



**DEVELOPMENT OF STRUCTURED STUDENT WORKSHEETS ON PROBLEM-BASED LEARNING MATERIAL LINEAR EQUATIONS WITH ONE VARIABLE**

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**Abstract**

*This research was conducted because the effectiveness of using Student Worksheets (LKS) at the junior high school level is still inadequate. This research aims to develop structured worksheets for problem-based mathematics learning with material on linear equations in one variable that is valid, practical, and effective. This research refers to the ADDIE development model, which includes analysis, design, development, implementation, and evaluation. This worksheet is designed to guide seventh-grade junior high school students in understanding the basic concepts of linear equations in one variable, identifying the elements in the equation, mastering techniques for solving linear equations, and applying these concepts in real-world situations. The structured worksheets developed were tested according to the level of validity, practicality, and effectiveness. LKS validation is carried out by material substance experts and teaching material design experts. The practicality assessment was obtained from the results of the student response questionnaire. Assessment of the effectiveness of structured worksheets is obtained from the results of problem-based test questions. Structured worksheets contain student orientation to problems, organized learning activities, individual and group investigations, presentation of work results, as well as analysis and evaluation of the problem-solving process. Material substance validation showed a score of 3.819, which is very valid, while design validation showed a score of 3.70, which is very valid. The practicality test shows a score of 3.53, which is very practical, while the effectiveness test shows an average score of 77, which is very effective. Thus, structured worksheets used as tools in problem-based learning methods help students maximize their abilities in problem-solving. This research is important to carry out to facilitate teachers in providing worksheets that suit students' needs. By integrating these worksheets into classroom learning activities, it is hoped that they can help students solve mathematical problems, improve thinking patterns, and support more effective mathematics learning.*

**Keywords:** *Development, Structured Student Worksheets, Problem-Based Learning*

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**INTRODUCTION**

The real conditions in the field up to now are that the teaching and learning process still tends to use conventional learning

patterns or teacher-centered learning, textbooks, and worksheets that do not describe everyday life, where teachers deliver material using lecture methods in a

monotonous manner so that it is possible for students to feel bored and tend to be passive.

This results in students tending to be fixated on assignments by teachers to only solve problems based on theory, and tend not to be interested in solving everyday problems related to mathematics. This is because mathematics is related to logical and numerical problems which require in-depth understanding. Students are unable to view mathematics as a tool that can be used to interpret ideas accurately to conclude (Istarani, 2016).

One learning method that has been proven to be effective is learning problem-based,

where students face real-life situations or problems that encourage them to think critically, collaborate, and apply the concepts learned.

Problem-based learning is a learning process that begins learning activities by providing a problem related to everyday life (Yusri et al., 2021). Meanwhile, according to Putri (2021) learning by problem-solving is a method that trains students to solve problems by thinking creatively through concrete steps. Therefore, problem-solving abilities should be formed from an early age, so that students are trained in problem-solving as they get older. Of course, this has an impact on increasing students' cognitive abilities. Apart from that, students'

problem-solving abilities are also influenced by the teacher's role in providing teaching materials.

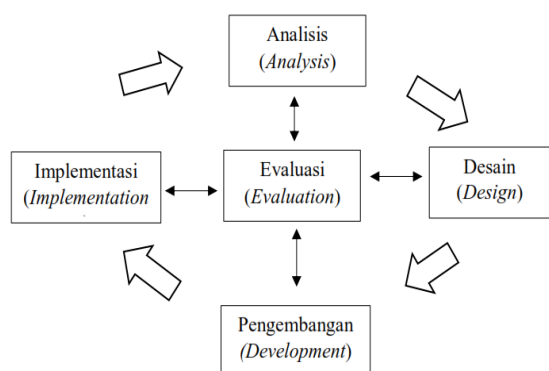
According to Meisya et al., (2018) , Increasing the quality of education relies significantly on the utilization of instructional materials that are tailored to the requirements of both teachers and students. The development of teaching materials that align with these needs plays a crucial role in enhancing the learning process. The teaching materials consist of textbooks, worksheets, modules, and other types which have been provided in several schools (Indariani et al., 2018). Student Worksheet (LKS), which is a type of teaching material printed in the form of sheets of paper containing documents, summaries, and procedures for carrying out academic tasks that must be completed, and refers to a basic competency that must be mastered (Arifin & Sepriyani, 2019).

Using LKS facilitates teachers' ability to make possible teachers' ability to convey material to students while also training students to identify and solve problems through LKS-assisted learning activities. LKS that are considered ideal do not only consist of questions but contain several activity steps that support students in applying problem-solving (Prasetyawan & Gunawan, 2020). Based on the background description, this research is intended to develop structured worksheets that are

valid, practical, and effective in problem-based learning with one-variable linear equations as a solution for providing worksheets that suit student needs. The structured worksheets referred to in this research are student activity sheets designed using a problem-based approach that is closely related to everyday life.

### METHOD

This product development uses the ADDIE development model, which stands for *Analysis, Design, Development, Implementation, and Evaluation*. The following are the research steps using the ADDIE model:



**Figure 1.** Use of the ADDIE model

*Analysis*, at the analysis stage the researcher identifies student characteristics such as the level of understanding of the material, experience, and student motivation. Researchers also explored information about LKS used in schools and the need for ideal LKS according to student characteristics.

*Design*, at the design stage the researcher designs the LKS to be developed, namely

determining the components of the structured LKS. Structured LKS components include basic competencies, indicators, and learning objectives. The material used as the research target is Systems of Linear Equations with One Variable (SPLSV) in Class VII SMP. At this stage, several problems that are close to students' daily lives are also designed.

*Development*, at the development stage, researchers began to develop structured worksheets that met the demands of the curriculum by paying attention to students' needs. To determine the level of validity of the structured worksheet being developed, it is necessary to assess material substance experts and teaching material design experts. Aspects of material substance assessment include aspects of appropriateness of content (suitability of material with basic competencies, up-to-dateness of material, stimulation of curiosity, and accuracy of material) and aspects of appropriateness of presentation (presentation of learning material, presentation support, presentation techniques, coherent flow of thinking, and clarity). Aspects of expert assessment of teaching material design include aspects of graphic suitability (layout design of LKS components and LKS cover design) and aspects of linguistic suitability (communicative, conformity with language rules, use of symbols or icons, suitability to

student development, straightforward, interactive, and dialogical).

*Implementation*, at this stage the structured LKS is tested and implemented for students VII-A and VII-B at SMP Negeri 27 Malang. After being declared worthy of testing by material substance experts and teaching material design experts, further research analysis was carried out in the form of testing on students using research instruments. The trial is intended to assess the effectiveness and practicality of the structured worksheet being developed. The research instrument for assessing effectiveness is in the form of problem-based questions that must be completed by students after testing. The research instrument for assessing practicality is in the form of a student response questionnaire.

*Evaluation*, namely the assessment of each stage in the series of structured LKS development carried out. The evaluation aims to ensure product quality before and after the implementation stage.

The type of data used is qualitative and quantitative data in collecting data from students at SMP Negeri 27 Malang class VII-C. A total of 10 students for limited testing and 64 students from classes VII-A and VII-B for extensive testing. The data collection process was carried out at the beginning of the even semester of the 2022-2023 academic year.

The validity of the worksheet is calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

Information :

$\bar{X}$  : Average score for each aspect of product assessment

$\sum_{i=1}^n x_i$  : Total score for each aspect of product assessment

$n$  : number of assessment items for each aspect of product assessment

With validity assessment criteria:

**Table 1 .** LKS Validity Assessment Criteria

Assessment criteria	Score
Very valid	$3.25 < \bar{X} \leq 4.00$
Valid	$2.50 < \bar{X} \leq 3.25$
Invalid	$1.75 < \bar{X} \leq 2.50$
Very invalid	$1.00 < \bar{X} \leq 1.75$

Source: Widoyoko, 2017

The practicality of LKS is calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{kn}$$

Information :

$\bar{X}$  : Average score for each aspect of product assessment

$\sum_{i=1}^n x_i$  : Total score for each aspect of product assessment

$n$  : number of assessment items for each aspect of product assessment

$k$  : number of respondents

With practicality assessment criteria:

**Table 2.** Criteria for assessing the practicality analysis of LKS

Assessment criteria	Score
Very practical	$3.25 < \bar{X} \leq 4.00$
Practical	$2.50 < \bar{X} \leq 3.25$
Not practical	$1.75 < \bar{X} \leq 2.50$
Very impractical	$1.00 < \bar{X} \leq 1.75$

Source: Widoyoko, 2017

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The effectiveness of LKS ( $e$ ) is calculated using the formula:

$$e = \frac{\text{the number of students who completed}}{\text{total students}}$$

With effectiveness assessment criteria:

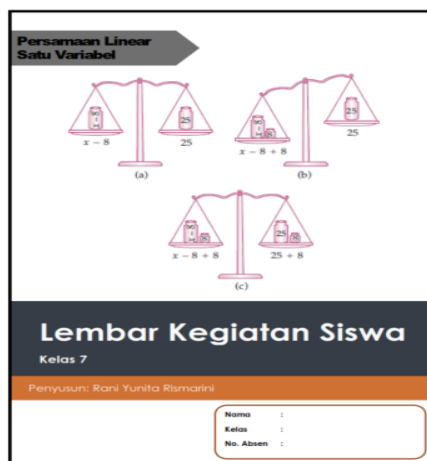
**Table 3 .** Criteria for assessing the effectiveness of LKS

Assessment criteria	Percentage
Very effective	$e > 80$
Effective	$50 < e \leq 80$
Ineffective	$20 < e \leq 50$
Very ineffective	$e \leq 20$

Source: Wulandari, 2018

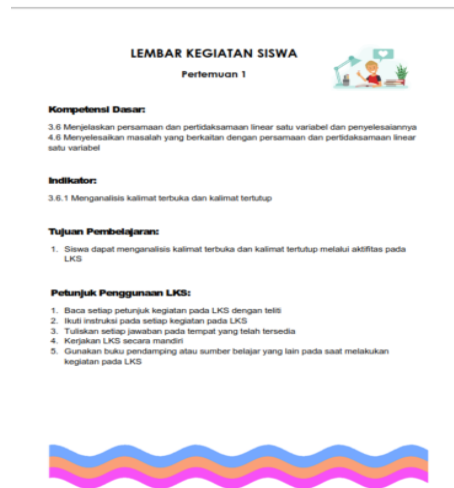
**RESULTS AND DISCUSSION**

The product produced in this development is a structured worksheet. The structured LKS design includes A *cover* page consisting of the LKS title, material title, and student personal data.



**Figure 2.** Structured Worksheet Cover

Furthermore, it contains learning outcomes, learning objectives, learning references, concept maps, and instructions for using LKS.



**Figure 3.** Structured Worksheet Instructions

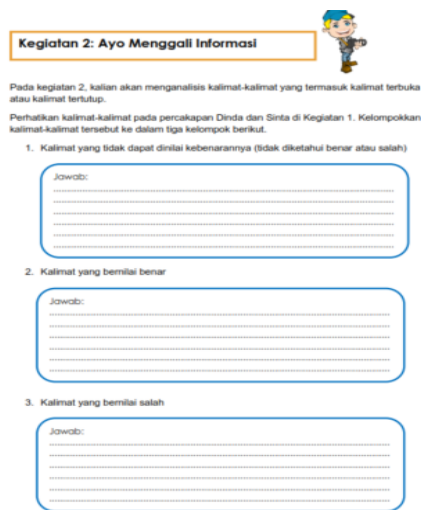
The core part of the worksheet begins with material that directs students to problem-based learning. On this page, there are instructions for making observations on a story problem or narrative.



**Figure 4.** Observation of story questions

The next sheet contains activity 2, namely an invitation to dig up information. In activity 2 there are instructions for analyzing *problems* so that students get used to solving problems using the knowledge and skills they have. After that,

there are ways to solve problems and how to draw conclusions.



**Figure 5.** Essay questions

The worksheet design contains 5 steps: 1. Orient students to the problem, namely the instructor outlines the goals of the lesson, and the material being taught, and motivates students to actively solve the chosen problem; 2. Organizing learning activities, namely the teacher helps students identify and plan educational activities about the material; 3. Guiding individual and group investigations, namely the teacher's role in encouraging students to collect related information and carry out experiments to obtain explanations and solve problems; 4. Develop and present the results of the work, namely the teacher helps students plan and prepare an appropriate report form to represent the results of the investigation. Reports can be in the form of written reports, videos, or other forms; 5. Examine and assess the process of solving problems, namely, the teacher helps students reflect or

evaluate the requirements and processes that have been implemented.

The process of preparing LKS uses teaching module references that have previously been prepared, especially the learning outcomes, learning objectives, flow of learning objectives, indicators, learning materials, learning methods, and models.

Material substance expert validation produced the following data:

**Table 4.** Validity assessment results in data by material substance experts

No	Rated aspect	Average score	Criteria
1	Eligibility of content	3,625	Very Valid
2	Material feasibility	3,833	Very Valid
3	Linguistic feasibility	4,000	Very Valid
Amount		11,458	
Average		3,819	Very Valid

Based on Table 4, each criterion produces a score in the very valid category with a final average result of 3.819 in the very valid category.

Furthermore, validity assessment by teaching material design experts produces the following data:

**Table 5 .** Data Result of Expert Assessment of Teaching Material Design

No	Rated aspect	Average score	Criteria
1	Language	3.66	Very Valid
2	Presentation	3.66	Very Valid
3	Media effects on	3.50	Very Valid

learning strategies			
4 Comprehensive view	4.00	Very Valid	
Amount	14.82		
Average	3.70	Very Valid	

Based on Table 5, each criterion produces a score in the extremely legitimate group with a final average result of 3.70 in the very valid category.

Based on the results of the validity test assessment by experts, it can be concluded that the product has a very valid category. Furthermore, the practicality of the product is determined from the results of a limited trial, namely filling out a student response questionnaire by 10 students who have been selected to be the assessment sample, resulting in the following data:

**Table 6 . Student Response Questionnaire Data**

No	Respon den	Aspect			Total	Average
		Conten ts	Presen tatio n	Con ditio n		
1	AFL	7	21	14	42	3,50
2	AA	7	21	14	42	3,50
3	DWS	7	22	13	42	3,50
4	DR	7	22	15	44	3,67
5	HKS R	7	21	12	40	3,33
6	KFN U	8	22	14	44	3,67
7	M.R. C	7	21	14	42	3,50
8	MAC	6	22	13	41	3,42
9	NV	7	22	15	44	3,67
10	TAI	7	22	14	43	3,58
	Total	70	216	138		

No	Respo den	Aspect			Total	Averag e
		Conten ts	Presen tatio n	Con ditio n		
	Average	3,50	3,60	3,45		
	FINAL AVERAG E		3.53			

The total average score shows a score of 3.53 in the range of  $3.25 < \bar{x} \leq 4.00$  with the practicality criterion being very practical.

To test effectiveness, researchers conducted a problem-based learning test on 10 sample students, and produced the following data:

**Table 7. Problem-Based Learning Test Results Data**

No	Student's name	Mark
1	AFL	80
2	AA	50
3	DWS	80
4	DR	80
5	HKSR	80
6	KFNU	80
7	MRC	90
8	MAC	80
9	N.V	60
10	TAI	90
	TOTAL	770
	AVERAGE	77

The effectiveness of the LKS developed in the limited trial showed that 2 out of 10 students still had not reached the KKM, namely less than 75, with an overall average score of 77. Meanwhile, the percentage in the limited trial was 80% with the effectiveness criteria being very effective.

Based on the results of this research, shows that problem-based learning methods can significantly improve students' problem-solving abilities. Problem-based learning facilitates students to practice their abilities in solving problems (Wijayanto & H.S., 2018). Learning using LKS can make students play an active role in learning activities through positive interactions between students to discuss problems that have been prepared in the LKS (Dinasti & Sukmawarti, 2022). Thus, LKS has the potential to be effective and can be used in mathematics learning (Trinuryono, et.al, 2022)

## CONCLUSION

The structure worksheet developed consists of student orientation to the problem, organized learning activities, individual and group investigations, presentation of work results, as well as analysis and evaluation of the problem-solving process. The worksheet was validated by a material substance expert with a score of 3.82 meeting the very valid criteria, while a teaching material design expert with a score of 3.70 met the very valid criteria. The LKS assessment was based on the practical aspect using a student response questionnaire which showed that the LKS developed had practical value with the total average score from the student response questionnaire being 3.53. The worksheet

developed is stated to be very practical. LKS assessment based on effectiveness aspects is obtained from the results of students' problem-based learning tests which show that students reach the effective category with an effectiveness percentage of 75%, so the LKS developed is declared effective. Therefore, it can be concluded that problem-based worksheets on one-variable linear equations for grade 7 junior high school are valid, effective, and practical to use as learning aids using problem-based learning methods.

However, this research has limitations, namely the structured worksheet was developed only for Linear Equations in One Variable. LKS has also only been tested for problem-based learning. Therefore, the suggestion for similar research is that researchers can develop worksheets on other mathematical materials. Apart from that, researchers can also test this structured LKS on other learning methods by making modifications to the LKS.

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