



DEVELOPMENT OF MATHEMATICAL LKPD BASED ON SCIENTIFIC APPROACH TO IMPROVE STUDENTS' MATHEMATICAL PROBLEM SOLVING AT SD NEGERI 1 RIMO

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Abstract

This study aims to describe the validity, feasibility, and effectiveness of the LKPD Mathematics based on a scientific approach to improve students' mathematical problem solving abilities. This research is research & development. While the research design used is a 4D Thiagarajan study. The research subjects were conducted to fourth grade teachers and 27 fourth grade students, as well as three validator experts. Data was collected by means of questionnaires, tests, and interviews. Based on the results of material expert validation, an average score of 87.96% was obtained, then the learning design expert validation obtained an average score of 95.31%, and linguist validation obtained an average score of 93.75%. When viewed from the number of three expert validators, an average score of 92.34% was obtained with the LKPD category being very valid and feasible to use. While the results of the student response questionnaire based on small group trials and field trials obtained an average score of 94.95% with a very good category. To find out the improvement of students' mathematical problem solving, the researchers gave pre-test and post-test questions. From the results of the pre-test and post-test, it can be seen that there is an increase in students' mathematical problem solving abilities. The students' pre-test results obtained an average of 54.28% and the post-test results obtained an average of 73.33%. Based on the n-gain score assessment criteria, the effectiveness of the Mathematics LKPD based on a scientific approach

obtained a value of 0.41, a score range of $0.3 < 0.7$ was classified in the medium criteria. This shows that the LKPD Mathematics based on a scientific approach is effective in improving students' mathematical problem solving abilities.

Keywords: *LKPD Mathematics, scientific approach, mathematical problem solving*

A. Introduction

The objectives of learning mathematics formulated by the National Council of Teachers of Mathematics (NCTM, 2000) are: (1) learning to communicate (mathematical communication); (2) learn to reason (mathematical reasoning); (3) learning to solve problems (mathematical problem solving); (4) learn to link ideas (mathematical connections); (5) the formation of positive attitudes toward mathematics (positive attitudes toward mathematics).

However, the reality of the conditions that characterize mathematics learning today is about the low quality or quality of mathematics education, which shows that the quality of education, especially in mathematics, is still low. This can be seen from the data from the TIMSS study which examined the comparison of mathematics and science learning outcomes in grades 4 and 8 in several countries. This is in line with the opinion of Minarni, et al (2020:45) problems will arise when someone has a goal but does not know how to achieve that goal. Problems require the existence of a problem-solving ability. Problem solving ability is a basic ability that must be mastered by students, even reflected in the concept of competency-based curriculum.

However, in reality, the ability to solve problems is still not maximized, seen from the difficulty of students understanding the concepts and values of students' cognitive learning outcomes that are not satisfactory. Many students do not have the will to try and think at a

higher level to find solutions to every difficulty in learning mathematics, but instead always avoid it. In fact, in the learning process in class, some students choose to be silent or tend to be passive and wait for the teacher to solve the questions given without any effort to do it themselves, understanding of the material being studied is still low and activeness in group discussions is also still lacking. They think that mathematics is abstract and not easy to do.

The Minimum Completeness Criteria (KKM) for Mathematics in grade IV SD Negeri 1 Rimo is 65, from the data above it shows that out of 30 students who have reached the KKM only 5 people or about 16.67% and students who do not reach the KKM 25 people or about 83.33%. The teaching materials used in the learning process are textbooks and LKS/LKPD from schools, but students still often have difficulty understanding the material in the textbooks and the LKPD itself. From the results of the students' mathematical problem solving ability tests, it can be concluded that students lack mathematical problem solving abilities.

Mathematical problem solving skills need to be trained and familiarized with students because mathematical problem solving skills are the provision of students in expressing their ideas and ideas to solve mathematical problems or problems found in everyday life both orally and in writing. Meilani (2019) states that learning mathematics in elementary schools is not only aimed at increasing the ability to count or applying formulas in solving routine questions, but is an important aspect in learning mathematics.

To achieve the above objectives, it is necessary to have a Student Worksheet (LKPD) which must be prepared by a teacher. LKPD is an important part that must be considered by the teacher because it is a

reference in seeing the ability of students to understand learning, being able to solve mathematical problems as evidenced by the ability of students to work on the LKPD given by the teacher on each subject matter. Romiyati, et al (2017) say that LKPD is a printed teaching material in the form of sheets of paper containing material, summaries and instructions, implementation of learning tasks that must be done by students and refers to the Basic Competencies that must be achieved.

However, the reality that occurs in the field, teachers find it difficult to develop LKPD in accordance with the needs of the 2013 Curriculum, so that the LKPD used is LKPD which is generally purchased and not made by the teacher himself. The difficulty of teachers in developing LKPD in accordance with the needs of the 2013 Curriculum is the lack of socialization of the 2013 Curriculum so that the teacher's understanding is not yet deep about the development of LKPD, besides that the student book provided by the Ministry of Education and Culture contains material that is quite minimal and brief so that students still need the LKPD. as a support for the learning process. With the existence of interesting mathematics worksheets, it is expected to provide understanding to students in recognizing and understanding various materials.

Based on an interview with one of the homeroom teachers for grade IV, Mrs. Yusraini, S.Pd at SD Negeri 1 Rimo, she stated that teachers have not used an adequate LKPD. Most teachers use existing LKPD directly provided in textbooks as student work material during learning activities, schools also use LKPD which are traded in the market, so the LKPD used is not in accordance with the needs of students.

Based on the results of the analysis above, the author intends to conduct research on the development of mathematical worksheets based on a scientific approach in accordance with the 2013 Curriculum because

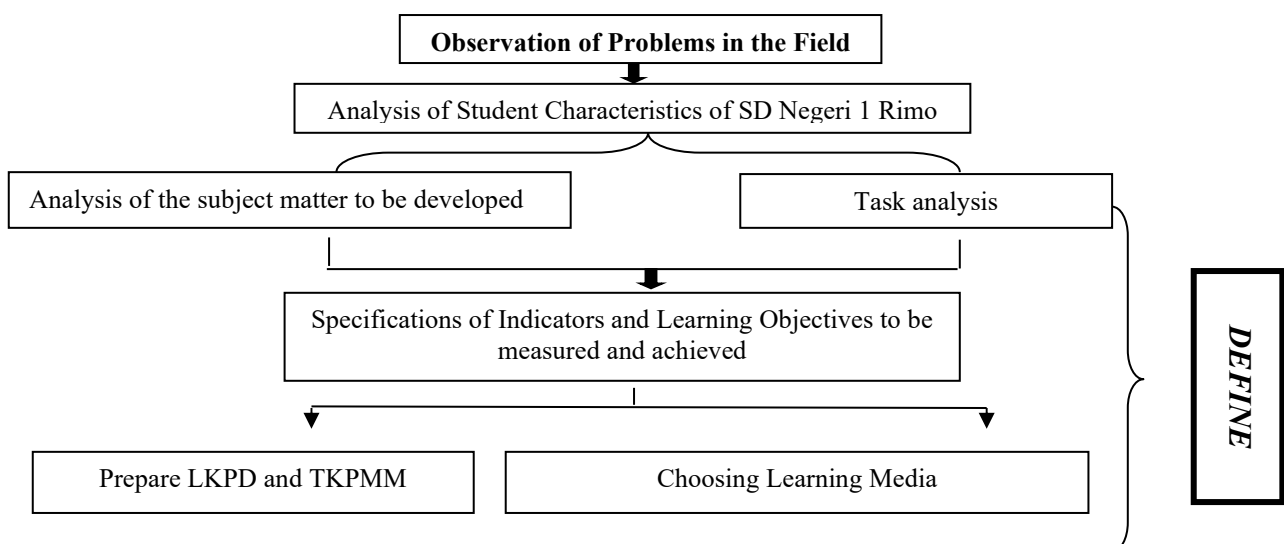
the scientific approach is a standard process in learning which consists of observing, asking questions, gathering information, associating, and communicating. Thus the scientific approach used in this development is expected to provide understanding to students in understanding various materials. Thus, students are more challenged to find the necessary information for themselves, are able to answer every problem well, and are able to develop their reasoning power.

Learning conditions using LKPD development with a scientific approach that refers to the 2013 Curriculum based on Permendikbud No. 65 of 2013 concerning the standard of the learning process which states that the scientific approach has five steps, namely observing, asking, trying, associating, and communicating. Of the five steps, it is hoped that it can encourage students to find out from various sources of observation, not being told, students are able to formulate problems (by asking a lot of questions), not only solve problems by answering only, and train analytical thinking (students are taught how to take decision) not mechanical thinking (routine by just listening and memorizing alone).

The development of mathematical worksheets with a scientific approach that is carried out has a high appeal to students and makes the learning situation of students more meaningful and impressed well on their understanding, where researchers will pay attention to the appearance, content of the existing material, and certain things that can make students interested, therefore it is important to develop LKPD based on a scientific approach. The development of this LKPD is expected to be used as an alternative to support learning, especially for fourth grade students at SD Negeri 1 Rimo in KPK and FPB material.

B. Method

This research is a Research and Development Research and Development (R&D) with a development model that is a reference for researchers, namely the Thiagarajan 4-D development model. This research was carried out at SD Negeri 1 Rimo, which is located at Jalan Iskandar Muda, Gunung Meriah District, Aceh Singkil Regency. This research was conducted in the odd semester of the 2021/2022 academic year. The subjects in this study were three expert validators (material experts, linguists, and learning design experts), teachers and fourth grade students at SD Negeri 1 Rimo, Gunung Meriah District, Aceh Singkil Regency. The trial was carried out 2 times, namely small group trials for Class IVB students taken 6 students with varying abilities, gender and intelligence levels, while the students of class IVA were 27 people as samples for field trials. In this study, a mathematical worksheet based on a scientific approach was developed. The LKPD development model used in this research is the 4-D development model proposed by Thiagarajan



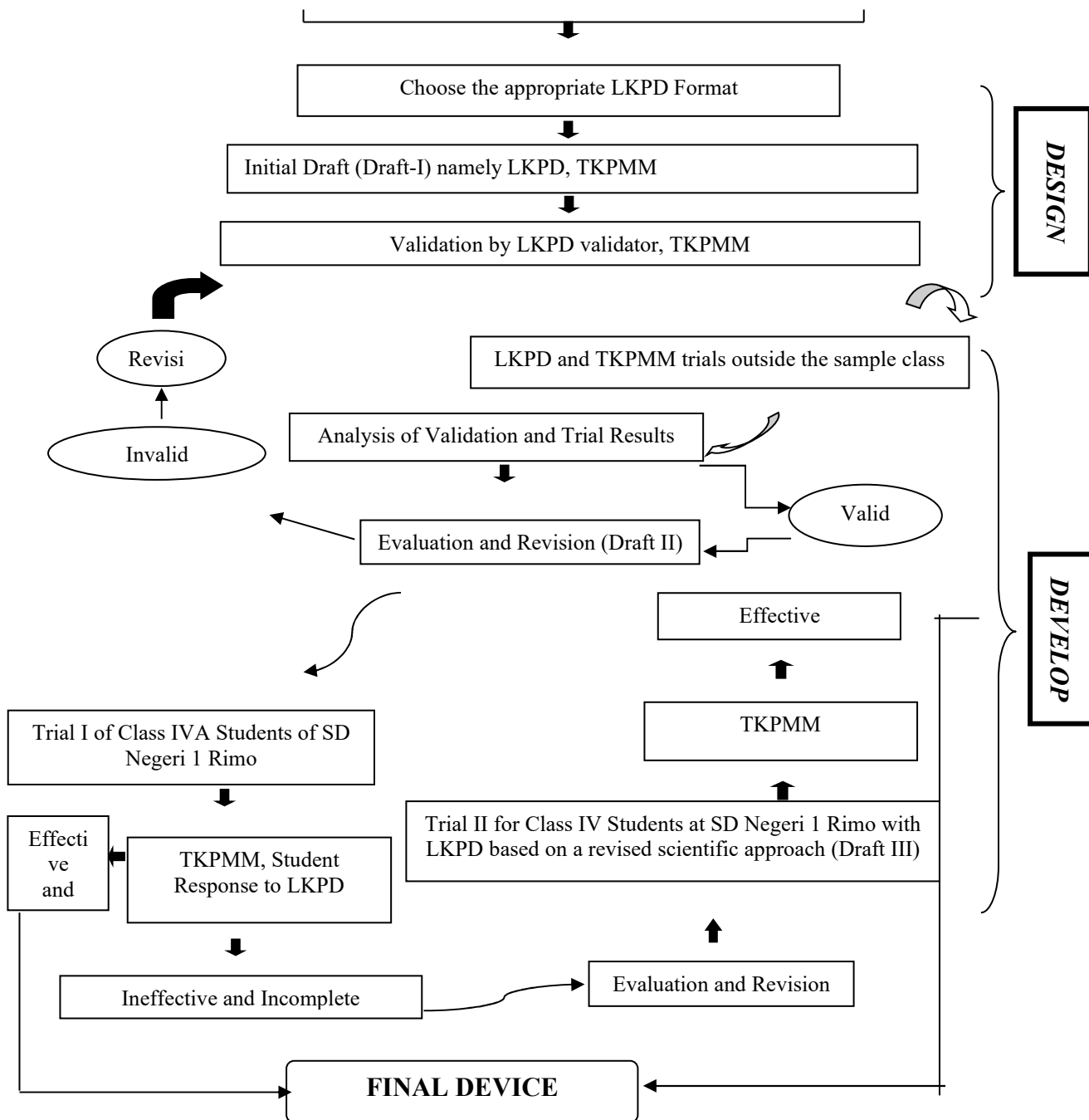


Figure 1. Research Procedures Development of LKPD based on a scientific approach to improve the KPMM of students

Data Collection Instruments and Techniques

To measure the analysis of the needs of students and teachers for the LKPD mathematics for KPK and FPB material, the feasibility of the scientific-based mathematics LKPD according to experts (materials, learning design, language), the responses of teachers and students on the scientifically-based mathematics LKPD that was developed, then an instrument was compiled and developed. study.

The instrument developed in this trial was given to respondents to fill out. The results of filling out the instruments that have been filled in by the respondents, were analyzed by researchers according to the data analysis techniques used, namely:

- Mathematical LKPD Validation Sheet Based on Scientific Approach,
- Mathematical Problem Solving Ability Test Validation Sheet and Mathematical Problem Solving Ability Test Instruments,
- Instruments for Student and Teacher Responses to Mathematics LKPD Based on a Scientific Approach

Data analysis technique

The purpose of data analysis in this study was used to answer the validity and practicality of mathematical worksheets based on a scientific approach that was developed referring to the formulation of the problem. The validity of the LKPD can be seen based on the average score of each validated LKPD. The practicality of LKPD is based on the assessment of validators/experts and product users find it easy to use the developed product and the product is feasible to use. Effectiveness is seen from the mastery of students' mathematical problem solving abilities.

- Data Analysis of Mathematical Problem Solving Ability Test
- Validity of LKPD Mathematics Based on Scientific Approach
- Student Response Data Analysis

C. Finding and Discussion

1. Result

This study aims to develop a product in the form of a Mathematics worksheet based on a scientific approach which will then be applied in learning by using R&D research or called development research based on Thiagarajan 4D development steps which include: defining, designing, developing, and distributing.

Table 1. Results of Expert Validation Recapitulation on Mathematics LKPD Based on Scientific Approach

No.	Validator	Percentage	Validity	Appropriateness
1.	Material Expert	87.96%	Very Valid	Very Worthy
2.	Linguist	93.75%	Very Valid	Very Worthy
3.	Learning Design Expert	95.31%	Very Valid	Very Worthy
Average		92.34%	Very Valid	Very Worthy

Product Trial

At this stage, the revised LKPD based on input, suggestions, and comments from experts and declared valid, then the LKPD in the form of draft II was tested, the trial was carried out 2 times, namely small group trials and large group trials/trials. field.

1. Small Group Trial

The assessment of the questionnaire responses of small group test students to the Mathematics LKPD based on a scientific approach shows

that the percentage of the questionnaire obtained is 93.3% with very good criteria. It can be concluded that the fourth grade students of SD Negeri 1 Rimo welcome and respond well to the Mathematics LKPD based on the scientific approach that has been tested.

2. Large Group Trial/Field Trial

a. Analysis of Students' Mathematical Problem Solving Ability

Table 2. Percentage of Students' Pre-test Answers on Mathematical Problem Solving Problems

Rated aspect	Question Number					
	1		2		3	
	B	S	B	S	B	S
Understanding the problem	25 (83%)	2 (17%)	23 (83%)	4 (17%)	20 (74%)	7 (26%)
Developing solutions	20 (74%)	7 (26%)	24 (89%)	3 (11%)	20 (74%)	7 (26%)
Achieve learning progress through discussion	19 (70%)	8 (30%)	22 (81%)	5 (19%)	19 (70%)	8 (30%)
Ability to draw conclusions	18 (67%)	9 (33%)	16 (60%)	11 (40%)	20 (74%)	7 (26%)
Percentage	74%	26%	78%	22%	73%	27%

Table Captions,

B = Right

S = False

Students are able to plan problem solving, namely by determining the GCF from the numbers that are known in the problem. And students are able to determine the factors of numbers by using prime factorization as well as to determine the GCF. But at the stage of making conclusions, students were wrong in counting the number of jelly candies, when in interviews students said they were in a hurry because the time was over.

The following is a table of the frequency distribution of pre-test scores for fourth grade students at SD Negeri 1 Rimo.

Table 3. Frequency Distribution of Pre-test Scores for Class IV Students at SD Negeri 1 Rimo

No	Mark	Fi	Relative Frequency (%)
1	33-37	2	7%
2	38-42	1	3%
3	43-47	4	15%
4	48-52	4	15%
5	53-57	4	15%
6	58-62	4	15%
7	63-67	8	30%
Amount		27	100%

Table 4. Percentage of Students' Post-Test Answers on Mathematical Problem Solving Problems

Rated aspect	Question Number					
	1		2		3	
	B	S	B	S	B	S
Understanding the problem	25 (83%)	2 (17%)	23 (83%)	4 (17%)	24 (89%)	3 (11%)
Developing solutions	20 (74%)	7 (26%)	24 (89%)	3 (11%)	20 (74%)	7 (26%)
Achieve learning progress through discussion	24 (89%)	3 (11%)	22 (81%)	5 (19%)	20 (74%)	7 (26%)
Ability to draw conclusions	24 (89%)	3 (11%)	22 (81%)	5 (19%)	22 (81%)	5 (19%)
Percentage	84%	16%	84%	16%	80%	20%

Based on the analysis of the answer errors, students cannot

identify the problem. Students immediately make alternative problem solving without analyzing the problem properly, students are immediately fixated on the final result and do not pay attention to the process, causing wrong problem solving. Students do not write down the known elements of the questions because they feel they are not necessary. Students immediately answer at the stage of planning and solving problems. Most of the students who had difficulty in solving the problems were because they did not understand the supporting material from the KPK and FPB, namely multiplication and division.

There are some students who are still confused in planning the problem solving, whether to use the FPB or the KPK. There are still students who have not been able to or have forgotten how to determine the KPK and FPB. Most of the students did not re-check the results of their work. There are also some students who are not careful in solving the questions because they want to collect them without re-checking the answers. This is in accordance with the results of research conducted by Ariani (2018) which says that students are less careful, forget and rush in doing questions, so that students are wrong or do not check the answers obtained at all. Students do not like questions in the form of story questions because they are considered difficult to understand so that teachers rarely provide problem-solving questions.

The following is a table of the frequency distribution of post-test scores for fourth grade students at SD Negeri 1 Rimo.

Table 5. Table of Frequency Distribution of Post-test Scores for Class IV Students SD Negeri 1 Rimo

No	Mark	Fi	Relative Frequency (%)
1	60-64	1	4%
2	65-69	7	26%
3	70-74	9	33%
4	75-79	1	4%

5	80-84	7	26%
6	85-89	2	7%
Amount		27	100%
Average		73.33	

After applying the activities and materials contained in the Mathematics LKPD based on a scientific approach in learning, there was an increase in students' problem solving abilities. Improvement is assessed from students being able to answer questions by following Polya's mathematical problem solving steps. The increase in the ability of students is described in the form of a diagram below

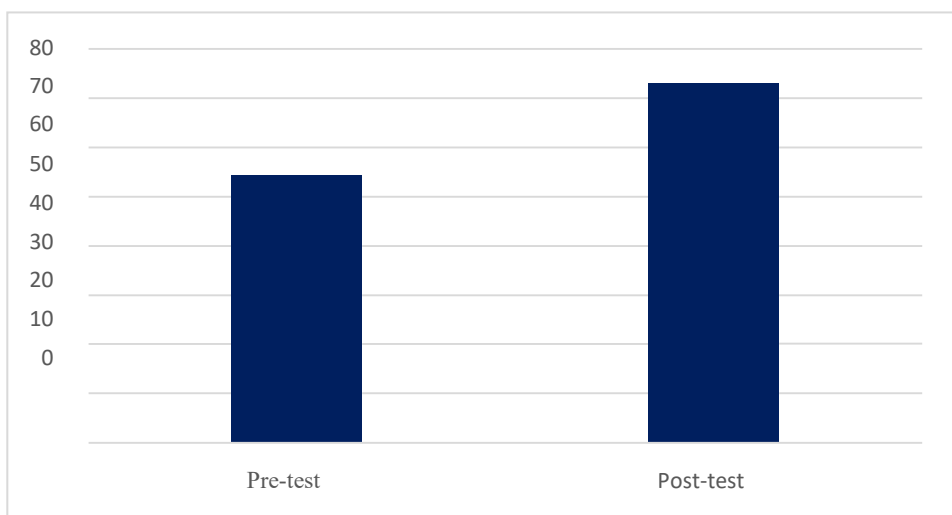


Figure 2. Diagram of Mathematical Problem Solving Ability Improvement

Based on the picture, there is an increase in mathematical problem solving ability from 54.28 during the pre-test to 73.33 during the post-test. In this case, the ability of students in solving mathematical problems still needs to be developed and honed in order to obtain even

better abilities. Then calculate the Gain Score:

Table 6. Gain Score Criteria

No	Score	Criteria
1.	$g \geq 0.7$	Tall
2.	$0.3 \leq g < 0.7$	Currently
3.	$g < 0.3$	Low

The moderate criteria which are in the range of $0.3 \leq g < 0.7$ provide an understanding that the ability of fourth grade students at SD Negeri 1 Rimo has increased by using the Mathematics LKPD based on a scientific approach. This can be input for teachers in developing the teaching and learning process in the classroom because LKPD plays a very large role in stimulating students' thinking and problem solving skills. If teachers often use a scientific-based learning approach and often hone mathematical problem solving skills, it is likely that students' mathematical problem solving abilities will develop even better.

a. Results of Questionnaire Analysis of Class IVA and IVB Teacher Responses

The following is the data on the results of the IVA and IVB teacher response questionnaires.

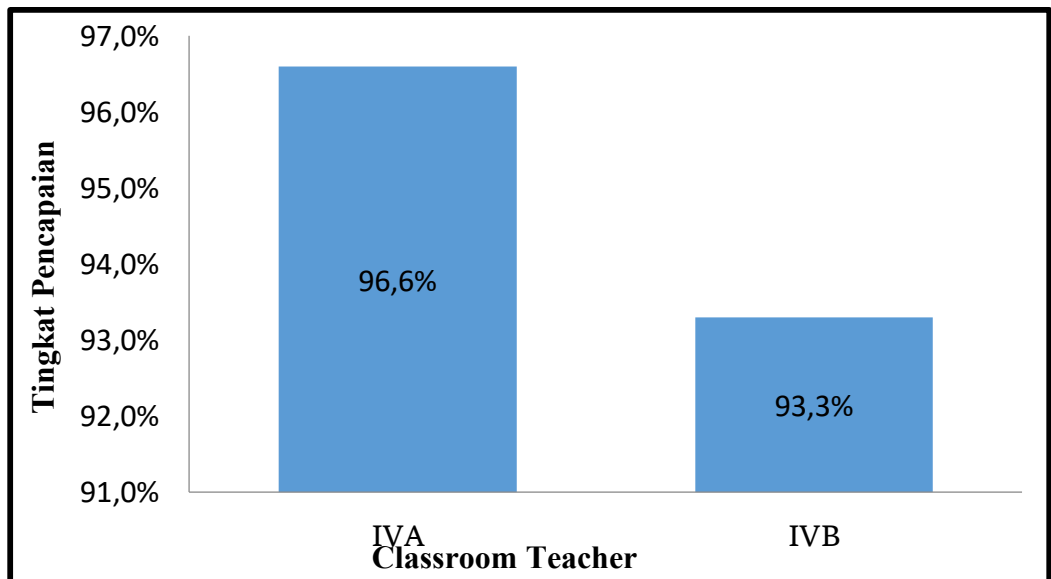


Figure 3. The results of the teacher's response questionnaire to the Mathematics LKPD based on a scientific approach

It can be concluded that the responses of teachers in grades IVA and IVB to LKPD Mathematics based on a scientific approach to improve students' mathematical problem solving are very good.

b. Results of Student Response Questionnaire Analysis Large Group Test/Field Test

Based on the small group test student response questionnaire, a percentage of 93.3% was obtained and the student response to the large group test/field test was obtained by a percentage of 96.6%, the average student response to the small group test and the large group test/field test was obtained. of 94.95% in the very good category.

2. Discussion

This study aims to develop a Mathematics LKPD based on a scientific approach as teaching materials and a collection of questions whose validity is tested based on the validity of material experts, learning design experts, and linguists. The resulting LKPD is expected to be used by students and teachers as teaching materials in learning and as a collection of questions for students to study outside of learning hours. The LKPD must be understood by students, so that students do not find it difficult to use the LKPD. In line with the research conducted by Nurhasanah (2019), the LKPD he developed increased students' understanding of concepts in learning.

The results of the assessment of the Mathematics LKPD based on the scientific approach according to the material expert validator, which is 87.96% or very valid category so it can be stated that the Mathematics LKPD based on the scientific approach on the KPK and FPB material is very valid and suitable for use by fourth grade elementary school students because it is in accordance with the material and Mathematics learning objectives. By studying Mathematics, students are expected to recognize, respond to, and appreciate science and technology and can instill habits of thinking and behaving that are critical, creative, and live independently. Destya (2017) explains that the nature of Mathematics education is the learning of students to understand the nature of Mathematics, by incorporating elements of attitudes and processes. Mathematics learning in elementary school must be modified so that students can easily learn it. Ideas and concepts must be simplified to suit their abilities and stages of cognitive, affective, and psychomotor development.

The result of the assessment of the learning design expert validator is 95.31% which is categorized as very valid so it can be stated that the

Mathematics LKPD based on the scientific approach is very valid and very feasible to use for fourth grade elementary school students because the learning design or learning steps in the LKPD developed have been in accordance with the scientific approach and also in accordance with the characteristics of the fourth grade elementary school students. According to Rusman (2015) there are five steps of a scientific approach, namely: (1) observing; (2) ask questions or formulate problems; (3) try or propose a hypothesis; (4) reasoning or collecting data; and (5) building networks or communicating concepts. Likewise, the learning presented in the Mathematics LKPD based on a scientific approach which also has five stages in sequence, namely:

The results of the assessment from the linguist validator are 93.75% or very valid category so it can be stated that the Mathematics LKPD based on a scientific approach to the KPK and FPB material is very valid and suitable for use in fourth grade elementary school students because the use of language in the LKPD is in accordance with the development of the participants. Elementary school students, one of which is the use of simple language and in accordance with the rules of writing Indonesian. Purwono (2008) said that the quality of good teaching materials is seen from the feasibility of the language in terms of sentence effectiveness, word accuracy, and standardity of terms. In the manufacture of teaching materials,

From the assessment results obtained from the three validators, the average obtained is 92.34% or a very valid category so that it can be stated that the Mathematics LKPD based on a scientific approach to the KPK and FPB material is valid and suitable for use by fourth grade elementary school students because in terms of the material, learning

design, and language are in accordance with the mathematics material for grade IV elementary school, in accordance with the function of LKPD as teaching materials that make it easier for students to understand mathematics material, in accordance with the stages of the scientific approach, according to the characteristics of students in grade IV elementary school. This suitability is also supported by previous research which characterizes the effectiveness of the use of LKPD based on the acquisition of criteria for learning Mathematics, learning media,

Based on the description above, it can be concluded that the Mathematics LKPD based on a scientific approach is appropriate for fourth grade elementary school students. After the LKPD is validated by each validator (material, learning design, language), small group trials and large group trials/field tests are carried out by distributing questionnaires in the form of questionnaires to teachers and students to see their assessment and response to the LKPD. already validated. The distribution of the questionnaire was carried out in class IV.

The average result of the teacher's response score to the Mathematics LKPD based on the scientific approach is 94.5% which has very good criteria so it can be stated that the Mathematics LKPD based on the scientific approach received a good response by the teachers of grades IVA and IVB at SD Negeri 1 Rimo. The results of the average student response score to the Mathematics LKPD based on the scientific approach of 96.2% which has very good criteria so that it can be stated that the Mathematics LKPD based on the scientific approach received a good response by the students of class IVA and IVB SD Negeri 1 Rimo.

Based on the results of the responses of teachers and students, it can be concluded that the Mathematics LKPD based on the scientific approach that was developed can be said to be effective. As with

Nihayah's research (2019), student responses to LKPD with a scientific approach that were developed obtained a percentage of 88% which showed a positive response from student responses, and research conducted by Widodo (2017) obtained student responses to LKPD based on a scientific approach which showed that students feel happy to take part in learning using LKPD based on a scientific approach, because there are activities to observe illustrations and interesting designs. Based on the results of teacher and student responses,

The last stage in this research is the dissemination stage, which is the stage of disseminating Mathematics worksheets based on a scientific approach. The LKPD, which had been validated by the three experts and assessed by teachers and students, was then distributed, but the distribution was only carried out or given to SD Negeri 1 Rimo schools due to limited material and time

D. Conclusion

The conclusion of this study is based on the findings of the research data, the systematic presentation is carried out by taking into account the research objectives that have been formulated. The conclusions obtained are as follows.

1. Feasibility of the Student Worksheet (LKPD) Mathematics based on a scientific approach which was developed based on the validation results has a high level of validity. Based on the results of assessments, criticisms, and suggestions from material experts, the percentage of validity reached 87.96%, learning design experts obtained the percentage of validity of 95.31%, and linguists obtained the percentage of validity reached 93.75%. Based on the data from the

validation results, the Mathematics LKPD based on a scientific approach to improve mathematical problem solving skills that was developed entered the very valid criteria and deserved to be used.

2. The results of the responses of teachers and students to the Mathematics LKPD based on a scientific approach which was developed based on the results of the questionnaire have a very good response rate of achievement. Based on the results of the analysis of the responses of the IVA class teachers, the percentage was 96.6% and the IVB class teachers were 93.3%. The results of the analysis of the responses of fourth grade students obtained a percentage of 96.5%. Based on the data from the analysis of teacher and student responses to the LKPD based on the scientific approach that was developed, it has very good response criteria so that it can be interpreted that the LKPD developed is understandable and easy to use, and there is an increase in students' mathematical problem solving both in small group trials. as well as large group/field trials

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