



Journal of Educational Sciences

Journal homepage: <https://jes.ejournal.unri.ac.id/index.php/JES>



P-ISSN
2581-1657

E-ISSN
2581-2203

Development of a *Problem Based Learning* Media to Build Mathematical Communication Capabilities Students of Class VIII Junior High School

Hany Zahira^{*1,2}, Zulkarnain², Putri Yuanita²

¹Pondok Pesantren Babussalam, Pekanbaru, 28294, Indonesia

²Mathematics Education Postgraduate Program FKIP- Universitas Riau, Pekanbaru, 28293, Indonesia

ARTICLE INFO

Article history:

Received: 20 Jan 2020

Revised: 07 June 2020

Accepted: 22 June 2020

Published online: 24 July 2020

Keywords:

Learning Media

Mathematical Communication

Problem Based Learning

ABSTRACT

This research was motivated by the difficulties of teachers in implementing the 2013 curriculum, especially in the preparation of learning tools. This research was aimed to develop a valid, practical and effective learning tool for VIII grade junior high school students. This type of research was Research and Development with a 4-D model. Data collection instruments in this study were validation sheets, practicality sheets and tests of mathematical communication skills. Data were analyzed using validation criteria, practicality and effectiveness tests. The results obtained from the device validation show that the RPP is valid and the LKPD is quite valid. The practicality test results of small groups and large groups obtained very practical criteria. The effectiveness test can be seen from the percentage of student KKM achievement that is equal to 92% meets the effective criteria and the average difference test (t test) is obtained that $t_{count} > t_{table}$, which is $16.976 > 1.677$ and the significance value is < 0.05 . These results indicate that the developed learning tools are effective in improving students mathematical communication skills.

1. Introduction

The curriculum is a reference in the administration of the education system. The curriculum contains a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for organizing learning activities to achieve certain educational goals. Without an appropriate and appropriate curriculum, then the goals and objectives of education, no matter how good, will be difficult to achieve.

* Corresponding author.

E-mail: hanyzahira6391@gmail.com

Doi: <https://doi.org/10.31258/jes.4.3.p.487-500>

The birth of the 2013 curriculum is basically an effort to improve the quality of education in Indonesia. However, in its implementation many things must be observed and prepared. So far, teachers are only required to prepare lesson plans where the syllabus as a guideline for preparation has been prepared by the Central Government. In the 2013 curriculum the syllabus has not been designed by the Government. The government only gives Permendikbud which contains basic competencies that must be mastered by students according to subjects. Teachers are required to develop learning tools based on the Ministry of Education and Culture given by the Government.

Sumarno (2014) said that learning tools are used as a teacher's guide in implementing the learning process in the classroom so that the learning process can take place more directed towards the competencies to be achieved. The right learning device is a very important factor in preparing students for a learning experience. Before teaching, the teacher should have arranged a plan or learning tool.

One of the learning tools that must be present in every learning process is the Syllabus and lesson plans. According to Amri (2013) the RPP is elaborated from the syllabus to direct learners' learning activities in an effort to reach KD. Every teacher is obliged to prepare lesson plans in a complete and systematic manner so that learning takes place interactively, inspiratively, fun, challenging, motivating students to participate actively. In order to create good learning, the teacher must also provide opportunities for students to play an active and creative role in exploring abilities in each learning process. One alternative that teachers can use to support such learning situations and conditions is the use of Student Education Activity Sheets (LKPD). According to Amri (2013) LKPD is a learning material that provides student-centered activities. LKPD is a means or media for students to carry out activities that can be in the form of questions or steps with the aim of finding a concept.

Attachment to Permendikbud No. 58 of 2014 concerning the junior high school curriculum is explained that one of the goals of mathematics learning is communicating ideas, reasoning and being able to compile mathematical evidence using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem. The purpose of learning mathematics in this Permendikbud is in line with the goals formulated by NCTM (Wardani & Merona, 2016), namely learning to communicate. Puji (2019) said that in education, the learning process is identified by the process of delivering information or communication. Thus, communication is an important part of education, one of which is mathematics.

To achieve the goals of mathematics learning, the role of the learning model used by the teacher is very important. One learning model that can train students to communicate ideas, reasoning and be able to compile mathematical evidence using complete sentences, symbols, tables, diagrams, or other media to clarify a situation or problem is Problem Based Learning.

According to Choridah (2013) the characteristic of problem-based learning is that learning begins with a problem. With these problems, students will deepen their knowledge about what they know and what they need to know to solve the problem. In addition, the characteristics of problem-based learning models that are oriented to a problem related to the real world have a positive effect on the thinking process of students. Positive influence on students can be seen from the extent to which students in searching and finding a solution to a problem.

Based on the description described, the researcher intends to conduct research into the development of PBL-based mathematics learning tools to build mathematical communication skills in SPLDV grade VIII Middle School.

2. Methodology

This type of research was Research and Development (R&D). According to Sugiyono (2013) this research method was used to produce certain products, and test the effectiveness of these products.

The development model used is a 4-D model referring to the Thiagarajan and Semmel development theories (Endang, 2014) include:

a) Defining stage

1) Initial analysis

The researcher analyzes the availability and suitability of the learning tools used in schools according to the process standard.

2) Analysis of students

Student analysis is a study of the characteristics of students in accordance with the design and development of learning tools.

3) Analysis of tasks

Task analysis is identifying the main tasks or skills that students do during learning, then analyzing them into a more specific sub-skills framework.

4) Analysis of material

This analysis aims to identify, detail and systematically arrange relevant material submitted based on preliminary analysis.

5) Analysis of the specifications of learning objectives

In this activity indicators of the achievement of mathematical communication ability will be formulated with reference to the basic competencies and objectives to be achieved. After the existence of indicators, it can formulate learning objectives.

b) The design stage

1) Media selection

The researcher determines the appropriate and appropriate media to present the material of the Two Variable Linear Equation System (SPLDV) also in accordance with the learning model used.

2) Format selection

At this stage the researcher chooses the format for designing content, selecting learning strategies, and learning resources that are in accordance with the principles, characteristics, and steps that are appropriate to the learning model used.

3) Initial design

The initial design of the learning tools in this study included the RPP, LKPD and communication skills test instruments. The resulting design is called Draft I.

c) Development stage

1) Expert validation

The results of the initial draft, namely draft I, were validated by the validator, and revisions were used as a basis for improving the learning tools to get draft II

2) Development test

Draft II was tested in small groups to obtain input descriptively before being used in the large group test. The small trial aims to assess the readability of the LKPD. The researcher then revised the product again based on the weaknesses found to get the draft III. Draft III was tested on a large group to see the practicality of the device being developed.

3) Test the effectiveness

The effectiveness test is carried out during large scale trials. Students are given a test of mathematical communication skills to obtain effectiveness data. The effectiveness of a product is measured to see whether or not the influence of the device on the mathematical communication skills of students.

d) Dissemination stage

Disseminate stage is the stage of using tools that have been developed on a broader scale, for example in another class, in another school, by another teacher. Disseminate is done in the preparation of articles to be published in journals.

Research instrument

The research instrument was a tool used to collect data in a study. The research instruments were RPP, LKPD and mathematical communication skills test. While the data collection instruments were validation sheets, observation sheets of learning accomplishments, student questionnaire responses and student learning outcomes.

Data collection technique

In the process of developing the device, the researcher validated after draft 1 has been designed. The researcher gives draft 1 to the validator along with the validation sheet to be assessed so that the validation data is obtained. Validation data was analyzed to obtain the validity criteria of the device. Practicality data was obtained from students questionnaire responses. Response questionnaires

were given to all students whose learning process uses products that are developed. Response questionnaires were given at the end of the learning process to see students responses to the developed LKPD. The response questionnaire was analyzed to obtain the practicality criteria of the device. The effectiveness data is obtained from the mathematical communication skills test of students. A mathematical communication ability test is given to all students at the end of the meeting. The mathematical communication ability test data is analyzed to obtain the effectiveness criteria of the learning device.

Data analysis technique

a) Analysis of the validation sheet

According to Akbar (2013), to determine the results of the validation of learning tools can use a percentage of the score given by the validator with a maximum score. Then conclusions are drawn based on validity criteria. Learning devices are said to be valid if the percentage of validation is more than 70%.

b) Analysis of the practicality sheet

According to Akbar (2013) the practicality analysis technique is the percentage of the total score per item questionnaire with a maximum score of all students. Then the conclusion is drawn based on the practicality criteria. learning tools are said to be practical if the percentage of practicality is more than 70%.

c) Analysis of effectiveness

Analysis of effectiveness can be seen from the percentage of mathematical communication ability tests of students, namely the average minimum of 80% of students reach KKM (Hobri, 2010) and the average two difference test (t test) on the results of mathematical communication ability tests of experimental class and control class.

3. Results and Discussion

Research result

This research is to develop mathematical learning tools based on Problem Based Learning (PBL) on the material of the Two Variable Linear Equation System in class VIII of Junior High School. The tools should meet the valid, practical, and effective criteria which is assessed by the experts. The tool that was developed is related to basic competence 3.5 (KD 3.5) which is explaining the system of two-variable linear equations and their solutions related to contextual problems and 4.5. futuremore is to Solving problems related to the system of two-variable linear equations.

Figure 1 is one of the display devices developed, namely RPP and LKPD. The RPP component that researchers developed was in accordance with the 2013 Curriculum based on Permendikbud Number 22 of 2016.

LEMBAR KERJA PESERTA DIDIK (LKPD-2)

Mata Pelajaran : Matematika
Kelas / Semester : VIII / 1 (Genjil)
Materi Pokok : Sistem Persamaan Linear Dua Variabel
Alokasi Waktu : 2 JP

NAMA :

Menyelesaikan Sistem Persamaan Linear Dua Variabel Dengan Metode Grafik

Tujuan Pembelajaran:
Melalui proses mengamati, menanya, mengumpulkan informasi, mengolah informasi, mengkomunikasikan hasil mengolah informasi dalam penugasan individu dan kelompok, diharapkan peserta didik terlibat aktif dalam kegiatan pembelajaran serta dapat :

1. Mengidentifikasi bentuk SPLDV dengan memperhatikan bentuk umumnya
2. Menentukan model matematika dari masalah sehari-hari yang berkaitan dengan SPLDV secara individu maupun kelompok dengan rinci dan teliti
3. Menyelesaikan masalah sehari-hari dari model matematika yang berkaitan dengan SPLDV melalui metode grafik dengan tepat

Petunjuk:

1. Bacalah Lembar Kerja Peserta Didik (LKPD-2) berikut dengan cermat.
2. Anda diberi waktu untuk memikirkan dan mengerjakan LKPD-2
3. Kerjakanlah latihan yang disediakan secara individu

ORIENTASI PESERTA DIDIK KEPADA MASALAH

Amati gambar dan masalah matematika berikut ini!

Jihan dan Sarah pergi ke sebuah supermarket untuk membeli jeruk dan apel. Mereka membeli jeruk dan apel yang dijual dalam bentuk paket. Jihan membeli paket "4 kg jeruk dan 2 kg apel" dengan harga Rp. 112.000,-. Sedangkan Sarah membeli paket "2 kg jeruk dan 4 kg apel" dengan harga Rp 128.000,-. Sesampai di rumah Agila juga ingin membeli buah tersebut, namun ia terlebih



Sumber: google

RENCANA PELAKSANAAN PEMBELAJARAN (RPP-2)

Nama Sekolah : SMP
Mata Pelajaran : Matematika
Kelas/Semester : VIII / 1
Materi Pokok : Sistem Persamaan Linear Dua Variabel
Alokasi Waktu : 2 JP

A. Kompetensi Inti

KI-1 : Menghargai dan menghayati ajaran agama yang dianutnya
KI-2 : Menunjukkan perilaku jujur, disiplin, tanggung jawab, peduli (toleransi, gotong royong), santun, percaya diri, dalam berinteraksi secara efektif dengan lingkungan sosial dan alam dalam jangkauan pergaulan dan keberadaannya
KI-3 : Memahami dan menerapkan pengetahuan (faktual, konseptual, dan prosedural) berdasarkan rasa ingin tahunya tentang ilmu pengetahuan, teknologi, seni, budaya terkait fenomena dan kejadian tampak mata
KI-4 : Mengolah, menyajikan dan menalar dalam ranah konkret (menggunakan, mengurai, merangkai, memodifikasi, dan membuat) dan ranah abstrak (menulis, membaca, menghitung, menggambar, dan mengarang) sesuai dengan yang dipelajari di sekolah dan sumber lain yang sama dalam sudut pandang/teori

B. Kompetensi Dasar (KD) dan Indikator Pencapaian Kompetensi (IPK)

Kompetensi Dasar (KD)	Indikator Pencapaian Kompetensi (IPK)
3.3 Menjelaskan sistem persamaan linear dua variabel dan penyelesaiannya yang ditubungkan dengan masalah kontekstual.	3.3.3 Mengidentifikasi bentuk SPLDV 3.3.4 Menentukan selesaian SPLDV dengan metode grafik
4.5 Menyelesaikan masalah yang berkaitan dengan sistem persamaan linear dua variabel.	4.5.3 Membuat model matematika dari masalah sehari-hari yang berkaitan dengan SPLDV 4.5.4 Menyelesaikan model matematika dari masalah sehari-hari yang berkaitan dengan SPLDV melalui metode grafik

C. Tujuan Pembelajaran
Melalui proses mengamati, menanya, mengumpulkan informasi, mengolah informasi, mengkomunikasikan hasil mengolah informasi dalam penugasan individu dan kelompok, diharapkan peserta didik terlibat aktif dalam kegiatan pembelajaran serta dapat :

1. Mengidentifikasi bentuk SPLDV dengan memperhatikan bentuk umumnya
2. Menentukan model matematika dari masalah sehari-hari yang berkaitan dengan SPLDV secara individu maupun kelompok dengan rinci dan teliti
3. Menyelesaikan masalah sehari-hari dari model matematika yang berkaitan dengan SPLDV melalui metode grafik dengan tepat.

Figure 1. Display of RPP and LKPD

The RPP and LKPD that researchers developed as many as 5 meetings. In the lesson plan learning activities use Problem Based Learning (PBL) based learning models. LKPD is made in color and attractive with pictures. Activities in LKPD also use a Problem Based Learning (PBL) based learning model, which starts from a contextual problem.

In addition to learning tools, the test was developed based on four aspects of the formulation of mathematical communication ability indicators related to SPLDV material. The indicators that researchers use are:

- 1) State everyday events in language or mathematical symbols
- 2) Making conjectures, compiling arguments, formulating definitions, and explaining / asking questions about mathematics.
- 3) Describe the situation of an issue into pictures, tables, diagrams, or graphs.
- 4) Explain mathematical or verbal ideas, situations and relations with real objects, pictures, graphics, and algebra

The test was developed in the form of a description of the problem relating to contextual issues. The test is given to two classes to see the achievement of students' mathematical communication skills, especially in class VIII.1 SMP Dwi Sejahtera Pekanbaru in mastering SPLDV material.

Device validation

Device Validation is an assessment of the initial draft of the lesson plans, lesson plans, LKPD and tests of mathematical communication skills by experts or validators. The results of the RPP validation are presented in Table 1 below.

Table 1. RPP Validation Results

No	Rated Aspect	RPP-1	RPP-2	RPP-3	RPP-4	RPP-5
1	Theory	91,67%	89,29%	85,71%	90,48%	89,29%
2	Presentation	93,33%	90,42%	86,67%	91,25%	92,50%
3	Language use and legibility	80,56%	80,56%	80,56%	83,33%	83,33%
Average Total Validity (RTV)		88,52%	86,75%	84,31%	88,35%	88,37%
Criteria		Very Valid				

Based on Table 1 an overall average of 87.26% is obtained with a very valid category. However, there are a number of suggestions for improvement, one of which is in the apperception section, where each meeting is almost the same, so the validator suggests changes.

The results of the LKPD validation are presented in Table 2 below.

Table 2. Results of LKPD Validation

No	Rated Aspect	LKPD-1	LKPD-2	LKPD-3	LKPD-4	LKPD-5
1	Display	87,50%	85,40%	85,42%	83,33%	85,42%
2	Theory	86,11%	90,28%	87,50%	87,50%	86,11%
3	Language and legibility	77,08%	77,08%	83,33%	79,17%	85,42%
Average Total Validity		83,56%	84,26%	85,42%	83,33%	85,65%
Criteria		Valid Enough	Valid Enough	Very Valid	Valid Enough	Very Valid

Based on Table 2 an overall average of 84.44% means that the developed LKPD is categorized as quite valid. In the language indicator and the readability of the validator gave a slightly lower assessment of the others because the use of language in LKPD questions still makes students confused to understand it because the presentation is too long. The three validators concluded that LKPD could be used with minor revisions. While the results of the validation of the mathematical communication ability test instrument are presented in Table 3 below.

Table 3. Instrument Validation Results for Mathematical Communication Capability Tests

No	Rated Aspect	Validator 1	Validator 2	Validator 3	Overall average
1	Material aspects	75,00%	56,25%	81,25%	70,83%
2	Construction	62,50%	68,75%	87,5%	72,92%
3	Language Aspects	75,00%	58,33%	83,3%	72,22%

Based on Table 3, an overall average of 71.99% is obtained, meaning that the mathematical communication ability test instrument is in the quite valid category. There are several things that need to be revised, namely a matter that is too long a discourse that will make students lazy to read. Then the language of the questions is still not communicative so the questions of the questions cannot be understood by students.

Development Test

After the revision of the device validation, the device will be tested with a small group. Trials were conducted on 8 students giving LKPD and questionnaire responses to each student to be filled in after students finished answering LKPD. The results of the questionnaire responses of students to the readability of LKPD are presented in Table 4 below.

Table 4. LKPD Readability Results

No	Rated Aspect	LKPD 1	LKPD 2	LKPD 3	LKPD 4	LKPD 5
1	Display	93,75%	92,19%	96,88%	96,88%	96,88%
2	Theory	91,8%	92,19%	93,4%	93,75%	94,53%
3	Language	92,19%	93,75%	93,36%	93,75%	93,75%
	Overall Average	92,58%	92,71%	94,66%	94,79%	95,05%
	Criteria	Very Practical				

Based on Table 4, an overall average of 93.96% obtained means that the readability of LKPD based on the PBL model on this SPLDV material is very practical for students to use.

After the revision of the small group trial, continued with the large group trial. This trial was conducted on eighth grade students of SMP Dwi Sejahtera Pekanbaru to obtain practicality and effectiveness data. The practicality data of the learning device are known from the results of observations of the implementation of learning and the analysis of the results of students' responses in the classroom testing of learning devices. Observation of the implementation of learning is used to see the practicality of lesson plans. The results of observing the feasibility of learning are presented in Table 5 below.

Table 5. Observation Results for Workability

Rated Aspect	Average	Criteria
Preliminary activities	92%	Very Practical
Core activities	80%	Very Practical
Closing activities	88,8%	Very Practical

Based on Table 5 an overall average of 85.47% is obtained with a very practical category. That is, in implementing PBL all stages have been implemented well. However, in the core activities of students it is still difficult to answer LKPD because in PBL students have not received material and have to construct their own knowledge.

Questionnaire responses of students to see the practicality of LKPD. The results are presented in Table 6 below

Table 6. Results of Student Responses

No	Indicator	LKPD 1	LKPD 2	LKPD 3	LKPD 4	LKPD 5
1	Display	92,71%	95,31%	93,75%	96,35%	96,88%
2	Theory	89,58%	89,84%	93,75%	95,05%	95,96%
3	Language	94,27%	92,19%	94,27%	95,83%	97,4%
	Overall Average	92,19%	92,45%	93,92%	95,75%	96,74%
	Criteria	Very Practical				

Based on Table 6 an overall average of 94.21% is obtained with a very practical category. Students state that the LKPD developed helps them learn SPLDV material.

Test the Effectiveness

The effectiveness test was conducted on two classes, namely the experimental class and the control class. Experiment class is a class where the learning process uses learning tools that are developed while the control class is a class where the learning process uses learning tools that have been used by the teacher before. Both classes were given the initial and posttest tests (tests of mathematical communication skills). This test aims to assess the quality of learning tools used in terms of effectiveness. The effectiveness test was analyzed through the completeness of students' learning outcomes, namely the mathematical communication skills of students and the average difference test.

1) Completeness Analysis of mathematical communication skills

Students who reached the KKM on the mathematical communication skills test numbered 22 of 24 students, with a percentage of 92%. This shows that the percentage has exceeded the minimum percentage of devices said to be effective (80%). So it was concluded that the learning device developed was effective to improve students' mathematical communication skills.

2) Analysis of Average Difference Test (t test)

Before the t test is performed, the prerequisite tests that must be met are the normality and homogeneity tests for each group. Following are the results of the analysis of normality and homogeneity tests in tabular form. The normality test uses the Kolmogorov-Smirnov test through SPSS 16.00 which the calculation results are presented in Table 7 below

Table 7. Pretest Data Normality Test Mathematical Communication Capabilities

		Experiment	Control
N		24	25
Normal Parameters ^a	Mean	41.44	39.56
	Std. Deviation	7.323	6.277
Kolmogorov-Smirnov Z		.462	.710
Asymp. Sig. (2-tailed)		.983	.695

a. Test distribution is Normal.

Table 7 shows the pretest data of students' mathematical communication skills obtaining a significance value of greater than 0.05, which means the data is normally distributed.

Table 8. Test Normality of Posttest Data Mathematical Communication Capabilities

		Experiment	Control
N		24	25
Normal Parameters ^a	Mean	89.47	44.22
	Std. Deviation	10.328	8.253
Kolmogorov-Smirnov Z		.754	.609
Asymp. Sig. (2-tailed)		.620	.852

a. Test distribution is Normal.

Table 8 shows the data post-test mathematical communication skills of students obtained a significance value of greater than 0.05, which means the data are normally distributed.

Homogeneity test is done to find out whether the experimental class and the control class have the same variance (homogeneous) or not before getting different treatment. Homogeneity test results of the pretest data are presented in Table 9 below

Table 9. Test Homogeneity of Pretest Data Mathematical Communication Capabilities

Test of Homogeneity of Variances			
KKM			
Levene Statistic	df1	df2	Sig.
.176	1	47	.677

Based on Table 9 it is known that the results of the pretest homogeneity test analysis for the experimental class and the control class show a significance value > 0.05, which means homogeneous.

Table 10. Homogeneity Test of KKM Posttest Data

Test of Homogeneity of Variances				
KKM	Levene Statistic	df1	df2	Sig.
	1.059	1	47	.309

Based on Table 10, it can be seen that the results of the post test homogeneity analysis for the experimental class and the control class show a significance value > 0.05 which means homogeneous.

After the results of the analysis prerequisite test that tests of normality and homogeneity have been met, showing that the data are normally distributed and homogeneous. Next, the analysis conducted is the t test of the students' mathematical communication skills posttest data. The results of the analysis are presented in Table 11 below.

Table 11. Test Differences in Mean Data Post-Test Mathematical Communication Capabilities

Class	N	Mean	Standard Deviation	F	Sig.	T _{Count}	Sig (2-tailed)
Experiment	24	89,47	10,328	1,059	0,309	16,976	0,000
Control	25	44,22	8,253				

Based on Table 11, it was found that the value of $t_{count} > t_{table}$, that is $t_{table} = 1.677$ and the significance value was < 0.05 . These results indicate that there are differences in mathematical communication skills between the experimental class and the control class. Thus, it can be concluded that the learning device has a significant effect on the mathematical communication skills of students of class VIII SMP. This means that devices developed are effective for improving students' mathematical communication skills.

Discussion

Nieveen in Novrini et al (2015) states that learning devices are said to have good quality if they are valid, practical and effective. Based on the description of the results of the validation of the RPP, LKPD for SPLDV material can be concluded that the learning tools developed have met the validity criteria.

Based on the observation sheet the implementation of teacher activities in the learning process towards the use of lesson plans, as well as the questionnaire of students' responses to the use of LKPD it can be concluded that the RPP and LKPD have fulfilled practical criteria. Based on the test results (mathematical communication skills) of students it can be concluded that the learning device developed is effective for improving students' mathematical communication skills.

These results are in line with research conducted by Fitriatul (2017) in class VIII of SMP. The results showed the mathematics learning tools developed each met valid criteria with the "good" category. The results of practicality assessments by teachers in the "good" category, the "very good" category based on student responses and the "very good" category based on observations of the implementation of learning. Learning tools developed are effective based on students' mastery learning. The percentage of students who completed the mathematics communication skills test reached 84.38% and the learning achievement test reached 81.25%. This is because in PBL students are confronted with real-world problems that encourage students to think logically and find solutions by linking these problems with mathematical formulas. In problem-based learning there is a stage where students are asked to investigate through group discussions. Each group member can ask each other questions, answer, criticize and clarify any mathematical concepts that arise in the given problem.

In line with the research conducted by Atika (2020) on PBL activities students are given guidance in stating daily events into mathematical language based on a given problem, using terms, notations or formulas and structures to present ideas carried out by guiding students in solving problems based on information gathering. Then draw conclusions from the solutions provided, the results of discussions that have been carried out in groups are then guided to make conclusions from the results of discussions that have been obtained. By guiding students, mathematical communication skills can be improved.

The results of research conducted by Duscri et al (2017), showed mathematical communication skills of students in the first cycle reached 60% completeness then in the second cycle increased to 95.83%. The way to apply PBL models in class IX-6 Banda Aceh 8 Middle School that can improve mathematical communication skills is to apply according to the PBL model phase to give contextual problems and in accordance with the real world of students, guide the mathematical communication steps that appear in each LKPD, and give a real appreciation to every student who asks or responds to questions.

According to Kodariyati and Astuti (2016) presentation activities can train students to dare to speak in front of others and can develop their communication skills verbally to explain the results of their discussions and respond to the work of other groups. This makes the communication skills of students can be formed through the application of the PBL model in the learning process. In this study students worked individually on the problems found in LKPD. Students are asked to communicate in writing the problems found in the LKPD, in the fourth step students will be chosen randomly from the teacher to verbally communicate the results of solving the problems they get.

4. Conclusion

Based on the results of research and discussion, it is concluded that the product development of PBL-based learning tools on the subject matter of Linear

Equation Two Variables (PLDV) meets the validity criteria with the validity level being in a very valid category, fulfills the practicality criteria with the practicality level being in the very practical category and fulfills the criteria effectiveness in terms of mathematical communication skills of students.

References

- Akbar, S. (2013). *Instrumen Prangkat Pembelajaran*. Bandung: PT. Remaja Rosdakarya.
- Amri, S. (2013). *Pengembangan dan Model Pembelajaran dalam Kurikulum 2013*. Jakarta: Prestasi Pustaka.
- Atika, N., Roza, Y., & Murni, A. (2020). Pengembangan Perangkat Pembelajaran Dengan Model Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Komunikasi Matematis. *Journal of Educational Sciences*, 4(1), 67-72.
- Choridah, D. (2013). Peran Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Komunikasi dan Berpikir Kreatif serta Disposisi Matematis Siswa SMA. *Jurnal Ilmiah Program Studi Matematika Stkip Siliwangi Bandung*, 2(2), 200.
- Duskri, M., Maidiyah, E., Risnawati., & Ilham, S. (2017). Penerapan Model Problem Based Learning Untuk Meningkatkan Kemampuan Komunikasi Matematis Dalam Pemecahan Masalah Di Kelas IX-6 SMPN 8 Banda Aceh. *Al-Khawarizmi : Jurnal Pendidikan dan Pembelajaran Matematika*, 1(1), 75-101
- Mulyatiningsih, E. (2014). *Metode Penelitian Terapan Bidang Pendidikan*. Bandung: Alfabeta.
- Fitratul, W. (2017). Pengembangan Perangkat Pembelajaran Berbasis Masalah Berorientasi pada Kemampuan Komunikasi dan Prestasi Belajar Matematika Siswa SMP. *Jurnal Riset Pendidikan Matematika*, 4 (1), 32-42.
- Hobri. (2010). *Metode Penelitian Pengembangan (Aplikasi pada penelitian Pendidikan Matematika)*. Jember: Pena Salsabila.
- Karunia, P., Maimunah., & Murni, A. (2019). Development of ICT-Based Mathematical Media on Linear Program Materials to Improve Motivation Learning Students. *Journal of Educational Sciences*, 3(2), 19-204.
- Kodariyati, L., & Astuti, B. (2016). Pengaruh Model PBL Terhadap Kemampuan Komunikasi dan Pemecahan Masalah Matematika Siswa Kelas V SD. *Jurnal Prima Edukasia*, 4(1). 93-106.
- Novrini, P., & Edy, S. (2015). Pengembangan Perangkat Pembelajaran Berorientasi Problem Based Learning Untuk Meningkatkan Kemampuan Visual Thinking Dalam Pemecahan Masalah Matematis Siswa Kelas VIII SMP. *Jurnal Paradigma*, 8(3), 84-97.
- Sugiono. (2013). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Sumarno., & Dhoriva, U. W. (2014). Pengembangan Perangkat Pembelajaran pada Materi Pokok Kalkulus SMA Kelas XI Semester 2. *Jurnal Riset Pendidikan Matematika*, 1(2), 257-267.
-

Wardani, V. W., & Merona, S. P. (2016). Implementasi Model Pembelajaran Berbasis Masalah Untuk Meningkatkan Komunikasi Matematis Siswa. *Jurnal Silogisme: Kajian Ilmu Matematika dan Pembelajarannya*, 1(2), 34-40.

How to cite this article:

Zahira, H., Zulkarnain, & Yuanita, P. (2020). Development of Problem Based Learning Tool Based Learning To Build Mathematical Communication Capabilities Students of Class VIII Middle School. *Journal of Educational Sciences*, 4(3), 487-500.
