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Development of Student Activity Sheets for System of Linear Equation Two Variables Based on Problem Solving in Junior High School

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ABSTRACT

This study aims to produce student activity sheets for system of linear equation two variables based on problem solving that valid and practical also look at potential effects on student's problem-solving abilities. The research method used is the Tessmer model development research, which stages consist of self review, expert review, one to one, small group and field test. The data collection techniques used in this research are questionnaire, test and interview. The questionnaire and test research data were analyzed by quantitative descriptive method, while interview research data were analyzed by qualitative descriptive method. The validity of the student activity sheets can be seen from three aspects, namely content, construct and language carried out at the expert review stage as well as comments and suggestions from the results of the one-to-one trial. The practicality of student activity sheets can be seen from the calculation results of the practicality questionnaire given at the small group stage. Based on expert review validation, one to one trial results and the results of the questionnaire calculation, the developed of student activity sheets has a validity percentage of 84.9% and has a practicality percentage of 89% with very practical criteria so that a valid and practical student activity sheet is obtained. The developed of student activity sheets also has a potential effect on problem solving seen from the overall test results that students can complete the given test questions with the description of 4 students categorized as very good with a percentage of 22.2%, 7 students categorized as good with a percentage 38.89%, 4 students categorized as enough with a percentage 22.2% and 3 students categorized as less with a percentage 16.67%.

Keywords: *Student Activity Sheets, Problem Solving, System of Linear Equation Two Variables.*

1. INTRODUCTION

Mathematics is not only a basic science in education, but also a tool used to develop abstract ways of reasoning so that mathematics is needed by humans to deal with advances in science and technology [1]. *National Council of Teachers of Mathematics* (NCTM) argues that in learning mathematics there are several subjects, namely numbers and their operations, algebra, geometry, measurement, data analysis and probability [2]. Algebra is one of the mathematical sciences that has many implementations in everyday life and has a role in the process of solving problems [3]. One of the algebraic materials that can be used in problem solving and is closely related to everyday life is system of linear equation two variables [4].

System of linear equation two variables is one of the important lesson to learn because it is a continuation of the system of linear equation one variable and prerequisite lesson from system of linear equation three variables [5]. In addition, system of linear equation two variables is contained in the topic of equalities and inequalities of algebraic content contained in *Trends in International Mathematics and Science Study* (TIMSS) with an algebraic proportion of 30% [6]. The TIMSS results in the last 10 years, Indonesia was ranked in the top 5 lowest. The low learning outcomes are caused by students who still have problems understanding concepts, obstacles in understanding the system of linear equation two variables prerequisite lesson, obstacles in presenting mathematical models from the story problems presented, as well as obstacles in using methods to find the completion set [7,8].

Low learning outcomes are also influenced by student learning activities. Students who tend to be active will get better learning outcomes than students who tend to be passive [9]. Learning activities are activities that require students to pay attention, listen, and understand the lesson presented by educators so that students are expected to provide feedback such as opinions, questions and feelings and their will [10]. This learning activity is very important, because the activities carried out by students can develop creative thinking skills in mastering the material and foster student curiosity [10]. Learning activities can also create an impression between students and educators in learning activities [11].

But in fact, the activeness of students in mathematics learning activities is less visible, especially on the system of linear equation two variable [12]. Less active students are caused by the selection of models, methods or learning approaches that are not appropriate [13]. In addition, the inactivity of students is due to learning activities that are dominated by the teacher (teacher center) where students only listen to the concepts presented [14]. Another cause is the unfocused attention of students on learning that seems boring and student's assumption that mathematics is synonymous with memorizing formulas so that learning activities are monotonous [15,16].

To make students actively involved, educators need media or learning materials to bridge these learning activities [17]. Student Activity Sheets is a teaching material that can support the activities of students in learning activities and act as a medium for students in solving mathematical problems [18]. Student Activity Sheets A good one can also involve students actively in teaching and learning activities and can make teaching and learning activities more meaningful [19].

But in reality, existing teaching materials have unattractive designs so that students do not have motivation in learning activities and do not contain real contexts such as those in everyday life so that these activities become meaningless [20]. In addition, the existing teaching materials generally only contain a summary of the lesson and evaluative questions, in other words, the answers to these questions are already contained in the summary of the lesson [21]. This causes students not to be serious about being actively involved in learning activities.

Therefore, learning activities or activities will occur if educators deliver material using a good approach [22]. One of the right approaches for system of linear equation two variables lesson is Problem Solving [23]. Problem solving has 4 stages, namely understanding the problem, formulating a plan, implementing the plan and checking again [24]. This approach begins with presenting a problem so that students can deepen their

knowledge by using what they know and what they need to solve the problems that have been presented [25].

2. METHOD

2.1. Research Design

The type of research in this research is development research which aims to produce student activity sheets for system of linear equation two variables based on problem solving that valid and practical also look at potential effects on student's problem solving abilities on grade VIII A of Srijaya Negara Palembang junior high school. The research subjects in this study were 18 students. The student activity sheets development procedure in this study consisted of two stages, namely the preliminary study stage (preparation stage, analysis stage and design stage) and formative evaluation stage (evaluation and revision stage) which consisted of *self evaluation, expert, reviews, one to one, small group and field test* [26].

2.2. Procedure

2.2.1. Preliminary Stage

The Preliminary stage consists of three stages, namely preparation, analysis and design. At the preparation stage, the researcher will determine the place of research, contact the school or subject teacher, determine the research subject, develop research instruments, arrange research permits and other needs. After doing the preparation, the researcher will do the analysis. In the analysis stage, researchers will analyze 3 things including students, curriculum and materials. The last stage of the Preliminary is the Design stage, where the researcher will design or design student activity sheets for problem-solving-based system of linear equation two variables materials that focus on three aspects, namely content, construct and language. The result of this design stage is called Prototype.

2.2.2. Formative Evaluation Stage

The Formative Evaluation stage consists of 5 stages. However, the stages used in this study were only up to the small group. The explanation of these stages is as follows:

2.2.2.1. Self-Evaluation

Products that have been designed according to the framework that has been planned at the previous stage will be evaluated by the researchers themselves with suggestions or input from the supervisor, if there are errors in writing or so on. The result of this stage is called Prototype 1.

2.2.2.2. Expert Review

After producing Prototype 1, the product will be validated by a validator consisting of one mathematics education lecturer and one mathematics teacher using the validation sheet provided by the researcher. The validity of the student activity sheets assessed is the content or content related to the system of linear equation two variables material, constructs related to the suitability of one activity with other activities, as well as the suitability of the language used. Suggestions and input from the validator will be used to improve the product being developed. Validator sheets were analyzed using the likert scale with the following scale [27]:

Table 1. Validation sheet assessment category

Score	Category
4	Very Good
3	Good
2	Fair
1	Not Good

Next, the score obtained from the validation data sheet is calculated to see the validity of the student activity sheets with the following formula:

$$Validity\ score = \frac{number\ of\ scores\ obtained}{maximum\ scores} \times 100\%$$

The validity score that has been obtained is used to determine the level of validity of the student activity sheets that has been validated through the validity criteria presented in the following table [27]:

Table 2. Criteria validated

Level of Validity	Criteria Validated
85,1% - 100%	Highly Valid or can be used without revision
70,1% - 85%	Valid enough or can be used eith minor revision
50,1% - 70%	Invalid or unusable
0,1% - 50%	Very Invalid

2.2.2.3. One to One

Still using Prototype 1, the product will also be tested with individual subjects. The researcher used three students who were selected based on the recommendation of the subject teacher and the willingness of the students themselves. The goal is to see the difficulties or obstacles of the subject while using student activity sheets. The trial was conducted online with students who would then be given comment and suggestion sheets in the form of a google form link to find out the difficulties obtained from the one to one

trial. The revised result of the expert review and one to one is called Prototype 2.

2.2.2.4. Small Group

After producing Prototype 2, the product will be tested with a group of students. The researcher used 6 students who were divided into 2 groups with 3 members in each group. The research subject at this stage is of course different from the research subject at the one to one stage. This trial was conducted online. After completing using student activity sheets, the subject will be given a student response questionnaire that aims to see the practicality of the product developed. Comments, suggestions, and difficulties encountered by students will be used to improve the product so that it gets a valid and practical student activity sheets. The revised result of the small group stage is called Prototype 3. The questionnaire sheet was analyzed using the Liket scale with the following practical criteria [28]:

Table 3. Likert scale statement format

Statement of Attitude	Score	
	Positive	Negative
Totally Agree	4	1
Agree	3	2
Disagree	2	3
Strongly Disagree	1	4

Table 4. Practicality criteria

Level of Achievement	Information
84% ≤ Na <100%	Very Practical
68% ≤ Na <84%	Practical
52% ≤ Na <68%	Less Practical
36% ≤ Na <52%	Impractical
20% ≤ Na <36%	Very Impractical

2.2.2.5 Field Test

After producing Prototype 3, the product will be tested with a group of students. The researcher used 6 students who were divided into 2 groups with 3 members in each group. This trial was conducted in a limited face-to-face basis. After finishing using the student activity sheets, the researcher will give a written test consisting of 3 questions for 60 minutes. Analysis of the written test is done by looking at the emergence of problem solving indicators. After the written test, the researcher will select several subjects to conduct interviews based on the results of the test answers.

Table 5. Value predicate category

Score	Criteria
$90 \leq n \leq 100$	Very Good
$80 \leq n \leq 89$	Good
$70 \leq n \leq 79$	Enough
< 70	Less

3. RESULT AND DISCUSSION

3.1. Preliminary Stage

In the first stage, namely the preparation stage, the research preparation carried out is the activity of developing student activity sheets. In addition, the researchers determined the school chosen as the research location, namely Sumsel Jaya junior high school to carry out one-to-one and small group trials. Next, the researcher met the principal of the Sumsel Jaya junior high school who was then directed to the homeroom teacher for class VIII to discuss so that he could obtain the information needed when carrying out the research, such as information about the research subject and the timing of the research. Then the researchers began to take care of administration such as research permits. After discussing with the homeroom teacher, the researcher got 3 students as one-to-one test subjects and 6 students as small group test subjects. Next, the researcher contacted the students who were the test subjects to inquire about their availability. However, only 1 student was willing to be the subject of a one-to-one trial so the researchers looked for 2 other students from different schools. This research was carried out online through the WhatsApp and Google Meet applications and was carried out outside of teaching and learning activities.

In the second stage, namely the analysis stage, the researchers analyzed three things. The first is student analysis which aims to determine the problem-solving abilities of the students to be studied. The researcher analyzed class VIII of Sumsel Jaya Palembang junior high school with the help of a math teacher and homeroom teacher. From the results of interviews with teachers, researchers found that student learning outcomes are low. This is because students are still difficult to master the material and represent a problem, thus causing low student learning outcomes. Then, the

teacher recommends 9 students as research subjects who will be divided into 3 students in the One To One trial stage and 6 students in the Small Group trial stage. Research subjects are selected based on the availability of students and students have studied prerequisite materials such as One Variable Linear Equation System. However, of the 3 students who have been recommended as One To One research subjects, only 1 student is willing, so the researchers asked for other recommendations to the mathematics teacher and homeroom teacher. After getting new recommendations from the mathematics teacher and homeroom teacher, the researcher asked the availability of these students to be the subject of the One To One trial research. However, the student was unwilling for several reasons. This causes the researcher to have to find a substitute subject outside the school, so that the researcher gets 2 students of class VIII outside the school. The second is curriculum analysis, where researchers conduct an analysis based on the curriculum based on Core Competencies and Basic Competencies that apply at Sumsel Jaya Palembang junior high school. And the last is material analysis, where this material is selected based on the results of discussions with supervisors and mathematics subject teachers, it is known that a two-variable linear equation system is an important material that is a prerequisite material for other materials. This material also has many benefits and implementations in everyday life. The indicators used are as follows: (1) Presenting a mathematical model of real problems related to system of linear equation two variables, (2) Determining the linear equation two variables solution, (3) Distinguishing linear equation two variables and system of linear equation two variables, (4) Determining the system of linear equation two variables solution using the graphical method, (5) Determine the solution of system of linear equation two variables using elimination and substitution methods, (6) Solve problems related to system of linear equation two variables.

The third stage is the Design stage. Researchers designed a problem-solving student activity sheets based on system of linear equation two variables material which contains student activities. The design process begins with formulating indicators and learning objectives and determining appropriate and appropriate activities. The draft of the contents of the student activity sheets to be developed is structured as follows:

Table 6. Students' Worksheet frame

Student's Worksheet Program	Content
Front Cover	<ol style="list-style-type: none"> 1. Title : Student Activity Sheet 2. Material Name : system of linear equation two variables 3. Author Name : Debi Suci Putri 4. Curriculum : 2013 (revision) 5. Group Member Name 6. Dry and Date 7. School Name 8. Time Allocation
Page 1 & 2	<ol style="list-style-type: none"> 1. Basic Competence 2. Indicator of Achievement of Basic Competence 3. Learning Objective 4. Instruction for Use 5. Basic Concepts
Lesson Plan	<ol style="list-style-type: none"> 1. The first meeting Student Activity Sheets Activities that direct students to be able to present mathematical models of real problems, determine the completion of linear equation two variables and distinguish between linear equation two variables and system of linear equation two variables 2. The second meeting Student Activity Sheets Activities that lead students to be able to determine the completion of system of linear equation two variables using graph, elimination and substitution methods
Back Cover	A brief explanation of the Problem Solving-based Student Activity Sheets

3.2. Formative Evaluation Stage

3.2.1. Self-Evaluation

At this stage, the researcher and his supervisor assessed the design and construct of the problem-solving-based student activity sheets material for system of linear equation two variables that was developed. If there are errors in terms of construct, content and language, the researcher will revise. The result of the revision at this stage is called Prototype 1.

3.2.2. Expert Review

At this stage, the researcher validates the student activity sheets that has been developed. The validity of

this student activity sheets focuses on content, construct and discussion which will then be discussed and corrected by two validators. The student activity sheets validation process is carried out by asking questions and filling out the student activity sheets validation sheet where the validation sheet contains 17 statements consisting of content, construct, and language. Based on the validation that has been done, the average percentage of validity is 84.9% which indicates that the problem-solving student activity sheets based on system of linear equation two variables material is quite valid but needs to be revised based on comments and suggestions from the validator. The comments and suggestions from the validator are as follows:

Table 7. Comments and suggestions along with revised decisions

Validator	Comment and Suggestion	Revised Decision
Validator A	<ul style="list-style-type: none"> • Because what you want to develop are activities in the system of linear equation two variables material, the content of the student activity sheets should be activities not Problem Solving. So develop activities that invite students to be active in the form of 	<ul style="list-style-type: none"> • The contents of the student activity sheets have been corrected according to suggestions

	activities instead of doing questions like student worksheet in general	
	<p>For Student Activity Sheets Meeting 1</p> <ul style="list-style-type: none"> Swimsuit image replaced with beach ball The image of the glasses is replaced with a more realistic one Activities at the first meeting are still not visible, preferably those that are not activities should not be included In the activity of distinguishing between linear equation two variables and system of linear equation two variables, a column is added to write the reason The Cartesian coordinates are given a grid (boxes) and write down the x-axis and y-axis 	<ul style="list-style-type: none"> Image has been changed Image has been changed What is not an activity has been removed The reason column has been added Grid and axis captions added
	<p>For Student Activity Sheets Meeting 2</p> <p>Problem solving questions are replaced with hands-on activities</p>	It has been replaced with activity
Validator B	<p>For Student Activity Sheets Meeting 1</p> <ul style="list-style-type: none"> The sequence of activities is considered again In activities 2 and 3, it is better to replace the beach ball with glasses to make more sense Add one activity after activity 2 and 3 which is a combination of activity 2 and 3 Make a conclusion column in activities 2 and 3 in the first meeting to write down the settlement set No need to talk about graphics first 	<ul style="list-style-type: none"> Already repaired Information on the problem has been changed Activities have been added Conclusion column has been added Graphic activity removed
	<p>For Student Activity Sheets Meeting 2</p> <ul style="list-style-type: none"> Ready to use 	<ul style="list-style-type: none"> No improvement

3.2.3. One-to-One

Besides being given to an expert review, the prototype was also tested on 3 students to see the validity of the problem-solving student activity sheets based on the system of linear equation two variables material that had been developed. The students consisted of one student of Sumsel Jaya Junior High School Palembang, one student of Junior High School Number 8 Palembang and one student of Junior High School Number 1 Pangkalanbaru. The one-to-one trial was held on September 03, 2021 to September 05, 2021. On September 3, 2021, the researcher gave student activity sheets meeting 1 and meeting 2 via WhatsApp group and asked students to do the student activity sheets given. Students ask the researchers about the difficulties during LAS work and then collect the results of the student activity sheets work through private channels. On September 5, 2021, researchers interacted with students via Zoom to find out what difficulties

were received by students during student activity sheets work, so they could provide input to improve student activity sheets. After conducting an online meeting via Zoom, the researcher provided a Google Form link to view student suggestions and comments on the student activity sheets that had been given. Here's a comment from a one-to-one test subject. .

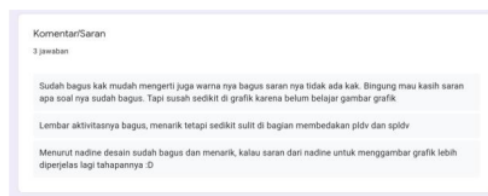


Figure 1 Comment and suggestion of one-to-one subject.

Based on the researcher's observations of the results of student answers on the student activity sheets and the

comments sheet that has been filled out, students can follow the steps in the activities contained in the student activity sheets, it's just that there is some confusion that causes errors in several steps in activities on the student activity sheets such as drawing graphs. Students provide input that the graphing section is difficult to understand and difficult to distinguish between linear equation two variables and system of linear equation two variables.

This is because students have not studied the material for straight-line graphs and the steps of the activities are less detailed, so the researchers improved the student activity sheets to make it easier to understand. The following are the overall results of observations regarding the difficulties experienced by students in doing student activity sheets at the one to one stage along with revision decisions:

Table 8. Observation results of One-to-One

Number	Student Difficulties	Revised Decisions
1	Students have difficulty in drawing graphs	Clarifying the information and the steps to answer it
2	Students have difficulty distinguishing linear equation two variables and system of linear equation two variables	Changed activity 4 to make it easier to differentiate between linear equation two variables and system of linear equation two variables

3.2.4. Small Group

The result of the revision of the expert review and one-to-one is called Prototype 2 which is then tested on a small group which is divided into 2 groups. One group consists of 3 students who are not the subject of the study. This trial aims to see the practicality of the problem solving-based system of linear equation two variables material student activity sheets that has been developed. The Small Group trial will be held on September 11, 2021 until September 12, 2021. Students are asked to do the student activity sheets given through the WhatsApp group by discussing with their group members. After the student activity sheets was completed, the researcher invited the students to have a virtual face-to-face meeting via Zoom to discuss the difficulties and confusion in doing the student activity sheets. Zoom meetings between group 1 and group 2 were conducted separately. This is because the schedule and availability of each group is different.

After the Zoom meeting, students were asked to fill out a practicality questionnaire through the google form provided by the researcher and write comments and suggestions on the student activity sheets as consideration for making further revisions. The questionnaire given consists of 10 questions which are divided into 7 positive statements and 3 negative statements and are filled out individually by students. The google form link is shared in the WhatsApp group after completing the meeting via Google Meet. The following are comments and suggestions from students at the small group stage.

Table 9. Comment and suggestion on small group

Initials	Comment and Suggestion
M	<ul style="list-style-type: none"> • Student activity sheets is good • In activity 3, the number of rows in the table is less
WPF	<ul style="list-style-type: none"> • Nice colors • Easy-to-understand learning
F	<ul style="list-style-type: none"> • Nice and interesting • In activity 4 meeting 1, add a box next to the table to make it easier
MRP	<ul style="list-style-type: none"> • Attractive student activity sheets display • In activity 3, the number of rows in the table is less • The elimination method is further clarified
PL	<ul style="list-style-type: none"> • Attractive design • Easy-to-understand steps • Nice color combination
MRAZ	<ul style="list-style-type: none"> • Student activity sheets has a good design • Activity table 3 less • It is recommended that the elimination section be made in steps

Based on students' comments and suggestions, overall it can be seen that students have given a positive assessment of the developed student activity sheets. It's just that there are several obstacles encountered, one of which is that students experience confusion in filling out the table in activity 3 to find the values of x and y because the number of table rows is less. In addition, students also have a little difficulty in the elimination and substitution sections because there are no activities

that guide students. Therefore, the researcher improved the number of table rows used in student activity sheets as well as the activity steps in the elimination and substitution methods to make it easier to understand.

Based on the results of the questionnaire calculation, the average percentage of validity is 89%, which indicates that the based on problem-solving student activity sheets system of linear equation two variables material has very practical criteria. After the small group trial results were obtained and the student activity sheets was revised based on comments and suggestions from students, prototype 3 was obtained which can be declared as a valid and practical product.

3.2.5. Field Test

Prototype 3 that has been obtained from the Small Group stage is then tested at this stage. The field test stage is the last stage in the formative evaluation. This stage was carried out in 3 meetings, where the first and second meetings carried out a direct learning process by forming groups consisting of 3-4 students who were then given problem-solving-based student activity sheets. After carrying out the learning process, and at the third meeting an online written test was conducted. This test consists of 3 questions in the form of a description of the system of linear equation two variables. This stage aims to determine the potential effect of the student activity sheets that has been developed on students' problem solving abilities

The following are the results of the VA subject's answers that bring up all the indicators for each item:

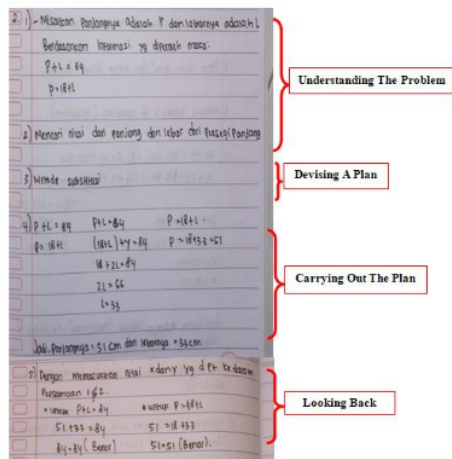


Figure 2 VA subject's answer.

In working on test questions, VA meets all indicators of problem-solving ability. The first indicator is that the VA can understand the problem by writing down what information is contained in the problem and what problems will be solved. VA can also make plans

by determining the strategies used in solving problems. Furthermore, VA is able to solve the problem using the method he has determined. In the recheck indicator, the VA can check the answer by substituting the results obtained into the initial equation.

The following are the results of the SA subject's answer which does not show an indicator of understanding the problem, checking again on the third item.

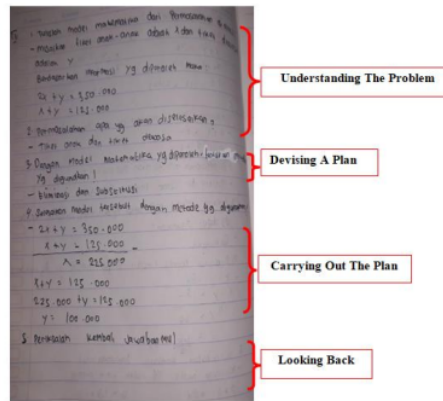


Figure 3 SA subject's answer.

In the answers to test questions number 1 and 2, SA fulfills all problem solving indicators. SA subjects can understand the problems given by writing down known information and what problems will be solved. SA subjects can also make plans and carry out the plans that he has drawn up. The re-examination indicator is also raised by substituting the results obtained into the initial problem. However, in item number 3, SA only fulfills the indicators of planning. In the indicator of understanding the problem, the SA subject did not bring up the indicator because he did not understand what the question meant. In the indicators of implementing the plan, the subject of the SA could not complete the plan that he had prepared completely. Because the two indicators did not appear, the SA subject could not re-examine because he did not get the answer to question number 3.

The following are the results of the PN subject's answers that do not show indicators for re-examining each item.

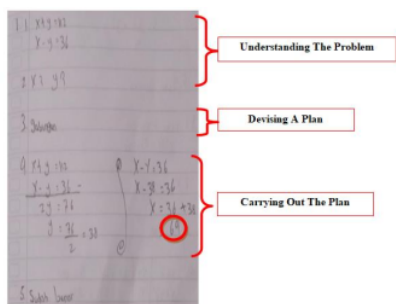


Figure 4 PN subject’s answer

In the answer to the test questions, PN only met three indicators of problem-solving ability, namely understanding the problem, planning and implementing the plan. PN writes down the information obtained from the problem and solves the problem with the strategy or method he has planned. However, there are some errors in the answers obtained. This is due to the inaccuracy of the PN subject in carrying out the plan so that there are errors in counting. PN subjects also did not check back. Based on the interview, this happened because the PN subject was in a hurry to finish the questions and was not used to re-examining the work he had made.

Table 10. Emergence of problem solving capability indicators

Subject	Question Number	Problem Solving Ability Indicator			
		1	2	3	4
VA	1	√	√	√	√
	2	√	√	√	√
	3	√	√	√	√
SA	1	√	√	√	√
	2	√	√	√	√
	3	-	√	-	-
PN	1	√	√	√	-
	2	√	√	√	-
	3	√	√	√	-

Furthermore, the results of all students' answers were analyzed according to the scoring rubric that had been made by the researcher where there were 4 students categorized as very good with a percentage of 22.2%, 7 students categorized as good with a percentage 38.89%, 4 students categorized as enough with a percentage 22.2% and 3 students categorized as less with a percentage 16.67%.

Based on the results of the test data analysis that has been carried out, overall students can solve the problems given which can be seen from good learning outcomes. This is in line with what was conveyed by Widodo and

Kadarwati that the problem-solving approach can increase the activeness and character of students in teaching and learning activities, so that it has an impact on increasing learning outcomes [29].

Based on the results of the interview analysis that has been carried out, it appears that the developed of student activity sheets is very helpful for students in understanding concepts and improving problem solving skills. This is line with what was conveyed by Siswono and Novitasari that the problem-solving approach can improve students mathematical abilities in solving problems and thinking creatively [30].

4. CONCLUSION

The development of problem solving-based student activity sheets on system of linear equation two variables material is carried out with a development procedure consisting of two stages, namely the preliminary stage (preparation stage, analysis stage and design stage) and formative evaluation stage (evaluation and revision stage) which consists of self evaluation, expert review, one to one and small group. After determining the school to conduct the research, the researcher conducted an analysis of the students, the applicable curriculum and the materials developed. Then the researcher designs or designs the student activity sheets according to the framework that has been prepared. After designing the student activity sheets, the researcher conducted a self review or evaluation of the student activity sheets independently so that there were not too many improvements when validated. The results of validation by the two validators who pay attention to content, construct and language have an average percentage of validity of 84.9%, which means that the student activity sheets developed is quite valid but needs to be revised based on comments and suggestions. Furthermore, it was also tested on 3 students at the one to one stage to find out what difficulties were received during the use of the student activity sheets, so that it could be used as input to be able to revise the student activity sheets. The practicality of the student activity sheets can be seen when students are able to do the student activity sheets given in a predetermined time and based on the results of filling out the student questionnaires, it is found that the average percentage of the questionnaire calculation is 89% which is included in the very practical category. This problem-solving-based student activity sheets also has a potential effect on students' problem-solving abilities. Judging from the analysis of student test results that overall students can complete the test questions given with 4 students categorized as very good with a percentage of 22.2%, 7 students categorized as good with a percentage 38.89%, 4 students categorized as enough with a percentage 22.2% and 3 students categorized as less with a percentage 16.67%.

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