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DEVELOPMENT OF PROBLEM-BASED LEARNING DEVICES ON MATHEMATICS AND TRIANGLE MATERIALS FOR JUNIOR HIGH SCHOOL STUDENTS CLASS VII AT JUNIOR HIGH SCHOOL 5 PAGUYAMAN

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Abstract:
The purpose of this research is to produce problem-based learning tools that are included with valid, practical, and effective mathematical problem solving steps.
This study develops problem-based mathematics learning tools and learning support devices for even semester VII SMP students. Learning tools consist of syntax, social system, reaction principle, support system, and instructional impact and accompaniment. The learning tools consist of learning implementation plans (RPP), Student Activity Sheets (LKPD), Media, Modules and Learning Outcomes Tests (THB). This development starts from several stages, namely: (a) the preliminary study stage, (b) the prototyping stage which includes the design stage, evaluation and revision stage, and (c) the assessment stage which includes the trial stage to determine the assessment of the practicality and effectiveness of the learning-based device. developed problem. The quality aspect of product development refers to the quality of product development according to Nieveen which consists of 3 aspects, namely valid, practical, and effective. The subjects of the research trial consisted of 25 students of SMP Negeri 5 Paguyaman.
The instruments in this study consisted of; (1) a validity instrument consisting of an assessment sheet on the validity of the Problem-Based Mathematics Learning Tool Components and Learning Support Tools; (2) practicality instruments consisting of practicality assessment sheets from teachers and from students; and (3) effectiveness instruments consisting of learning outcomes tests, and student appreciation questionnaires for problem-based mathematics learning.
Based on the results of research that includes syntax, social system, reaction principle, and instructional impact and accompaniment, it is feasible to use the very valid category. The results of the trial show that the level of practicality of the teacher's assessment in all meetings on average meets the very practical criteria. In addition, the level of practicality based on the assessment of students was also shown that the problem-based mathematics learning tools had met the very practical criteria. The effectiveness of problem-based learning tools based on the results of the THB has met the effective criteria with the percentage of classical completeness achieved by 76% and based on the student appreciation questionnaire, the students have met the effective criteria.

Keywords: Development, Learning Tools, Problem Based Learning

INTRODUCTION

Students are expected to be able to construct their own knowledge, this is a general learning process based on the opinion of Joyce, Weil & Calhoun (2004:13) namely "…the idea that learning is the construction of knowledge". In this learning process, there is also a process of receiving information, ideas and skills, but in this learning process it also includes the reconstruction of new ideas or knowledge by the mind. Therefore, the construction process is the core knowledge of the learning process.

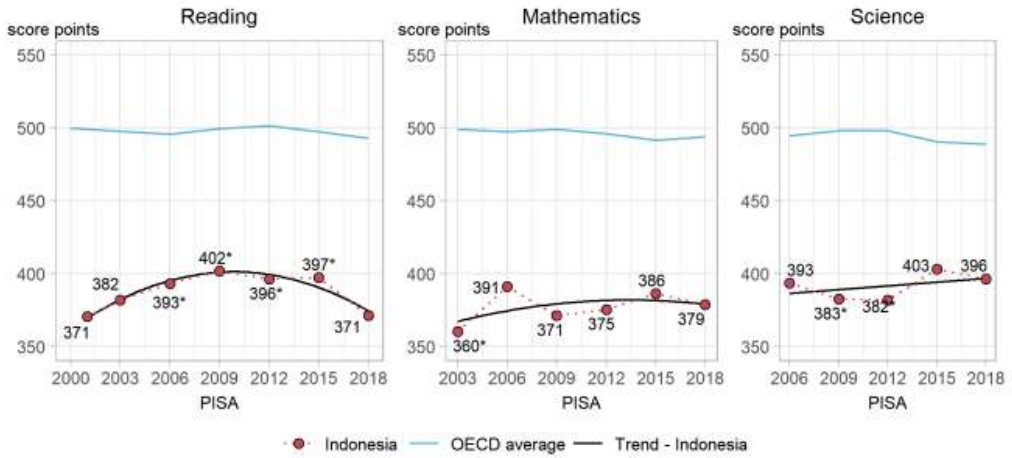
Based on the results of the TIMSS and PISA studies to measure the level of problem solving skills and mathematical literacy skills, students in Indonesia in mathematics subjects, where Indonesia has participated in TIMSS

in 2003, 2007, 2011, 2015 and PISA in 2000, 2003, 2006, 2009 , 2012, 2015, 2018 with the results not showing much change in each participation. The following are the results of TIMMS from 2003 – 2015:

Tabel 1 : Hasil TIMSS Indonesia

TIMSS results				
Years	Rating	Participant	Average Score of Indonesia	Average International Score
2003	35	46 Negara	411	467
2007	36	49 Negara	397	500
2011	48	42 Negara	386	500
2015	44	49 Negara	397	500

Meanwhile, the results of the study based on PISA are as follows:



According to Andri (2020 online learning or e-learning is a form of learning tool that is facilitated and supported by the use of information and communication technology).

Based on the results of TIMSS and PISA Indonesia above, problem solving is the focus in learning mathematics. This emphasizes that learning mathematics should begin with the introduction of problems that are appropriate to the situation (contextual problems) so that students are given the opportunity to be able to develop questions and conduct investigations to be able to solve problems in the context of the knowledge construction process in students.

In the process of solving mathematical problems there are several steps that need to be done. These problem-solving steps are known as problem-solving heuristics. According to Polya (1973: 5) heuristics in problem solving consist of stages (1) understanding the problem, (2) planning a strategy, (3) implementing the strategy, and (4) reviewing the solutions obtained.

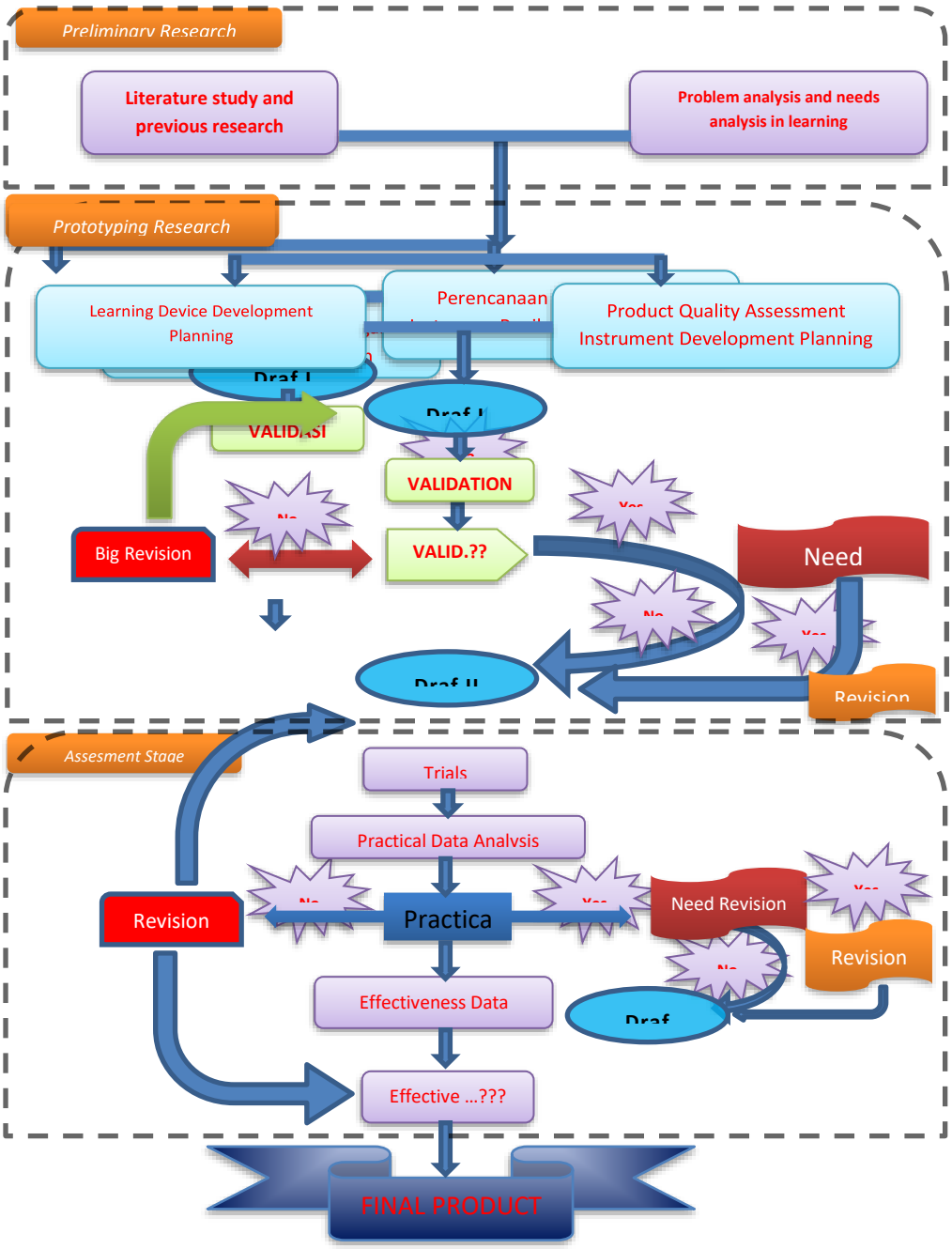
Based on the background of the problems mentioned above, overall it can be concluded that, in learning mathematics, it is necessary to develop learning tools in order to achieve the objectives of learning mathematics, especially the ability to solve mathematical problems.

Based on the description above, the researcher is interested in conducting a study entitled "Development of Problem-Based Learning Devices on the Materials of Quadrangle and Triangle Mathematics Subjects for Class VII Junior High School Students at SMP Negeri 5 Paguyaman".

METHOD

This research method uses development research methods where the development used in this study refers to the prototyping model according to Nieveen which includes (1) preliminary research, (2) prototyping stage, and (3) assessment stage.

The following are the stages of the Prototyping Development Model according to Nieevan:



FINDINGS

This research was carried out at SMP Negeri 5 Paguyaman, totaling 25 students of class VII as respondents to see the validity, practicality and effectiveness of the learning tools developed. Based on this, the results of the validity test, practicality test and effectiveness test of the learning devices are obtained in the following table:

1. Results of the Feasibility Test of Research Instruments

a. Instrument Validation Results by Experts

Table 4.1: Average Score of Research Instrument Validation Results

No	Instrument Name	Actual Score				Average	Category
		V1	V2	V3	V4		
1	Assessment sheet for the validity of the Learning Implementation Plan (RPP)	38	34	32	33	34,25	A
2	Student Activity Sheet Validity Assessment Sheet (LKPD)	38	34	35	32	34,75	A
3	Assessment sheet of the validity of the Learning Outcome Test (THB)	38	32	35	34	34,75	A

4	Practicality assessment sheet from the teacher (Teacher Assessment Questionnaire)	38	27	27	31	30,75	B
5	Student practicality assessment sheet (Student Response Questionnaire)	38	32	32	33	33,75	A
6	Student appreciation sheet for problem-based mathematics learning.	38	32	37	32	34,75	A

Information: V1, V2, V3, V4 = Validator 1, 2, 3, 4
A = Very Valid, B = Valid

a. Test Results of Learning Outcomes Test Instruments

Table 4.2: Difficulty Index (V) Learning Outcome Test

Question Number	Level of difficulty (V)	Criteria	Question Number	Level of difficulty (V)	Criteria	Question Number	Level of difficulty (V)	Criteria
1	0,63	Currently	11	0,63	Currently	21	0,63	Currently
2	0,81	Easy	12	0,81	Easy	22	0,81	Easy
3	0,88	Easy	13	0,52	Currently	23	0,88	Easy
4	0,82	Easy	14	0,82	Easy	24	0,82	Easy
5	0,69	Currently	15	0,69	Currently	25	0,69	Currently
6	0,44	Currently	16	0,81	Easy	26	0,24	Hard
7	0,52	Currently	17	0,52	Currently	27	0,22	Hard
8	0,88	Easy	18	0,88	Easy	28	0,28	Hard
9	0,82	Easy	19	0,69	Currently	29	0,25	Hard
10	0,52	Currently	20	0,52	Currently	30	0,22	Hard

Info : V = Level of difficulty

1. Learning Device Trial Results

a. Problem-based Learning Tool Validity Results

1) Result of Validation of Problem-Based Mathematics Learning Device Components

Table 4.3

Scores and Criteria for the Validity of the Problem-Based Learning Model Components

No	Component	Validator Score				Average score	Criteria
		I	II	III	IV		
1	Syntax	12	12	12	14	12,5	Very Valid
2	Social System	12	12	14	14	13	Very Valid
3	Reaction Principle	8	8	8	8	8	Very Valid
4	Accompaniment Impact & Instruction	8	8	8	8	8	Very Valid

2) Results of Validation of Learning Implementation Plans (RPP)

Table 4.4

No	Validator	Score	Criteria
1	I	68	Valid
2	II	69	Very Valid
3	III	67	Valid
4	IV	77	Very Valid
Average		70,25	Very Valid

Score and Criteria for RPP Validity Assessment Results

3) Results of Validation of Student Activity Sheets (LKPD)

Table 4.5
Score and Criteria for LKPD Validity Assessment Results

No	Validator	Score	Criteria
1	I	62	Very Valid
2	II	56	Very Valid
3	III	55	Valid
4	IV	67	Very Valid
Average		60	Very Valid

4) Results of Validation of Learning Outcomes Test (THB)

Table 4.6
Percentage of THB . Validity Assessment Results

THB	Description	Expert Assessment Results			
		Expert 1	Expert 2	Expert 3	Expert 4
THB 1	Percentage (%)	91.7	91.7	95.8	92
	General rating	Valid	Valid	Valid	Valid
THB 2	Percentage (%)	95	95	100	100
	General rating	Valid	Valid	Valid	Valid
THB 3	Percentage (%)	100	93.8	93.8	94
	General rating	Valid	Valid	Valid	Valid
THB 4	Percentage (%)	100	85	90	100
	General rating	Valid	Valid	Valid	Valid
THB 5	Percentage (%)	100	91.7	91.7	100
	General rating	Valid	Valid	Valid	Valid

a. Practical Results of Problem-Based Mathematics Learning devices

Table 4.7: Scores and Criteria for Practicality Assessment Results from Teachers

Meeting	Score	Criteria
I	45	Practical
II	55	Very Practical
III	47	Practical
IV	52	Very Practical
V	51	Very Practical
VI	52	Very Practical
VII	55	Very Practical
VIII	50	Very Practical
Average score	50.875	Very Practical

Table 4.8: Scores and Criteria for Practicality Assessment Results from Students

	ASPECT		TOTAL
	1	2	
Actual Score	4,69	3,36	8,06
Criteria	Very Practical	Very Practical	Very Practical
Percentage of "yes" answers	94%	84%	89,56%

Information: 1. ease of understanding;
2. ease of implementation/completion of tasks

Tabel 4.9
Persentase Keterlaksanaan Sintak Pembelajaran Matematika Berbasis Masalah

No	Syntax/Step Learning	Percentage (%)Implementation at the Meeting							
		I	II	III	IV	V	VI	VII	VII
1	Problem orientation	100	100	100	100	100	100	100	100
2	Organization for learning	67	100	100	100	100	100	67	67
3	Solution to problem	100	100	100	100	100	100	50	50
4	Presentation of Works	50	100	100	100	100	100	100	100
5	Analysis & Evaluation	50	100	100	100	100	100	100	100

Table 4.10
Percentage of Implementation of Social Systems, Principles of Reaction and Problem-Based Mathematics Learning Support Systems

No	Learning Component	Percentage (%)Implementation at the Meeting							
		I	II	III	IV	V	VI	VII	VII
1	Reaction Principle	100	100	100	100	100	100	100	100
2	Social System	75	100	100	100	100	100	75	75
3	Support System	67	100	100	100	100	100	100	100

c. Results of the Effectiveness of Problem-Based Mathematics Learning tools

1) Learning Outcome Test Results

Table 4.11: Student Learning Outcomes Data

No	Category	Score
1	Maximum Value	100
2	The highest score	100
3	Minimum score achieved by students	38
4	Average	82,7
5	Standard Deviation	14,4

2) Results of Student Appreciation Questionnaire for Problem-Based Learning.

Table 4.12: Scores and Criteria for Student Appreciation Questionnaire Results for Problem-Based Learning

Aspect Actual Score				Overall Actual Score
Attention	Interest	Enjoyment	Participation	
15,49	15,7	17,73	15.97	65.03
Effective	Effective	Effective	Effective	Effective

DISCUSSION

The development of problem-based mathematics learning tools in this study adapts the prototyping development procedure according to Nieveen, with the quality criteria of the development product to be achieved which include valid, practical and effective criteria. The following will explain clearly the validity, practicality and effectiveness of the problem-based mathematics learning tools developed.

1. Validity of Problem-Based Mathematics Learning Model

Based on the results of the preliminary study, it was obtained Draft I for the development of problem-based learning tools at the prototyping stage. Furthermore, the first draft of the learning device was reviewed by experts to determine its validity criteria. Based on the results of the data analysis of the validity of the research instruments, lesson plans, LKPD, Modules, Teaching Media and THB which were consecutively presented in the previous data analysis, it can be seen that the tools developed have met the valid criteria. Based on the assessments of four experts, the level of validity of the components of problem-based mathematics learning tools consisting of syntax, social systems, reaction principles and instructional impacts and accompaniments reached very valid criteria. Furthermore, the level of validity of the learning tools is indicated by the validity of (1) the lesson plans reaching the very valid criteria; (2) LKPD achieves very valid criteria; and (3) THB reached the valid criteria.

The following are the components of problem-based mathematics learning that have been developed in this study:

a. Syntax/steps of Problem-Based Mathematics Learning

Step 1. Student orientation on problem situations

- Step 2. Organization of students for learning
- Step 3. Troubleshooting
- Step 4. Presentation of the work
- Step 5. Analysis and Evaluation

b. Problem-Based Mathematics Learning Social System

Based on the analysis of the implementation of problem-based mathematics learning tools, students have started to be involved in solving the problem from the second to the sixth meeting. Furthermore, the role of the teacher as an evaluator has also been carried out in all problem-based mathematics learning for eight meetings

c. Reaction Principle of Problem-Based Mathematics Learning

The principle of reaction relates to the teacher's role in learning. In problem-based mathematics learning, the teacher's role is to direct and emphasize the problem solving process, as well as provide feedback on the results of students' mathematical problem solving. The role of the teacher to evaluate and guide students during the learning process has been carried out for eight times problem-based mathematics learning at school.

d. Problem Based Mathematics Learning Support System

In the implementation of problem-based mathematics learning in schools, a support system in the form of LKPD which stimulates problem solving abilities and teaching aids in the form of a flat-shaped model are available in all learning meetings.

e. Instructional Impact and Problem-Based Mathematics Learning Accompaniment Impact

Direct objectives include: problem solving process, mastery of basic competencies (KD), and the ability to construct knowledge. The achievement of basic competencies can be shown from student learning outcomes, while the problem-solving process has also been implemented in most of the implementation of learning based on the results of observations of the implementation of problem-based mathematics learning. Indirect goals include: cooperative skills, self-control ability, self-confidence, self-esteem, and motivating students

Practicality of Problem-Based Mathematics Learning

Based on the results of the practicality assessment of student responses as presented in Table 27, it can be seen that the level of practicality of problem-based mathematics learning tools as a whole or each assessment indicator reaches very practical criteria.

The following are the stages of solving mathematical problems during the trial of problem-based learning tools:

- Understanding the problem (Understand the problem)
- Planning Strategy (Devise a plan)
- Implementing Strategy (Carry out the plan)
- Look Back

The Effectiveness of Problem Based Mathematics Learning

Based on the results of the competency achievement test using THB, as shown in Figure 10, the percentage of complete learning outcomes of class VII students after participating in problem-based mathematics learning is 76%, namely 19 students (out of 25 students). The classical average value achieved is 82.5, with the highest score being 100 and the minimum score being 38.

CONCLUSION

Based on all the studies above, it can be stated that the development of problem-based mathematics learning tools is a learning that has been tested for validity, practicality and effectiveness, so that it can be considered for use in learning mathematics in schools.

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