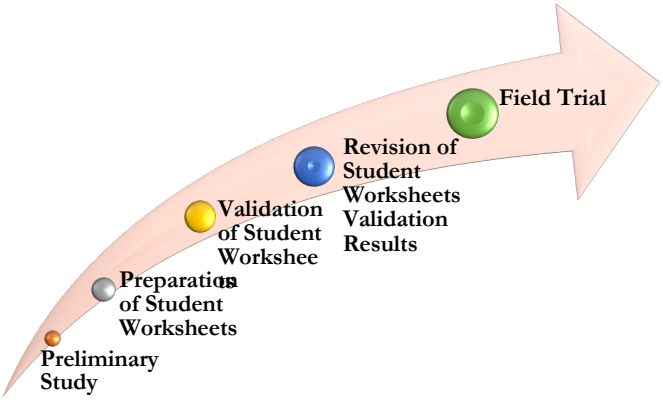


**Figure 1**

*The Steps in This Research*

### Preliminary Study

This study was conducted by observing Student Worksheets, interviewing teachers, and observing student learning activities in class using Student Worksheets. Analysis of standard competence and basic competencies in mathematics, class VIII mathematics syllabus, and indicators of mathematical communication skills as topic for consideration of topic preparation and evaluation. Interviews were

conducted with the mathematics teacher to get information about the characteristics of student learning.

**Preparation of Student Worksheets**

Student Worksheets are expected to facilitate students' mathematical communication skills through mathematical problems and their solutions. Arranged in sequence consisting of the title page, inside cover page, preface, SK-KD and learning objectives, learning activities 1 to learning activities 6 that contains the title topic, topic description, and practice questions. Next, the Student Worksheets assessment instrument will be arranged in the form of Student Worksheets validation scale for topic and media experts.

**Validation of Student Worksheets**

In addition, the instruments (student worksheet) also validated by experts, such as the mathematics communication test. After being validated by an expert, a mathematics communication test is distributed to students who are not the research subjects. The results then analyzed for the level of difficulty, distinguishing features, validity and reliability of the questions (R. Ramadhani & Narpila, 2018).

**Revision of Student Worksheets Validation Results**

Student Worksheets that have been made are written on the validation sheet as topic for revision. Revisions are made continuously and consulted back to the two experts until they get the desired results (Ratnasari, Tadjudin, Syazali, Mujib, & Andriani, 2018).

**Field Trial**

At this step, students are given a scale sheet that measures readability, student interest, and their response to Student Worksheets before finally Student Worksheets is ready to be used in fieldwork. After the data is obtained, revisions are made according to the trial results. Revisions are made again until all suggestions and responses of students during the trial phase are followed up.

**Participants**

In the preliminary study conducted several steps as an analysis of the needs of LKPD, namely observation, interviews, and analysis of the difficulty level of the questions. The subjects at the time of observation were students of class VIII B and VIII C. The subject at the time of the interview was one teacher who taught mathematics in class VIII. The subject when analyzing the difficulty level of the questions were students of class VIII D.

The field implementation test of Student Worksheets was conducted to determine the effectiveness of Student Worksheets on students' mathematical communication skills and self-efficacy. This field test was conducted in class VIII B, C, and D at MTs Negeri 2 Bandar Lampung with a total of 120 students with heterogeneous mathematical abilities. After the end of learning, a test was given to

test the effectiveness of Student Worksheets on students' mathematical communication skills and self-efficacy.

**Table 1.**

*Demographic Structures of Participants*

| Islamic School of MTs Negeri 2 Bandar Lampung | | |
|---|---|---|
| **Participant Class** | **Number of Student** | **Information** |
| **VIII B** | 40 | Control |
| **VIII C** | 40 | Control |
| **VIII D** | 40 | Experiment |

**Data Analysis**

There is a link between the PBL model and the multiple intelligences of junior high school students. The research shows that the PBL model provides better mathematics learning achievement compared to conventional learning. The PBL can be applied if supported by a constructivist learning environment. Constructivists will build knowledge even though there are different versions in each student, depending on the experience of each. The PBL creates meaningful learning, students will be able to solve the problems they face (Maskur, Syazali, & Utami, 2019).

The self-efficacy indicators this study based on Bandura's opinion (Ratnasari et al., 2018). The indicator is sourced from four things; first, Achievement of performance the effect generated based on previous experience will decrease or increase one's self efficacy. Second, the experience of others is evidence of a comparison of his abilities with others. Third, verbal persuasion refers more to good bait, words from an older person or teacher. Fourth, Psychological index is an assessment of his abilities, including their weaknesses and strengths (Kasayanond, Umam, & Jermsittiparsert, 2019).

**Table 2.**

*Stages of the Problem Based Learning (PBL) Model*

| Phase | Indicator | Teacher's activities |
|---|---|---|
| 1 | Student orientation to problems | Explain learning objectives, explain the logistics needed, and motivate students to engage in problem solving activities |
| 2 | Organizing students for learning | Helps students define and organize learning assignments related to the assignment. |
| 3 | Guiding individual/ group experiences | Encourage students to gather appropriate information, carry out experiments to get explanations and problem solving. |
| 4 | Develop and present the work | Help students plan and prepare appropriate work such as reports, and help them share assignments with friends. |
| 5 | Analyze and evaluate the problem solving process | Helping students to reflect or evaluate their investigation and the process they use. |

The instrument needed consisted of two types of instruments, non-test and test. For the preliminary study, form of interview guide to conduct interviews with the teacher during observation about the initial conditions of the school, teacher, and students, as well as the learning. Furthermore, the instruments for the Student Worksheets validation test were a Likert scale questionnaire with 4 scales, Very Good (VG), Good (G), Less (L), and Very Less (VL), which were submitted to topic experts, and media experts, as well as equipped with comments and suggestions from experts. Questionnaire instruments for students were given to six students with different abilities. Questionnaire in the form of a Likert scale with a assessment scale of 4 with categories of Very Good (VG), Good (G), Poor (P), and Very Poor (VP). The instrument at the time of field test or field implementation test consists of tests of mathematical and non-test communication skills.

Before the mathematical communication ability test,validated first then tested on another class to find out the level of difficulty, distinguishing power, and reliability of the questions. Following the explanation of the stages from the validity test to the reliability test of the mathematical communication ability test. Data on mathematical communication test results that refer to the indicators that have been made are given at the end of the meeting to measure the level of achievement of mathematical communication.

## Results

Communication in mathematics helps teachers understand students' abilities in interpreting and expressing their understanding of mathematical concepts and processes their learning.

Many researchers revealed the indicators of mathematical communication as the drawing ability, which includes the ability of students to express mathematical ideas in the form of drawings, diagrams or graphs,the ability to write with correct mathematical expressions,and mathematical models (Saregar, Latifah, & Sari, 2016). Problem description of mathematical communication skills can be the form of question problems, transfer, explorative, elaborative, applicative, and estimation (Saregar, Marlina, & Kholid, 2017). Mathematical communication ability tests are used to measure the effectiveness of using Student Worksheets for problem based learning. The assessment of mathematical communication indicators can be seen in Table 3.

**Table 3.**

*Assessment of Mathematical Communication Indicators*

| Score | Written texts | Drawing | Mathematical Expression |
|---|---|---|---|
| 0 | The wrong answer or misunderstanding concept. | | |
| 1 | Only a few explanations are correct. | Only a few drawings, diagrams, or tables are correct. | Only a few mathematical models are correct. |
| 2 | The mathematical explanation makes sense but only partially complete and correct. | Describe diagrams, pictures, or tables but not complete and correct. | Make a mathematical model correctly, but wrong in getting a solution. |
| 3 | The mathematical explanation makes sense and correct, even though it is not arranged logically or there are few language errors. | Describe diagrams, pictures or tables completely and correctly. | Make a mathematical model correctly, then calculate or get a solution correctly and completely. |
| 4 | The mathematical explanation makes sense and is clear and logically arranged. | | |
| | Maximum Score = 4 | Maximum Score = 3 | Maximum Score = 3 |

**Test the Content Validity**

The content validity test can be known by comparing the contents in the mathematical communication ability test with the specified learning indicators. Empirical validity is performed on class IX B students. The technique to empirical validity test using the product moment correlation formula.

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$

$r_{xy}$ = The correlation coefficient between variable X and Y variable
**N** = Number of Students
$\sum X$ = Number of student scores on each item
$\sum Y$ = Total number of student scores
$\sum XY$ = Number of results of multiplication of student scores on each item with a total of students score

Distribution (Table r) for α = 0,05 and degrees of freedom (d= n – 2). Rule of decision: If $r_{xy} > r_{table}$ is valid, then $r_{xy} < r_{table}$ is non-valid. Interpretation of value correlations by comparing with value $r_{table}$= 0.44. Table 4 presents the results of the validity of the instrument.

**Table 4.**
*The Validity of Mathematical Communication Instruments*

| Question Number | $r_{xy}$ | Decision |
|---|---|---|
| 1a | 0.84 | Valid |
| 1b | 0.79 | Valid |
| 1c | 0.74 | Valid |
| 2 | 0.74 | Valid |
| 3a | 0.90 | Valid |
| 3b | 0.85 | Valid |

**Reliability**

Reliable instruments to measure the same object. The reliability coefficient based on opinion of (Mujib, 2016)which states that to calculate the reliability Alpha formula:

$$r_{11} = \left(\frac{n}{(n-1)}\right)\left(1 - \frac{\sum \sigma_i^{\,2}}{\sigma_t^{\,2}}\right)$$

$r_{11}$ : instrument reliability scores (tests)
$n$ : the number of items
$\sum \sigma_i^{\,2}$ : the sum of the variances of each item
$\sigma_t^{\,2}$ : total variance

The instrument said to be good if it has a reliability coefficient ≥ 0.70. Based on the calculation results of a mathematical communication instrument trial, a reliability coefficient is 0.87. It shows that the instrument being tested has high reliability.

**Distinguishing Points**

The difference test item is ability to distinguish between high and low-ability test. The power of different test items can be determined by looking at the level of discrimination or the number that indicates the size of difference. (Anwar et al., 2019) revealed that calculating distinguishing power was determined by the formula:

$$\mathrm{DP} = \frac{\mathrm{JA} - \mathrm{JB}}{\mathrm{IA}}$$

DP : distinguishing power index of a particular item
JA : the sum ofthe top group scores on the items processed
JB : the number of scores in the lower group on the items processed
IA : ideal groupscore (up/ down)
The distinguishing point are interpreted based on the classifications in Table 5.

**Table 5.**
*Differentiation Value Interpretation*

| Value | Interpretation |
|---|---|
| -1.00 ≤ DP ≤ 0.10 | Very poor |
| 0.10 ≤ DP ≤ 0.19 | Poor |
| 0.20 ≤ DP ≤ 0.29 | Need revisions |
| 0.30 ≤ DP ≤ 0.49 | Good |
| 1.00 ≤ DP ≤ 0.50 | Very good |

The instrument criteria in this study have good interpretation, which has a value of distinguishing power ≥ 0.30. The calculation of distinguishing items that have been tested are presented in Table 6.

**Table 6.**
*Distinguishing Points (DP)*

| Item NumberQuestion | Value of DP | Interpretation |
|---|---|---|
| 1a | 0.45 | Good |
| 1b | 0.40 | Good |
| 1c | 0.35 | Good |
| 2 | 0.31 | Good |
| 3a | 0.32 | Good |
| 3b | 0.31 | Good |

By looking at the distinguishing points of items, the instrument has fulfilled the criteria for differentiating the questions in accordance with the expected criteria.

**Difficulty level**

The instrument is said to be good if it has a moderate degree of difficulty, is not too difficult and not too easy.

$$TK = \frac{J_T}{I_T}$$

TK : the degree of difficulty
$J_T$ : the number of scores obtained by students
$I_T$ : the maximum number of scores students can get
Interpret the level of difficulty used the difficulty index criteria in Table 7.

**Table 7.**
*Interpretation of Difficulty Level Values*

| Value | Interpretation |
|---|---|
| 0.00 ≤ TK ≤ 0.15 | Very difficult |
| 0.16 ≤ TK ≤ 0.30 | Difficult |
| 0.31 ≤ TK ≤ 0.70 | Medium |
| 0.71 ≤ TK ≤ 0.85 | Easy |
| 0.86 ≤ TK ≤ 1.00 | Very easy |

The difficulty test problems are presented in Table 8.

**Table 8.**
*Item Difficulty Level*

| Item Number Question | TK Index | Interpretation |
|---|---|---|
| 1a | 0.81 | Easy |
| 1b | 0.76 | Easy |
| 1c | 0.63 | Medium |
| 2 | 0.26 | Difficult |
| 3a | 0.71 | Easy |
| 3b | 0.62 | Medium |

By looking at the difficulty level of the items, the communication test instrument has fulfilled the criteria for the difficulty level of the questions as expected.The self-efficacy scale in this study measures four aspects, authentic mastery experiences, vicarious experiences, verbal persuasions, and physiological indexes. This scale was made based on a Like rt scale with four answer choices Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Indicators of self-efficacy are shown in Table 9.

**Table 9.**
*Aspect of Self Efficacy Assessment*

| No | Aspect | Description | Indicator |
|---|---|---|---|
| 1 | Authentic mastery experiences | Capability indicators based on the performance of previous experience | 1. Students' views of their mathematical abilities.<br>2. Students' views about math skills |
| 2 | Vicarious experiences | Evidence based on competence and comparison | 1. Students ability to compare their mathematical abilities with others<br>2. Students' views about mathematical abilities possessed by themselves and |

| | | | |
|---|---|---|---|
| | | | others |
| 3 | Verbal persuasions | Refers to direct feedback or the words of a teacher or a more mature person | 1. Students' ability to interpret mathematical sentences in mathematical creative thinking questions |
| 4 | Physiological indexes | Assessment of abilities, strengths, and weaknesses about a task | 1. Students' views about their mathematical abilities<br>2. Views about the weaknesses and strengths students have in mathematics |

Before the field test, the self-efficacy scale was validated by Psychologist, Mrs. Mirra Septia Veranika, M.Psi. She is a counselor at Darma Bangsa School. The purpose of validation is to see the suitability of the contents with the indicators and the purpose of scaling. The evaluation criteria from the experts are: the relationship of indicators with the objectives; the appropriateness of the statement with the measured indicator; correspondence between statement and purpose; and the use of good and correct language. Based on this assessment, the self-efficacy scale met both criteria and was declared suitable for use in the field test.

After validation, the scale is tested to determine the reliability and validity empirically. The trial was conducted on eighth grade students with 20 respondents. The calculation process uses IBM SPSS Statistics 20 software. Determination of the score of each category on a self-efficacy scale for each statement using response scaling according to (Maulidi, Apriliani, & Syazali, 2019). Calculation procedure:

1) Calculate the frequency of each category for each statement item
2) Determine the proportions of each category
3) Determine the proportions of each category
4) Calculate the amount of cumulative proportion
5) Calculate the value of $pk_t = \frac{1}{2}p + pkb$, when $pkb$ = cumulative proportion in the left category
6) Look for in the standard normal distribution table the standard number (z) that corresponds to $pk_t$.
7) Adding the value of z with a constant $k$ so we get the smallest value of $z + k = 1$ for a category in one statement.
8) Round up the sum of the results in step 6

## Discussion and Conclusion

Data analysis techniques are explained based on the types of instruments used in each stage of research development. The reliability and validity calculation of the statement items can be seen in Table 10.

**Table 10.**
*Test Results of Student Validity Self-efficacy Scale*

| Statement | Sig. | Criteria | Statement | Sig. | Criteria |
|---|---|---|---|---|---|
| 1 | 0.357 | Valid | 21 | 0.679 | Valid |
| 2 | 0.470 | Valid | 22 | 0.511 | Valid |
| 3 | 0.853 | Valid | 23 | 0.646 | Valid |
| 4 | 0.679 | Valid | 24 | 0.378 | Valid |
| 5 | 0.384 | Valid | 25 | 0.411 | Valid |
| 6 | 0.853 | Valid | 26 | 0.670 | Valid |
| 7 | 0.814 | Valid | 27 | 0.391 | Valid |
| 8 | 0.679 | Valid | 28 | 0.853 | Valid |
| 9 | 0.784 | Valid | 29 | 0.697 | Valid |
| 10 | 0.712 | Valid | 30 | 0.550 | Valid |
| 11 | 0.311 | Valid | 31 | 0.853 | Valid |
| 12 | 0.411 | Valid | 32 | 0.697 | Valid |
| 13 | 0.365 | Valid | 33 | 0.389 | Valid |
| 14 | 0.679 | Valid | 34 | 0.688 | Valid |
| 15 | 0.786 | Valid | 35 | 0.374 | Valid |
| 16 | 0.340 | Valid | 36 | 0.379 | Valid |
| 17 | 0.853 | Valid | 37 | 0.349 | Valid |
| 18 | 0.357 | Valid | 38 | 0.555 | Valid |
| 19 | 0.853 | Valid | 39 | 0.379 | Valid |
| 20 | 0.481 | Valid | 40 | 0.853 | Valid |

The importance of mathematical communication management is the subject of this research. Based on research problems in research, the results of research obtain very important information that without communication in mathematics we will have little information, data, and facts about students' understanding of mathematical processes and applications. This means, communication in mathematics helps teachers understand students' abilities in interpreting and expressing their understanding of mathematical concepts and processes they are learning. Mathematical communication management becomes a way to convey with the best language techniques in the community, so that in its application it is easy to understand that communication is the essence of teaching, learning, and assessing mathematics.

From the results of the study, we also revealed that the indicators of mathematical communication are as follows:

- The ability to draw (drawing), which includes the ability of students to express mathematical ideas in the form of drawings, diagrams or graphs.
- The ability to write (written text), which is in the form of the ability to provide explanations and reasons in mathematics with correct and easy to understand language.
- The ability of mathematical expressions (mathematical expressions), namely the ability to make mathematical models.

This has a corresponding relationship with (Kesumawati & Octaria, 2019), that to express mathematical communication skills can be done in various ways, such as discussion and work on various forms of questions, both multiple choice and description. The description of the questions that can be used to measure students' mathematical communication skills can be in the form of transfer questions, exploratory, elaborative, applicative, and estimating.

**Preliminary Study Data Analysis Techniques**

Preliminary study data in the form of observations, interviews were analyzed descriptively as a background for the need for Student Worksheets. The results of the review of various textbooks and SK and KD mathematics junior high school were also analyzed descriptively as a reference for preparing Student Worksheets.

**Technical Analysis of Feasibility Study Data on Student Worksheets**

Qualitative data from the comments and suggestions validator are described qualitatively as a reference to improve Student Worksheets. Quantitative data from a score of material experts and media experts are described quantitatively using a Likert scale with 4 scales and then explained qualitatively.

The steps for preparing the assessment criteria are:

1) Determine the number of intervals, i.e. 4,
2) Determine the range of scores, i.e. maximum and minimum scores,
3) Calculate class length (p), i.e. range of scores divided by number of classes,
4) Arrange interval classes starting from the smallest to the largest score.

Assessment categories and value intervals for each category are shown in Table 11.

**Table 11.**

*Interval Value of Each Assessment Category*

| No | Assessment category | Value Intervals |
|---|---|---|
| 1 | Very good | ($S$ min + 3p) $< S \leq S$ max |
| 2 | Good | ($S$ min + 2p) $< S <$ ($S$ min + 3p – 1) |
| 3 | Less | ($S$ min + p) $< S <$ ($S$ min + 2p – 1) |
| 4 | Very less | ($S$ min) $< S <$ ($S$ min + p – 1) |

$S$ : Expert validation score
$S$ min : Lowest score
$S$ max : Highest score
$p$ : class interval

**Data Analysis Techniques Field Trial**

The data analysis technique during the Student Worksheets trial was carried out by analyzing the scale sheet given to students after the Student Worksheets trial. This analysis technique is used to measure the level of readability and interest of students in using Student Worksheets. Student response scales were analyzed using a Likert scale with four criteria. The value interval and assessment criteria used are the same as the analysis at the validation stage of Student Worksheets, which is in Table 10.

**Field Test Data Analysis Techniques**

There are two data analysis techniques obtained when giving instruments in the field test, namely mathematical communication skills data and self-efficacy data

**Mathematical Communication Skills**

The results of posttest students' mathematical problem solving abilities that refer to the indicators that have been made are given a score in accordance with scoring guidelines. (Jermsittiparsert & Sawasdee, 2012) said that "the ideal learning completeness for each indicator with a minimum ideal criteria of 75%". It means that ideal learning completeness occurs if 75% of all students are said to be complete or get a score above the KKM of 70. To calculate the percentage of mastery learning used the following formula:

$$P = \frac{\text{the number of students who have completed their studies}}{\text{the number of students}} x100\%$$

**Self-Efficacy**

1) Data retrieval is done by giving scale sheets to students after learning (posttest). The calculation is done using Microsoft Excel 2010. The steps to calculate the tendency of student attitudes according to (Muhamad Syazali, 2015) are as follows.
2) Classifying statement items with each aspect.
3) Add up the scores obtained in each category.
4) Finding the average score of each category of trial results as a neutral score.
5) Finding the average neutral score item in each aspect as a neutral score class.
6) Adding the results of the times between the scores of each category with the scores of the trial results, then dividing it by the number of students as SKL score items.
7) Look for the average item statement in each aspect as SKL score.
8) Comparing neutral scores with SKL scores.

This research in Student Worksheets through the Problem Based Learning model to improve mathematical communication skills and self efficacy. The development of this Student Worksheets includes:

- The structure of the presentation topic is determine the value of two variables linear equations in real context, make mathematical models of real problems related to linear equations of two variables, find equivalent concepts, practice exercises that measure mathematical communication.
- The questions in Student Worksheets are made simply in the form of everyday problems that can be solved in groups. The problems presented help students to interpret, analyze, and draw conclusions from these problems.

- Display Student Worksheets in the form of images and presentation languages that use language that is often heard and easily understood by students but still leads to work.

The posttest results show that mathematical communication indicators are writing, drawing, mathematical expression. The indicator with the highest percentage is writing and the indicator with the lowest percentage is mathematical expression (expression mathematic) because students have difficulty in expressing mathematics in the form of symbols.

Results in the study of the development of problem-based Student Worksheets applied to PLDV grade VIII MTs N 2 Bandar Lampung, an indicator of students' self-efficacy with the highest percentage on psychological index indicators. The lowest indicator is the indicator of performance achievement. This is because many students depend on each other in their groups

## Recommendations

Based on the conclusions of the results and discussion the researchers gave suggestions that they should pay attention to the problem-based Student Worksheets guide in each section so that it is easier to participate in learning, and some students who show a passive attitude during learning with Problem-based Student Worksheets should be made work on Student Worksheets with motivation, reward and punishment. Student Worksheets are made more colorful and more interesting and inserted game activities although not necessarily in every meeting so that makes students more interested in understanding the material and working on the questions.

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