

Problem-Based Student Work Sheet Development to Improve Learning Outcomes Mathematics of Elementary School Class Students

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Abstract: Efforts to realize an increase in learning outcomes require teaching materials in the form of LKS media that can assist and facilitate learning activities so that they can run successfully. The advantage is obtained when problem solving is carried out by involving awareness of thought processes and self-regulation abilities, thus enabling the building of a strong and thorough understanding of the problem accompanied by logical reasons. The formulation of the problem in this research is; what is the process of developing problem-based student worksheets for improving mathematics learning outcomes, what is the feasibility of developing problem-based student worksheets for improving mathematics learning outcomes, how practical is the development of problem-based student worksheets for improving mathematics learning outcomes, how is the effectiveness of developing problem-based student worksheets for improving mathematics learning outcomes. This research is a type of product development research, the steps adhere to the Borg and Gall theory, namely (1) research and information gathering, (2) research planning, (3) developing initial products, (4) product design validation, (5) product design revision stage I, (6) limited trials, (7) product revision stage II, (8) field trials, (9) Final Product Improvement, (10) Dissemination. Expert validation includes media and language expert validation. Data mining using pretest and posttest. effectiveness and feasibility test using normality test, homogeneity and independent sample t-test. The conclusion from the results of this study is that teachers and students need to develop problem-based student worksheets (LKS) to improve mathematics learning outcomes for fifth grade elementary school students. consists of several parts including 1) compiling a map of the needs of problem-based student worksheets; 2) determine the title of the problem-based student worksheet; and 3) Form design planning, problem-based student worksheets (LKS) are appropriate for use to improve mathematics learning outcomes for fifth grade elementary school students, development of problem-based student worksheets (LKS) is effective for improving mathematics learning outcomes for fifth grade elementary school students.

Keywords: Problem-based learning, Mathematics learning outcomes, educational development

1. Introduction

Education is a conscious and planned effort to create a learning atmosphere and learning process that can actively develop one's potential. Education is also a supporting means in achieving the goals of the State of Indonesia, namely educating the life of the nation and improving the quality of Human Resources (HR) who believe and fear God Almighty (Kemendikbud, 2014). Conceptually, the purpose of education reflects the existence of three educational domains, namely, affective consisting of faith, piety and noble character, cognitive, namely knowledge, creative competence, and psychomotor, namely health, independence, democracy and responsibility. Education is the right step in an effort to develop every aspect of human personality both physically and mentally, so that it is formed to become a complete human being (Sofie, 2017).

To achieve quality education, the learning process must also be of high quality. The process of learning mathematics needs to be related to everyday life. In the context of Mathematics content, Mathematics skills are daily human activities that are important for present and future life. Mathematics is a science related to exact knowledge that has been organized systematically including rules, ideas, logical reasoning and logical structures. The presence of ethnomathematics in learning mathematics provides a new nuance that learning mathematics is not only limited in the classroom but also in

the outside world. Numerical literacy is part of mathematics, so that the components in the implementation of numeracy literacy cannot be separated from the coverage material in mathematics (Kemendikbud, 2017).

The purpose of giving mathematics subjects into five mathematical competencies that must be possessed by students, including problem solving, communication, reasoning, connection and mathematical representation, all of which are mathematical literacy abilities. The ability to complete mathematics is not just understanding and knowing mathematical concepts. But also able to analyze a mathematical problem and solve problems related to everyday life (Rohmayasari, 2018). Mathematical literacy is defined as the ability to use mathematical knowledge and understanding effectively in facing the challenges of everyday life. Someone who is mathematically literate is not enough to only be able to use knowledge, but also must be able to use it effectively (Indrawati, 2020).

Students' ability to learn mathematics in Indonesia is still relatively low. The results of the TIMSS (Trends International Mathematics and Science Study) study in grades 4 and 8 which were included in the research as a comparison of mathematics and science achievement in 2015 which was conducted in 49 participating countries including Indonesia, showed that the reasoning abilities of students in Indonesia scored 397 out of 500 average scores international average who follow TIMSS. TIMSS is an international study on the direction of the development of mathematics and science in various countries. The results of the latest study from TIMSS in 2015 show that Indonesia is far behind other countries in mathematics. Indonesia is ranked 44th out of 49 participating countries. The PISA (Program For International Student Assessment) assessment as an institution assessing students' learning abilities in 2018 announced by the OECD (The Organization for Economic Cooperation and Development) shows Indonesia is ranked 73 out of 79 countries participating in mathematics with a score of 379 out of the average score 489 OECD member countries. Indonesia is experiencing a downward trend in math skills. China and Singapore are in the highest ranking with scores of 591 and 569 for mathematics (OECD, 2016).

The results of the interviews conducted by the researcher with the class V teacher, the research obtained some information related to the learning of mathematics in class V which had low residual grades in class V and the teaching materials used at school were textbooks that were loaned at the school library and students still used worksheets students (LKS) were taken, but as the researchers saw that the LKS used by students as teaching materials was still not interesting. Student Worksheets (LKS) Teaching materials based on scientific mathematics that have not been developed, have not developed scientific-based LKS, have never used student learning motivation questionnaires, and teaching materials used in the learning process in class are still limited, namely in the student handbook and teacher handbook. This is an obstacle in learning in the classroom, which can be seen from the low mathematics learning outcomes.

The reason for the low achievement of students in mathematics is that learning is not optimal. The phenomenon was found that the teacher was busy explaining what had been prepared. Busy students themselves become good recipients of information. As a result, students only imitate what the teacher does, without meaning and understanding so that in solving problems students think that it is enough to do what is exemplified. Mathematical literacy is able to form individual mathematical reasoning. The ability to solve math problems must be developed for all students (Mardiah, 2017). The formation of mathematical reasoning requires an appropriate teaching material. This is done as an effort to create educational interactions between educators and students. An educator must be able to arrange learning resources that attract the attention of students in the form of effective learning (Zaman, 2013).

One of the teaching materials that can be used to facilitate student learning is the Student Worksheet (LKS) (Nurjumhar, 2021). Prastowo (2014) states that LKS is a printed teaching material in the form of sheets of paper containing material, summaries, and instructions for carrying out learning tasks that must be done by students, both theoretical and practical, which refers to the basic competencies that must be achieved. Student Worksheets are one of the teaching materials in the form of sheets of paper containing material, summaries, and instructions for implementing learning tasks that must be done, so that they can assist students in achieving the goals of learning. Majid (2014: 176) mentions Student Work Sheets are sheets containing assignments that must be done by students. LKS is usually in the form of instructions, steps to complete a task. The tasks ordered in the LKS must be clear about the basic competencies to be achieved.

Suriyana's research (2018) entitled Development of Problem-Based Student Worksheets to Improve Learning Outcomes found that the percentage of completeness was 78%, so LKS based on the subject matter of surface area and volume of cubes can be said to be effective. While the developed LKS obtained a score from the student response questionnaire of 3.01 so it can be concluded that the LKS is practical. So it can be concluded that the developed problem-based LKS meets the feasible criteria, can be used as a good teaching material. Aswarliansyah's research (2020) with the title Development of Contextual-Based Student Worksheets to Improve Mathematics Learning Outcomes in Elementary Schools found that the level of practicality of contextually-based student worksheets after analyzing student responses was known that the average percentage of student responses was 80%. Contextually based student worksheets are practical to use. While the effectiveness of student worksheets is analyzed through the correlation of learning responses and student learning outcomes. The results of the data analysis show that there is a relationship of 0.766 with the criteria of effectiveness.

Kusumawati's research (2017) entitled optimizing problem-based learning models with the help of student worksheets (LKS) to increase activity and learning outcomes in mathematics subjects found an increase in learning

activity from cycle II of 5.26 from an average score of 79, 08 in the quite active category in cycle I became 83.34 with an active category in cycle II, and there was an increase in learning outcomes in cycle II of 1.75 from an average score of 79.71 with a good category in cycle I to 81.46 with good category in cycle II. The problem-based learning model with the help of student worksheets (LKS) can increase student activity and learning outcomes in mathematics in class V SDN 1 Pamotan. Khasanah (2018) in his research obtained the results of material expert validation on the feasibility aspect of the content obtaining an average score 3.92 with very good criteria, in the linguistic aspect an average score of 3.71 with very good criteria and in the inquiry approach aspect an average score of 3.83 with very good criteria. Media expert validation on the graphical aspect obtained an average score of 3.43 with very good criteria and on the presentation aspect obtained an average score of 3.55 with very good criteria. In the small group trials, the attractiveness test obtained an average score of 3.04 with attractive criteria and field trials obtained an average score of 3.38 with very attractive criteria.

The results of the researcher's survey by observing and interviewing grade IV elementary school teachers found that almost 90% of students, totaling 15 people, had very low ability to master math problems, besides that the level of students' reasoning in solving automatic math problems was also very low. From the results of interviews with the grade IV teacher it was also found that in teaching mathematics, the teacher only gave arithmetic formulas from the mathematics material in learning without providing the basic concepts of the formula or material. Students are used to being given questions or problems that are only in accordance with the formula given by the teacher, so that when students find other questions to solve math problems, students cannot solve them correctly. The currently circulating LKS only contains practice questions for students to work on. Worksheets used in the field tend to contain very brief information and do not guide students to construct mathematical understanding. Submission of material in LKS has not facilitated student activity in solving problems and does not meet the requirements. Through mathematics problem-based learning, students are directed to develop their abilities, including building new mathematical knowledge, solving problems in various contexts related to mathematics, applying various strategies needed, and reflecting on the process of mathematical problems.

Efforts to achieve increased learning outcomes require teaching materials in the form of LKS media that can assist and facilitate learning activities so that they can run successfully. The advantage is obtained when problem solving is carried out by involving awareness of thought processes and self-regulation abilities, thus enabling the building of a strong and thorough understanding of the problem accompanied by logical reasons. This kind of understanding is something that is always emphasized when teaching mathematics at all levels of education, because of its strong compatibility with patterns of thinking in mathematics. Problem-based Student Worksheets (LKS) are learning steps that organize students to learn, orient students to problem situations, guide individual and group investigations, develop and present work results and analyze and evaluate problem-solving processes.

2. Research Methods

The type of research used is applied research using Research and Development (R&D) or research and development methods. The research design is using research and development (Research and Development) using the Borg and Gall models. Data collection techniques through interviews, observation sheets and questionnaires. The research instrument uses interview guidelines, expert validation guidelines and observation sheets. Data analysis techniques using preliminary study data analysis, product validation analysis and product effectiveness analysis

This product trial was conducted to collect data used as a basis for determining the feasibility of the product being developed. There are several things that need to be considered in product trials, namely: (1) trial design, (2) trial subjects, (3) data types, (4) data collection instruments, and (5) data analysis techniques. Can be described as follows:

1. Trial Design

Product Student Worksheets (LKS) from the development are tested for the feasibility of the product by means of validation by several experts. Test the feasibility of the media by giving a questionnaire to the validator to assess the level of validity, as well as the practicality of the product being developed. Test the feasibility of the target by giving questionnaires to students through field tests. Validation was carried out by calculating a questionnaire with a Likert scale and paying attention to the suggestions and comments given to experts. Field trials were carried out with implementation designs in two different schools with the same level.

2. Trial Subjects

a. Expert Test (Expert)

Before conducting trials on students, the developed media must be validated first. Validation was carried out by material experts/experts, question experts/experts and media experts/experts. With the validation of teaching media by material experts/experts, question experts/experts and media experts/experts, the initial product developed is feasible to be tested on students. Expert tests were conducted on Media Experts, Language and Mathematics Teachers.

b. Limited Trial

Limited trials were carried out with the aim of getting responses and responses from students as a reference for improving teaching material media. In this limited trial phase, the researcher collected data obtained from a questionnaire which was distributed to students as well as evaluation questions

that students worked on. The questionnaire given to students contained students' responses to teaching media.

Questionnaires were also given to class teachers with the aim of obtaining data regarding class teacher responses to teaching media. A limited trial was conducted on 10 participants

c. Extensive Trials

The extensive trial phase was carried out to find out whether the teaching media being developed was feasible in the aspects of learning aids, content or material. The difference between broad trials and limited trials lies in the breadth of the subject, i.e. limited trials are conducted on several students, and wide trials are conducted on students in one class. Questionnaires and evaluation questions were given to students, as well as questionnaires to class teachers. The data obtained from the extensive trial phase will be used to improve teaching media in order to obtain a final product that is effectively used in learning, especially mathematics material for class V SD.

3. Research Result

Needs Analysis for the Development of Problem-Based Student Worksheets (LKS) to Improve Mathematics Learning Outcomes for Class V Elementary School Students

Needs Analysis for the Development of Problem-Based Student Worksheets (LKS) to Improve Mathematics Learning Outcomes for Class V Elementary School Students was sought through learning observations and questionnaires distributed to a number of students at SDN Pamotan 1, SDN Pamotan 2 and SDN Pamotan 5 as follows:

3.1 Analysis Through a Questionnaire

The questionnaire used by researchers is a questionnaire that can explore the types of student needs for student worksheets by asking what kind of student worksheets are expected. Based on these questions the researcher wanted to collect data about the types of student worksheets expected and needed by students. Students can answer these questions by choosing one or more of the 10 statements that have been provided. The way to fill in the statement is that students can check the circle that has been provided for each statement if they agree and empty the circle if they do not agree with the statement that has been provided. Needs analysis was carried out on one class consisting of 25 students. Filling in the needs analysis questionnaire by students was carried out on Sunday, January 9 2023. The results are shown in the graph in Fig. 1 as follows:

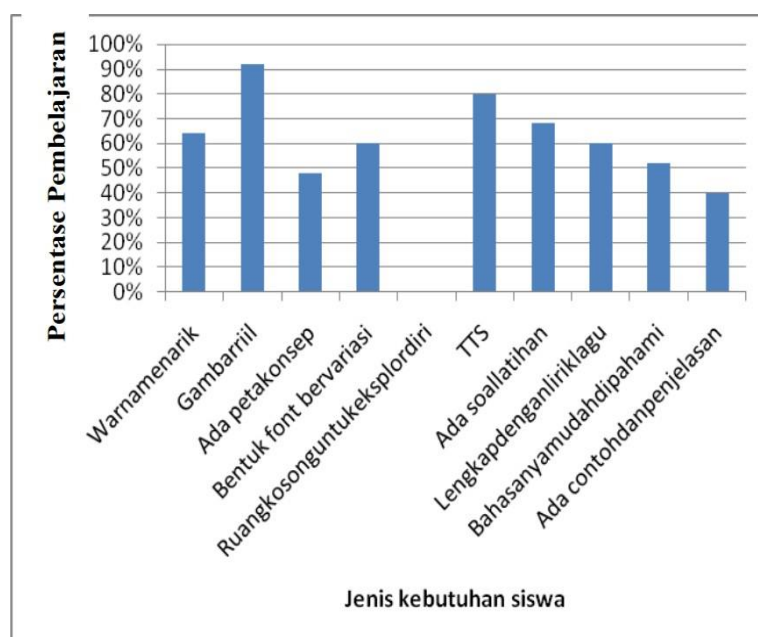


Fig. 1 - Percentage of student needs analysis.

Based on the graph in Fig. 1, then the types of student needs for Student Worksheets are grouped into three categories, namely low, medium and high. The types of needs that have a low category have a percentage of 0% - 33%, the medium category has a percentage of 34% - 66% and the high category has a percentage of 67% - 100%. The following is a grouping of types of needs based on their categories:

- High category the types of needs for the high category are student worksheets equipped with real pictures, crosswords and equipped with exercises
- Medium category the types of needs included in the medium category are student worksheets with attractive color displays, there are concept maps, there are song lyrics related to the material, the language is easy to understand and there is an explanation of the material

c. Low category the type of need that is included in the low category is that there is an empty space for self-exploration

3.2 Analysis Through Observation of Learning

Based on these data, information is obtained that student worksheets that must be developed for students at least meet the needs of the high category, namely real pictures, there are crossword puzzles and there are exercises

This learning analysis uses a sample of one class consisting of twenty-five students. The results of the learning analysis questionnaire can be presented in the following graph

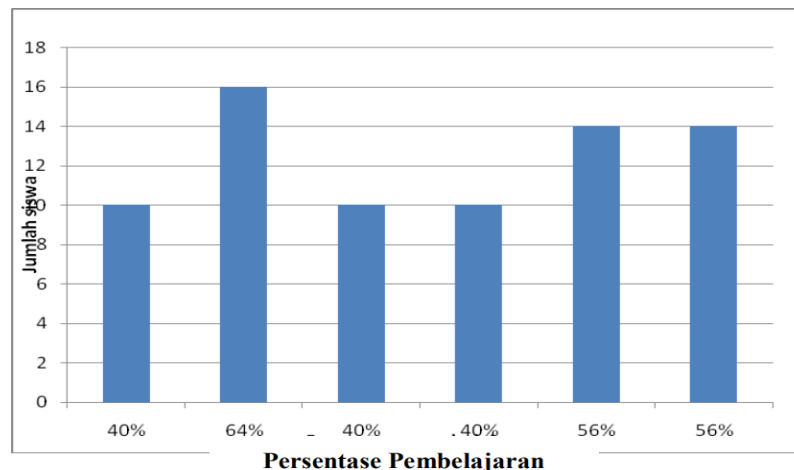


Fig. 2 - Percentage of student learning analysis.

Based on Fig. 2, information is obtained regarding the expected learning of students in the high, medium and low categories as follows:

3.2.1 Types of learning in the high category Based on the image analysis of the students' learning, information is obtained on the types of learning that have a high category with a range of 67% - 100%, namely that learning in the high category does not have enthusiasts because the resulting percentage does not meet the category

3.2.2 Types of learning in the medium category Based on the images of the student learning analysis, information is obtained on the types of learning that have a moderate category with a value range of 34% - 66%, namely learning with power points, lectures, discussions, outside the classroom and giving assignments

3.2.3 Types of learning in the low category Based on the picture of the analysis of student learning, information is obtained on the types of learning that have a low category with a value range of 0% - 33%, i.e. none

3.3 Analysis of Children's Intelligence

The third stage in research and development with the Dick & Carey model is the analysis of the behavior or type of intelligence of students. This analysis was carried out to determine the type of intelligence of students in the class. Researchers used several questions that represent each intelligence as an instrument to determine the type of intelligence of students. The intelligence of students obtained information that the class consists of students who have various intelligences. Information obtained that the most intelligence owned by students is intrapersonal intelligence with a percentage of 16.1%. So, the learning in the classroom must be arranged in such a way that students can learn simple airplane material with intrapersonal learning, but it must also be noted that in the classroom there are students who have different intelligences. It was shown by the results of the multiple intelligences test that intelligence which has the second rank is visual-spatial, kinesthetic, natural, musical, linguistic, interpersonal, logical-mathematical and existential. The data gives a signal to the teacher that students have different intelligences, therefore the needs of one individual with another individual cannot be equated.

4. Test Independent sample t test

4.1 Differences in Mathematic Learning Autco of Experiment 1 Class Student Experiments 2

The results of the independent test sample t test between experimental class 1 and experimental class 2 which both use problem-based student worksheet development (LKS) can be seen as follows The independent test sample t test aims to find out which learning method is more effective in improving the mathematics learning outcomes of fifth grade elementary school students between students who use problem-based student worksheet

development (LKS) and those who do not use it. In detail, it can be explained as follows:

Table 1 - Independent sample t test experiment 1 with experiment 2.

		Levene's Test					
for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	
Mathematics Learning	Equal variances assumed	.434	.512	.188	61	.851	
Outcomes of Class Elementary School Students	Equal variances not assumed			.184	51.395	.855	

Based on the independent sample t-test on equal variance assumed, the Tcount value is $0.188 < T_{table} 1.99962$ and the sig (2 tailed) value is $0.851 > 0.05$. These results indicate that there is no difference in the mathematics learning outcomes of experimental class 1 students and experimental class 2 because they both use problem-based student worksheet development (LKS). It can be said that the results of student mathematics learning using problem-based development of student worksheets (LKS) have the same learning outcomes

Table 2 - Experimental statistical group 1 with experiment 2.

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
27	Mathematics Eksperimen 1		81.481	12.4569	2.3973
Learning Outcomes of Class V Elementary School Students	Eksperimen 2	36	82.033	10.7875	1.7979

Based on the table above, the mean value of the mathematics learning outcomes for fifth grade students at SD Negeri Pamotan 1 (experiment 1) is 81.5, while the learning outcomes for grade V

Table 3 - Independent sample t test experiment 1 with control levene's test.

for Equality of Variances			t-test for Equality of Means			
			FSig.	t	df	Sig. (2-tailed)
Hasil Belajar Matematika Siswa Kelas V SD	Equal variances assumed	.006	.941	5.079	60	.000
	Equal variances not assumed			5.089	56.464	.000

Based on the independent sample t-test on equal variance assumed, the value of Tcount is $5.079 > T_{table} 2.00030$ and a significance level of $0.000 < 0.05$. These results indicate that there are differences in the mathematics learning outcomes of students who use problem-based student worksheet development (LKS) and those who do not. It can be said that the mathematics learning outcomes of students who use problem-based student worksheet

development (LKS) and those who do not use are fundamentally different

Table 4 - Experimental statistics group 1 with controls.

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Mathematics Learning Outcomes of Class V Elementary School Students	Eksperimen 1	27	81.481	12.4569	2.3973
	Kontrol	35	65.140	12.6396	2.1365

Based on the table above, the mean value of the mathematics learning outcomes of fifth grade students of SD Negeri Pamotan 1 (experiment 1) using problem-based student worksheet development (LKS) is 81.5 while the mathematics learning outcomes of fifth grade students of SD Negeri Pamotan 5 (control) without using problem-based student worksheet development (LKS) of

65.1. These results mean that the average mathematics learning outcomes of students who use problem-based student worksheet development (LKS) are higher than those who do not use ($81.5 > 65.1$). Thus it can be concluded that the development of problem-based student worksheets (LKS) is more effective in improving the mathematics learning outcomes of fifth grade elementary school students compared to those who do not use

a. Differences in Mathematics Learning Outcomes of Experiment 2 Class Students with Control The results of the independent test sample t test between experimental class 2 which used problem- based student worksheet development (LKS) and the control class which did not use problem-based student worksheet development (LKS) can be seen as follows :

Table 5 - Independent sample t test experiment 2 with control.
Levene's Test

for Equality of Variances

t-test for Equality of Means

		FSig.	t	df	Sig. (2-tailed)
Mathematics Learning Outcomes of Class V Elementary School Students	Equal variances assumed	.604	.440	69	.000
	Equal variances not assumed			66.708	.000

Based on the independent sample t-test on equal variance assumed, the value of Tcount is $6.064 > T_{table} 1.99495$ and a significance level of $0.000 < 0.05$. These results indicate that there are differences in the mathematics learning outcomes of students who use problem-based student worksheet development (LKS) and those who do not. It can be said that the mathematics learning outcomes of students who use problem-based student worksheet development (LKS) and those who do not use are fundamentally different.

Table 6 - Experimental statistics group 2 with controls.

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Mathematics Learning Outcomes of Class V Elementary School Students	Eksperimen 2	36	82.033	10.7875	1.7979
	Kontrol	35	65.140	12.6396	2.1365

Based on the table above, the mean value of the mathematics learning outcomes of fifth grade students at SD Negeri Pamotan 2 (experiment 2) using problem-based student worksheet development (LKS) is 82.0 while the mathematics learning outcomes of fifth grade students at SD Negeri Pamotan 5 (control) without using problem-based student worksheet development (LKS) of

65.1. These results mean that the average mathematics learning outcomes of students who use problem-based student

worksheet development (LKS) are higher than those who do not use ($82.0 > 65.1$). Thus it can be concluded that the development of problem-based student worksheets (LKS) is more effective in improving the mathematics learning outcomes of fifth grade elementary school students compared to those who do not use.

1. Calculation of Gain Index

The gain index calculation was carried out as a supporting test to determine the magnitude of the increase in learning outcomes of students in the control class using conventional learning models, experiment 1 and experimental class 2 which used problem-based student worksheet development (LKS). With the following criteria:

Table 7 - Gain index calculation criteria

intervals	Criteria
$0,7 \leq N\text{-Gain} \leq 1$	Tall
$0,3 < N\text{-Gain} > 0,7$	currently
$N\text{-Gain} \leq 0,3$	low

Tabel 8 - Improving experimental class student learning outcomes 1.

No	Name	Pretest	Posttest	N Gain	Criteria
1	ASP	53.3	86.7	0.7	Tall
2	AWA	46.7	60	0.2	low
3	DS	46.7	66.7	0.4	currently
4	ESN	40.0	53.3	0.2	low
5	FIH	53.3	86.7	0.7	Tall
6	GWS	53.3	86.7	0.7	Tall
7	LAC	60.0	93.3	0.8	Tall
8	PA	46.7	80	0.6	currently
9	RIF	40.0	73.3	0.6	Tall
10	RP	40.0	80	0.7	Tall
11	ME	53.3	86.7	0.7	Tall
12	NSA	66.7	100	1.0	Tall
13	DKD	40.0	73.3	0.6	currently
14	MDP	53.3	86.7	0.7	Tall
15	YSP	60.0	86.7	0.7	Tall
16	WSR	60.0	93.3	0.8	Tall
17	DAL	53.3	53.3	0.0	low
18	FA	53.3	86.7	0.7	Tall
19	FJ	40.0	73.3	0.6	currently
20	GM	46.7	80	0.6	currently
21	HH	46.7	86.7	0.8	Tall
22	JJN	66.7	100	1.0	Tall
23	KN	60.0	93.3	0.8	Tall
24	LA	60.0	93.3	0.8	Tall
25	LAS	53.3	86.7	0.7	Tall
26	MN	46.7	73.3	0.5	currently
27	WN	53.3	80	0.6	currently

Based on the table above, it is known that the calculation of the gain index of increasing mathematics learning outcomes for fifth grade students at SD Negeri Pamotan 1 Rembang using problem-based student worksheet development (LKS), found that 16 (59.3%) students experienced a high increase in learning outcomes, as many as 8 (29.6%) students experienced a moderate increase in learning outcomes and as many as 3 (11.1%) students experienced a low increase in learning outcomes

Table 9 - Improvement of experimental class student learning outcomes 2.

No	Name	Pre	Post	N Gain	criteria
1	AYP	46.7	80	0.6	currently
2	AEW	60	86.7	0.7	Tall
3	DAS	46.7	80	0.6	currently
4	DTI	40	73.3	0.6	currently
5	FES	46.7	66.7	0.4	currently
6	JL	46.7	73.3	0.5	currently
7	FP	53.3	80	0.6	currently
8	KFA	53.3	86.7	0.7	Tall
9	MDP	66.7	100	1.0	Tall
10	MW	60	93.3	0.8	Tall
11	NSK	60	86.7	0.7	Tall
12	NS	40	60	0.3	low
13	RDP	53.3	80	0.6	currently
14	RDT	40	73.3	0.6	currently
15	VY	60	60	0.0	low
16	WZ	40	60	0.3	low
17	ANA	46.7	80	0.6	currently
18	AZR	53.3	86.7	0.7	tall
19	AHU	53.3	93.3	0.9	tall
20	AAS	60	100	1.0	tall
21	ALN	40	73.3	0.6	currently
22	KN"	40	80	0.7	tall
23	MAK	60	86.7	0.7	tall
24	MAR	73.3	100	1.0	tall
25	MA	40	73.3	0.6	currently
26	MIR	46.7	80	0.6	currently
27	NRA	53.3	93.3	0.9	tall
28	NAU	46.7	80	0.6	currently
29	NSA	66.7	93.3	0.8	tall
30	RA	53.3	80	0.6	currently
31	RAI	60	86.7	0.7	tall
32	AR	60	93.3	0.8	tall
33	AN	40	73.3	0.6	currently
34	AFA	46.7	86.7	0.8	tall
35	DT	46.7	80	0.6	currently
36	DSK	53.3	93.3	0.9	tall

Based on the table above, it is known that the calculation of the gain index of increasing mathematics learning outcomes for fifth grade students at SD Negeri Pamotan 2 Rembang using problem-based student worksheet development (LKS), found that 17 (47.2%) students experienced a high increase in learning outcomes, as many as 16 (44.4%) students experienced a moderate increase in learning outcomes and as many as 3 (8.4%) students experienced a low increase in learning outcomes.

Table 10 - Improvement of control class student learning outcomes.

No	Name	Pretest	Posttest	N Gain	criteria
1	AA	60	73.3	0.3	low
2	ABW	46.7	53.3	0.1	low
3	CF	46.7	60	0.2	low
4	JPS	53.3	53.3	0.0	low
5	AAT	53.3	60	0.1	low
6	RP	53.3	66.7	0.3	low
7	DRD	46.7	53.3	0.1	low
8	DMF	66.7	60	-0.2	low
9	MRA	73.3	93.3	0.7	tall
10	NAM	46.7	60	0.2	low
11	FP	40	46.7	0.1	low
12	SDA	40	53.3	0.2	low
13	TNS	46.7	60	0.2	low
14	YA	53.3	73.3	0.4	currently
15	YUS	40	66.7	0.4	currently
16	ZAM	40	53.3	0.2	low
17	AK	46.7	66.7	0.4	currently
18	AA	60	80	0.5	currently
19	AR	53.3	73.3	0.4	currently
20	MIM	60	66.7	0.2	low
21	MSZ	66.7	80	0.4	currently
22	NA	53.3	60	0.1	low
23	NR	73.3	100	1.0	tall
24	RA	53.3	73.3	0.4	currently
25	SK	40	53.3	0.2	low
26	SM	46.7	60	0.2	low
27	SLS	46.7	53.3	0.1	low
28	VSU	40	46.7	0.1	low
29	ZM	53.3	66.7	0.3	low
30	ZA	40	53.3	0.2	low
31	ZE	40	60	0.3	low
32	DPM	46.7	66.7	0.4	currently
33	KUS	60	80	0.5	currently
34	LIS	66.7	86.7	0.6	currently
35	VN	53.3	66.7	0.3	low

Based on the table above, it is known that the calculation of the gain index of increasing mathematics learning outcomes for fifth grade students at SD Negeri Pamotan 5 Rembang without using problem-based student worksheet development (LKS), found that as many as 2 (5.7%) students experienced a high increase in learning outcomes, as many as 10 (28.6%) students experienced a moderate increase in learning outcomes and as many as 23 (65.7%) students experienced a low increase in learning outcomes.

Based on the results of the gain index, students' mathematics learning outcomes in the experimental and control classes can be summarized as follows:

Tabel 11 - Rekapitulasi indeks gain hasil belajar matematika siswa.

Kriteria	SDN Pamotan 1 (Eksperimen 1)	SDN Pamotan 2 (Eksperimen 2)	SDN Pamotan 5 (Kontrol)
Tinggi	59,3%	47,2%	5,7%
Sedang	29,6%	44,4%	28,6%
Rendah	11,1%	8,4%	65,7%

The results of this study explained that in learning using problem-based student worksheet development (LKS) in experimental class 1 and experiment 2 the majority of students experienced a high increase in mathematics learning outcomes while in learning without using problem-based student worksheet development (LKS) in class the control of the majority of students experienced a low increase in learning outcomes. These results prove that learning using problem-based student worksheet development (LKS) is more effective in improving the mathematics learning outcomes of fifth grade elementary school students compared to learning without using problem-based student worksheet development (LKS).

5. Conclusion

Based on the description of the background of the problem and the results of the research above, the following conclusions can be drawn Teachers and students need to develop problem-based student worksheets (LKS) to improve mathematics learning outcomes for fifth grade elementary school students.

- (1) The process of developing problem-based student worksheets (LKS) to improve mathematics learning outcomes for fifth grade elementary school students Lembar kerja siswa (LKS) berbasis masalah layak digunakan untuk peningkatan hasil belajar matematika siswa kelas V Sekolah Dasar
- (2) Development of problem-based student worksheets (LKS) is effective for improving mathematics learning outcomes for fifth grade elementary school students.

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Conflict of Interest

The authors declare no conflicts of interest.

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