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Development of Learning Devices to Improve Student's Mathematic and Self-Efficacy Communication Abilities Through the Problem Based Learning Model Assisted by the Video Media Learning in 10th Grade Senior High School

Elita Erawati Silaban Mariani, Mulyono
Mathematics Education, Postgraduate School, State University of Medan
Medan, North Sumatra, Indonesia

Abstract
This study aims to: 1) analyze the validity of learning devices using the Problem Based Learning model developed to improve students 'mathematical communication abilities and students' self-efficacy; 2) to analyze the practicality of learning devices based on the Problem Based Learning model developed to increase students 'mathematical communication abilities and students' self-efficacy; 3) analyzing the effectiveness of the learning devices using the Problem Based Learning learning model which was developed to improve students 'mathematical communication abilities and students' self-efficacy; 4) knowing the importance of learning media assistance in the form of Learning Videos to achieve learning objectives. This study used a modified Dick & Carey development model from Dick & Carey and was implemented in 10th grade Senior High School 18 Medan for the 2020/2021 school year. The results showed that: 1) The validation of the learning devices was developed with the total mean value of the whole being at a value of $4 \leq Va < 5$ so that the experts stated that the learning device was in the "valid" category; 2) Problem Based Learning learning devices that have been developed have met the "practical" category; 3) The developed learning devices oriented to the problem-based learning model meet the criteria of being effective; 4) There is a significant increase between the average mathematical communication abilities and the average N-gain in the first trial of 0.25 which is in the low category, increasing in the second trial of 0.37 which is in the medium and Self- Efficacy of students who are given learning devices based on Problem Based Learning.
Keywords: development of learning devices, mathematical communication abilities, self-efficacy, problem based learning, video media learning
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1. Introduction

The development and progress of science and technology are increasingly rapid, causing education to develop. Education has an important role in creating human character and quality. This is in accordance with the national education function contained in the Law of the Republic of Indonesia No. 20 of 2003 article 3 discusses the National Education System

Education is an effort that aims to create quality resources, to mature and instill values for humans to improve their quality. Through education we are able to form competent Human Resources (HR) so that they can be useful to help him in facing the progress of the times.

One branch of science that is considered very important for its role in the development of science is Mathematics. In this case, the inculcation of strong mathematical concepts is very important for students as a provision to explore various other sciences. Mathematics as a means to assist in the development of knowledge in various fields.

Mathematics studies about order, about organized structures, mathematical concepts arranged hierarchically, structurally and systematically, starting from the simplest concepts to the most complex concepts. Mathematics is a science that has a very important role in everyday life to improve the quality of oneself and be able to form Human Resources. As expressed by Hasratuddin (2015: 36) that mathematics is one of the most important sciences in everyday life as well as supporting human resource development and contains a means of thinking to develop a means of thinking logically, systematically, objectively, critically and rationally and is very competent to form a person's personality, so everyone needs to learn and must be nurtured from an early age.

One of the things that must be considered in carrying out mathematics learning so that the objectives of learning mathematics can be achieved are learning devices. This is in accordance with the opinion of Nazarudin (2007: 111) learning devices are anything or some preparations prepared by the teacher either individually or in groups so that the implementation and evaluation of learning can be carried out systematically and obtain the expected results, while the learning devices in question consist for Effective Week Analysis,

According to the National Council of Teachers of Mathematics (NCTM) as quoted by Armadan, et al (2017), "there are 5 (five) basic abilities that serve as standards in the mathematics learning process, namely

problem solving abilities, reasoning abilities and evidence (reasoning and proof), the ability to communicate (communication), the ability to connect (connections) and the ability to represent (representation) ".

In addition, the learning process in the classroom cannot be separated from the role of a teacher as a professional educator. The professional ability of teachers is part of the competencies that teachers have. Ambarita and Siburian (2013: 85) also explained that one of the factors that make a teacher successful is determined by his ability to plan learning, carry out a quality learning process, assess and evaluate quality learning outcomes.

The way to design learning in question is to design learning devices that will later be carried out to achieve a learning goal. Effective learning devices are very supportive of achieving educational goals. Learning devices are devices that support students to achieve the desired competency standards.

Learning devices are an innovation in achieving quality education. Learning devices are said to be effective if they are able to lead students to achieve learning goals. As stated in Permendikbud Number 65 of 2013 learning objectives include the development of the realms of attitudes, knowledge and abilities. In order for learning objectives to be achieved, teachers are required to be able to design or design effective learning devices. Learning devices as a means of achieving the goals of the educational curriculum are an important part of the learning process, as well as guidelines for teachers in carrying out the learning process in the classroom. This aims to determine the extent to which the learning material has been presented, what indicators are to be achieved, to what follow-up will be carried out by the teacher. In addition, the learning device also aims to help students participate in the mathematics learning process.

The learning device is an innovation to support the learning process in improving the quality of education. Learning devices are said to be effective if they are able to lead students to achieve learning goals. As stated in Permendikbud Number 65 of 2013 learning objectives include the development of the realms of attitudes, knowledge and abilities. In order for learning objectives to be achieved, teachers are asked to design or design effective learning

Therefore, it is necessary to develop effective learning devices so as to produce meaningful learning. Ibrahim (Trianto, 2011: 201) states that the learning devices needed in managing the teaching and learning process can be in the form of: Syllabus, Learning Implementation Plan (RPP), Student Worksheets (LKS), Evaluation Instruments or Learning Outcomes Test (THB), learning media , as well as student textbooks

As explained above, learning devices are one of the important factors that can support an effective learning process so that learning objectives can be achieved. Learning devices as learning resources that need to be considered in carrying out the teaching and learning process. Learning devices are crucial for the success of learning in the classroom. This is supported by Trianto (2014: 251) that the success of a teacher in implementing learning depends on the insight, knowledge, understanding and level of creativity in developing or managing learning devices.

Based on the description above, researchers are interested in conducting research with the title "Development of Learning Devices to Improve Students' Mathematical Communication Ability and Self-Efficacy through Problem Based Learning Learning Model CLASS X SMA".

2. Theoretical Studies

Learning Tool Development

Learning devices are a set of learning resources arranged in such a way that teachers and students carry out learning activities and have an important role in the learning process in the classroom. Suhadi, as quoted by Mangelep (2017), explained that learning devices are a number of materials, devices, media, instructions and guidelines that will be used in the learning process.

Learning devices will be developed in the form of: Learning Implementation Plans (RPP), Teacher Books (BG), Student Books (BS) and Student Activity Sheets (LKS), as well as Mathematics Communication Ability Tests (TKKM) and student Self-Efficacy.

Learning Model Problem Based Learning

According to Margetson in Rusman (2010) states that the Problem Based Learning Model helps to improve the development of lifelong learning abilities in an open, reflective, critical, and active learning mindset, and facilitates the success of problem solving, communication, group work. , and interpersonal abilities better than other models.

Mathematical Communication Abilities

Communication in general can be defined as interactions that occur in two directions in the process of conveying messages to one another. Suriansyah (2014) said that communication is an activity that is always carried out by everyone wherever he is, because communication is one of the needs of humans as social beings. Meanwhile, according to Abdulhak (in Ansari, 2012), it is explained that communication is interpreted as the process of delivering messages from sender to recipient of messages through certain channels for certain purposes.

Self-Efficacy

Self-efficacy was first introduced by Albert Bandura. Bandura (in Schunk, Pintrinch & Meeece, 2010: 20) states that "Self-efficacy is defined as, people judgments of their capabilities to organize and execute courses of action required to attain designates types of performances". The quote implies that self-efficacy is an assessment of a person in doing a task which is reflected in his actions to achieve his goals.

3. Research Methods

Types of research

This research is a development research in this research, researchers develop mathematics learning devices using the Problem Based Learning learning model, which includes the Learning Implementation Plan (RPP), Teacher's Book (BG), Student Book (BS) and Student Activity Sheet (LKS), as well as Mathematical Communication Ability Test (TKKM) and Student Self-Efficacy on the Functions material.

Research subject

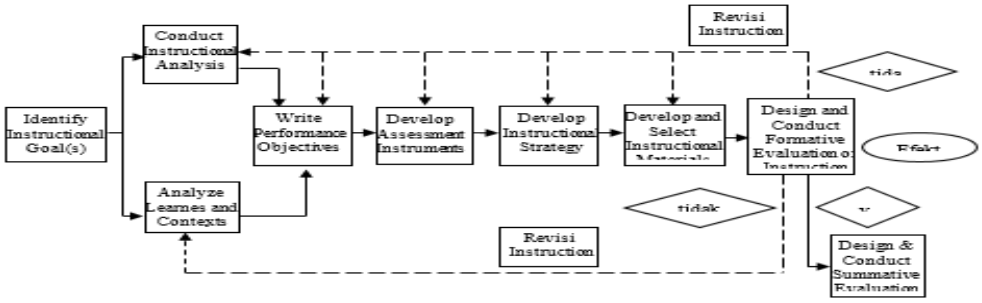
The subjects in this study were students of class X MIPA-1 SMA Negeri 18 Medan for the 2020/2021 academic year, each of which consisted of 34 students in the 1st trial and students of class X MIPA-2 which also totaled 34 people.

Data Collection Instruments

The development of learning devices has instruments in the form of (i) Learning Implementation Plan; (ii) Student Book; (iii) student worksheets; (iv) Teacher's Manual; (v) communication abilities test

Data analysis

The learning device development model used in this study is to use the Dick & Carey development model procedure for several reasons, namely: (1) the Dick & Carey model has been widely used to develop effective teaching materials; (2) every step of the Dick & Carey model there is feedback or revision; (3) the steps of the Dick & Carey model are very concise, concise, clear, and interrelated with one another, and in accordance with the applicable curriculum because it begins with identifying learning objectives. The procedure for developing learning devices with the Dick & Carey development model can be seen in Figure 3.1. following:



Gambar 3.1. Model Desain Pengembangan Dick & Carey (Dick & Carey, 2009)

4. Result

1. Analysis of the Effectiveness of Problem Based Learning Model Toolkit

Learning devices with the Problem Based Learning learning model will be feasible if they can have a positive or significant impact on learning. Thus, the learning device with the developed Problem Based Learning learning model must meet the effectiveness criteria, namely: (1) classical student learning completeness, that is, at least 85% of students who take part in learning are able to achieve a score of ≥ 75; (2) achievement of learning objectives at least 85%; (3) at least 80% of the subjects studied gave a positive response to the components of the Problem Based Learning learning devices developed.

The description of the results of students' mathematical communication abilities in the first trial and second trial is shown in Table 4.1. following.

Table 4.1. Description of the Results of Mathematical Communication Abilities of Mathematics Pretest and Postest in Trial I and Trial II

Information	Mathematical Communication Ability Pretest		Posttest of Mathematical Communication Abilities	
	Trial I	Trial II	Trial I	Trial II
Highest score	75	100	100	100
Lowest score	16,67	16,67	25	33,33
Average	42,65	116,67	84,32	133,33

Table 1 shows that the average of students' mathematical communication abilities on the pretest results is

42,65 and the posttest results are 84,32. And it also shows that the average of students' mathematical communication abilities on the pretest results is 116,67 and the posttest results are 133,33.

Furthermore, the classical completeness results of students' mathematical communication abilities in the first trial can be seen in Table 4.2. following.

Table 4.2. Classical Completeness Level of Mathematical Communication Abilities in Trial I

Category	*Pretest*	Classical Completeness Percentage	*Posttest*	Classical Completeness Percentage
	Total students		Total students	
Completed	4	11,76%	32	94,11%
Not Completed	30	88,23%	2	5,88%
Total	34	100%	34	100%

Based on the data in Table 4.2 above, it can be seen that the classical completeness of the results of students' mathematical communication abilities in the pretest trial I was 11,76%, while in the posttest trial I was 94,11%.

Then the results of classical student learning completeness for students' mathematical communication abilities in the second trial can be seen in Table 4.3. following.

Table 4.3. Classical Completeness Level of Mathematical Communication Abilities in Trial II

Category	*Pretest*	Classical Completeness Percentage	*Posttest*	Classical Completeness Percentage
	Total students		Total students	
Completed	20	65,63%	31	87,50%
Not Completed	14	34,37%	3	12,50%
Total	34	100%	34	100%

Based on the data in Table 4.3, it can be seen that classical student learning completeness in the pretest trial II was 65,63% while in the posttest trial II it was 87,50%. In accordance with the criteria of classical student learning completeness, that is, at least 85% of students who take part in learning are able to achieve a score of ≥71, then the posttest results of mathematical communication abilities in the second trial have met the criteria for achieving classical completeness. So it can be concluded that in the second trial the application of the Problem Based Learning learning model that was developed had met the classical completeness criteria.

For the analysis of the achievement of learning objectives, it was carried out to determine the percentage of achievement of the learning objectives on each posttest item of mathematical communication abilities. The achievement of posttest learning objectives of mathematical communication abilities in the first trial and second trial can be seen in table 4.4:

Table 4.4. Achievement of Posttest Learning Objectives of Mathematical Communication Ability in Trial I

No	Learning objectives	Trial I		Trial II	
		Mathematical Communication Abilities		Mathematical Communication Abilities	
		% Achievement of Learning Objectives	Information	% Achievement of Learning Objectives	Information
1.	Students are able to identify the characteristics of function in problems related to everyday life	71,88%	Not achieved	79,43%	Achieved
2.	Students are able to solve problems related to the properties of the function	72,39%	Not achieved	76,30%	Achieved
3.	Students are able to apply the rules of function in solving problems	72,39%	Not achieved	84,38%	Achieved

From table 4.4 for the results of the mathematical communication abilities of trial I, it can be seen that the achievement of the learning objectives in question number 1 was obtained by 71,88%, the achievement of learning objectives for question number 2 was obtained by 72,39%, and the achievement of learning objectives for question number 3 was obtained by 72 , 39%. And it can also be seen that the results of the achievement of the learning objectives of each question of mathematical communication abilities in the second trial, the achievement of the learning objectives for question number 1 was 79,43%; The achievement of the learning objectives for question number 2 was obtained by 76,30%, and the achievement of the learning objectives for

question number 3 was obtained by 84,38%.

Furthermore, the average percentage of students' total positive responses in the first trial was 85,52%. And the average percentage of students 'total positive responses in trial II was 93,23%. If the results of this analysis were referred to the criteria set out in chapter III, it was concluded that the students' responses to the components and learning activities were very positive. Because, more than 80% of students gave positive responses to the components of the learning devices developed.

Based on the results of the data analysis of trial I, it is known that the learning devices developed have been effective, this is based on the indicators of the effectiveness of learning devices that have been achieved, namely the posttest results of students' mathematical communication abilities in the first trial of 94,11% that have met the criteria for completeness achievement. Classical, the achievement of learning objectives has reached the specified criteria, the achievement of learning time is at least the same as the conventional learning time has been reached, and student responses are positive to the components of learning devices with the developed Problem Based Learning learning model.

2. Analysis of the practicality of learning devices with a problem based learning model

The practicality of the learning devices developed can be seen from: (1) the results of the validation of the experts, (2) the ability of the teacher to manage learning. Based on the two criteria of practicality, it was found that the expert team stated that the learning device could be used with minor revisions and the feasibility of learning had also fulfilled the predetermined criteria as described in Table 4.5 as follows :

Table 4.5. Average Assessment of Teacher Ability to Manage Learning in Trial II

No	Aspects Observed	Average of Each Aspect
1	Initial activity	4,1
2	Directing students to understand contextual problems	3,8
3	Guide resolving contextual problems	3,6
4	Compare or discuss answers	4
5	Conclusion	3
6	Closing	3,8
Average Teacher Ability		3,7
Category		GOOD

From table 4.5, the highest score is the teacher's ability to manage preliminary activities or early learning activities, which is 4,1 from the masculine score, namely 5.While the lowest score is the teacher's ability to conclude is 3. The value of the teacher's ability to direct students in understanding contextual problems is 3, 8, the teacher's ability to guide solving contextual problems was 3.6, the teacher's ability to compare and discuss answers was 4 and the closing activity was 3,8.

The overall average ability of the teacher to manage learning using the devices developed in the second trial was 3,7 and was in the "GOOD" category. Based on the reference in Chapter III regarding the teacher's ability to manage learning, it is said to be successful, namely the fulfillment of the ability score in the "GOOD" category or at least 3,50 ≤KG <4,50.

Based on the above discussion, it can be concluded that the learning devices that have been validated by experts state that the devices developed can be applied or used in the field with little or no revision. In addition, the results of the teacher's ability to manage learning regarding the learning devices developed did not meet the specified criteria. Thus, it can be concluded that the problem based learning model that has been developed does not yet meet the "practical" category.

3. Analysis of Improving Students' Mathematical Communication Abilitya

The improvement of students' mathematical communication abilities in trial I and trial II will be seen through the N-Gain of the pretest and posttest results of mathematical communication abilities in the first trial and second trial. The results of the calculation of N-Gain on mathematical communication abilities can be seen in the table. 4.18. following:

Table. 4.6. Summary of N-Gain Results of Trial Mathematical Communication Ability I

N-Gain	Interpretation	Total students (Trial I)	Total students (Trial II)
$g \leq 0,3$	Low	2	16
$0,3 < g \leq 0,7$	Medium	9	3
$g > 0,7$	High	23	15

Based on table 4.6 in the first trial it can be seen that students who got an N-Gain score in the range> 0.7 or experienced an increase in mathematical communication abilities with the "High" category were 23 people, students who experienced an increase in mathematical communication abilities were in the "Medium" category. or got an N-Gain score of $0.3 <g \leq 0.7$ as many as 8 people and 2 students who experienced an increase in mathematical communication abilities in the "Low" category or got an N-Gain score $g \leq 0,3$. So, the average gain in the first trial was 0,21 in the high category. Based on Table 4.6. It can also be seen that there were 15

students who got N-Gain scores in the range> 0,7 or experienced an increase in mathematical communication abilities in the "High" category. There were 16 students who experienced an increase in mathematical communication abilities in the "moderate" category or got an N-Gain score of 0,3 <g ≤ 0,7 and students who experienced an increase in mathematical communication abilities in the "low" category or got an N-Gain score g ≤ 0,3 as many as 13 people. So, the average gain in the second trial was 0,37 in the medium category.

4. Analysis of the Improvement of Students' Self-Efficacy Ability

The increase in student self-efficacy in trial I will be seen through the N-Gain of the results of the pretest and posttest self-efficacy of students in the first trial. The results of the calculation of N-Gain on student self-efficacy can be seen in the table. 4.7. following:

Table. 4.7. Summary of N-Gain Results of Students' Self-Efficacy Ability in Trial I and Trial II

N-Gain	Interpretation	Total students (Trial I)	Total students (Trial II)
g ≤ 0,3	Low	18	15
0,3 < g ≤ 0,7	Medium	14	14
g > 0,7	High	0	3

Based on Table 4.7. In Trial I it can be seen that students who get N-Gain scores in the range> 0,7 or experience an increase in student self-efficacy with the "High" category are 0 people, students who experience an increase in student self-efficacy are in the "Medium" category or got an N-Gain score of 0,3 <g ≤ 0,7 as many as 14 people and students who experienced an increase in self-efficacy in the "Low" category or got an N-Gain score g ≤ 0,3 were 18 people. So, the average gain in the first trial was 0,25 in the low category. And in the second trial it can be seen that there were 3 students who got N-Gain scores in the range> 0,7 or experienced an increase in student self-efficacy in the "High" category. There were 14 students who experienced an increase in the self-efficacy of students in the "moderate" category or got an N-Gain score of 0,3 <g ≤ 0,7 and students who experienced an increase in mathematical communication abilities in the "low" category or got an N-Gain score. g ≤ 0,3 as many as 15 people. So, the average gain in the second trial was 0,31 in the medium category.

5. Conclusion

1. The learning devices based on Problem Based Learning have been validated by five experts, consisting of: (1) RPP validation results with a total average of 4,44; (2) the results of the validation of the Teacher's Book with a total average of 4,55; (3) the results of the validation of the Student Book with a total average of 4,46; (4) the results of the LKS validation with a total average of 4,51; and (5) the validation of the students' communication and creative thinking abilities test can be used with small revisions and without revision, where the overall mean value is at a value of 4 ≤ Va <5 so that the experts declare the learning device in the "valid" category.
2. Learning devices that have been validated by experts, state that the devices developed can be applied or used in the field with little or no revision. In addition, through the results of interviews conducted with students regarding the learning devices developed, it turned out to be able to help and facilitate students in the teaching and learning process. Thus, it can be concluded that the Problem Based Learning learning devices that have been developed have met the "practical" category.
3. Learning devices oriented to the developed problem-based learning model meet the criteria of being effective, it can be viewed from: (1) completeness of classical student learning outcomes with a minimum score of 75 has reached 87,50%; (2) student activities in all observed aspects are within the ideal time tolerance set; and (3) students' positive responses reached 100%. Thus, it can be concluded that the Problem Based Learning learning devices that have been developed have met the "effective" category.
4. There is a significant increase between the average mathematical communication abilities and the Self-Efficacy of students who are given problem-based learning devices.

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