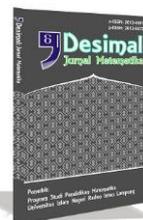




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Student worksheets (LKPD) using a scientific approach: The impact on critical thinking skills in linear equation system material

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ABSTRACT

The LKPD development process with a scientific approach uses the ADDIE model which consists of several stages, the first is analysis, namely analyzing the curriculum, validating work gaps, analyzing student needs and characteristics, the second stage is development, namely small group trials and large group trials. The third stage is implementation is by applying the LKPD that has been tested and the last stage is an evaluation which conducts an assessment of the comments of teachers and students on the developed LKPD. The purpose of this development research is to determine the effectiveness of mathematics LKPD with a scientific approach on SPTLT material. The effectiveness obtained based on the developed product can improve students' critical thinking skills from the results of the pretest and posttest which were tested with the N-gain test. After being analyzed by the N-gain test, a score of 0.73 is obtained, namely in the high category and the LKPD developed is effective. LKPD with this scientific approach can improve students' critical thinking skills very well.

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INTRODUCTION

Critical thinking skills are related to the ability to identify, analyze, and solve problems creatively and think logically so as to produce appropriate judgments and decisions. Critical thinking skills possessed by students can help in problem-solving, including problems in learning mathematics (A. K. Dewi et al., 2020). According to Samsudin (2009), critical thinking skills are intellectual potential that can be developed through the learning process. So, it can be

understood that what is meant by critical thinking is the ability to think logically, reflectively, and productively which is applied in assessing situations to make good judgments and decisions (Asmar & Delyana, 2020).

70% of high school graduates lack competence both regarding critical thinking skills, and for 4 years students only have 28% critical thinking skills (Wartono et al., 2018). Critical thinking skills are influenced by 2 factors, namely external and internal factors. An external

factor is a factor that arises from outside the student, such as the teacher, the competence of a professional teacher. While internal factors are factors that come from within students such as health, intelligence, talent, interests, and motivation, as well as study habits of students (Anam, 2021). The factor that causes students' critical thinking skills to be less empowered is that the teacher does not have good competency in designing learning (Wartono et al., 2018). The lack of variation in the use of learning methods causes the tendency of students to be passive, less motivated in learning mathematics, and less optimal abilities of students in terms of critical, creative, analytical, and logical thinking.

The reality in the field, students' critical thinking skills are still very low. It can be seen that in solving a mathematical problem, students still tend to find it difficult to analyze questions that have a higher level of difficulty. Especially on the material of a system of linear equations with three variables (SPLTV). For SPLTV material, students still have difficulty so that a system of linear equations with three variables (SPLTV) is considered as one of the branches of mathematics that is difficult for students, especially the part in completing and interpreting the completion of a system of linear equations with three variables (SPLTV).

Based on the experience of researchers in the field, the material for a system of linear equations with three variables (SPLTV) is one of the materials that is integrated at two grade levels at the upper secondary level. Every year the author always gets into problems in learning the material for a system of linear equations with three variables (SPLTV). For example, in class X MIPA, the material for a system of linear equations with three variables (SPLTV) taught is the basic material including the general form of a system of linear

equations with three variables (SPLTV), solving a system of linear equations with three variables (SPLTV) by substitution, elimination, substitution-elimination. and solve problems related to a system of linear equations with three variables (SPLTV). While in class XI MIPA the material for a system of linear equations with three variables (SPLTV) is continued with a linear program.

Based on the observations of researchers, in several academic years, there are always problems in learning a system of linear equations with three variables (SPLTV) learning. For example, in class XI MIPA, linear programming material certainly requires students to really understand how to solve a system of linear equations in the previous material. Based on my experience for several generations, if the material for class X is not fully understood, then class XI will experience many problems. Many students do not understand this material until it finally has an impact on students' interest and motivation to decrease, there are even some who are not interested at all because they think that a system of linear equations with three variables (SPLTV) is a difficult material that they do not understand.

This is based on the researcher's observations and interviews with one of the mathematics teachers at SMAN 6 Jambi City, it was found that only 25% of students are able to solve the questions given by the teacher. There are still numerous students who cannot solve questions that are different from the examples given by the teacher. This shows the low critical thinking skills of students in analyzing questions. The teacher also said that the worksheets used in class are still too complicated for students to understand.

The mathematics LKPD used has not shown the steps of learning with a scientific approach in solving problems that help students to improve critical

thinking skills. LKPD in schools presents short material and multiple-choice questions along with essays without using the steps of a scientific approach, namely observing, asking questions, gathering information, communicating, and concluding. The learning process is still teacher-centered with the lecture method so that students become less active and do not have the opportunity to develop their knowledge independently (Marshel & Ratnawulan, 2020).

There are several ways to improve students' critical thinking skills, one of which is the research of Fitriana et al. (2016) entitled *Developing Student Worksheets Using a Scientific Approach to See Students Critical Thinking on Comparative Material*. Based on the results of the research and discussion, conclusions are obtained, namely, the characteristics of the subject matter of valid and practical comparisons using a scientific approach are a) The comparative subject matter developed is in accordance with KI and KD in the 2013 Curriculum b) The constructs used are in accordance with the scientific approach and critical thinking indicators c) Sentences using good mathematical language and do not cause multiple interpretations or misunderstandings d) Student worksheets for comparison materials are stated to be practical, it can be seen based on the results of small group trials and field tests, it can be seen from students being able to use and complete student worksheets (LKS) using a scientific approach on comparative material well.

This research also produces teaching materials in the form of worksheets that have a potential effect, namely the critical thinking skills of students of SMP Negeri 33 Palembang. Based on the analysis of student test questions on the field test where students take tests in the form of questions that have four indicators of

critical thinking skills and get good results with an average of 60. From this research, it can be seen that students' critical thinking skills in learning using a scientific approach is quite good (Fitriana et al., 2016).

Based on that research result, it can be seen that students' critical thinking skills are quite good in learning using a scientific approach. However, it is recommended for researchers who want to conduct research using a scientific approach can use critical thinking indicators from other experts and more than 4 indicators so that students' critical thinking skills can improve. Based on these suggestions, the researchers wanted to develop an LKPD for mathematics subjects on SPLTV material with a scientific approach to improve students' critical thinking skills using 5 indicators.

Activities carried out by students are required to be able to think critically. This is in accordance with the assessment in the 2013 Curriculum which is closely related to critical thinking skills. Critical thinking is a way of thinking about a subject, content, or problem in which thinkers improve the quality of their thinking by taking more of the structures inherent in thinking and applying intellectual standards within them. Through critical thinking, students can learn to be more critical in examining perspectives on issues regarding the impact of science and technology in everyday life, and evaluate these to obtain solutions or solve problems. Critical thinking also allows students to study problems systematically, deal with many obstacles in an organized manner, formulate innovative questions, and design appropriate solutions to problems at hand (Aini et al., 2020).

This scientific approach encourages students to construct their knowledge through scientific stages such as observing, asking questions, collecting

data, processing data, concluding, and communicating. If the stages of this scientific approach are carried out properly, then learning in the classroom will be student-centered, students are accustomed to higher-order thinking, students' ability to solve problems develops, and learning outcomes are high (Asmaranti & Pratama, 2018)

In this research, the authors chose to use a scientific approach because this approach is a learning approach that emphasizes students' critical thinking skills to observe, ask questions, reason, try and communicate what they get. In accordance with the author's goal, namely to help students improve critical thinking skills. All stages from observing to communicating are in line with critical thinking indicators.

The application of a scientific approach in learning needs to be supported by teaching materials. The form of teaching materials that will be used is Student Worksheet (LKS) (Bohori, 2015). In the LKS content section, scientific steps can be applied so that the learning process with a scientific approach is easier to apply and can take place in a systematic, structured, easy way to evaluate student learning activities. The use of worksheets in the scientific approach can help streamline the application of the approach through the activity stages as a recording tool for student activities.

The design of this student worksheet can be designed by the teacher themselves according to the needs of the students in the class they

teach. Teachers must be able to provide adequate facilities to help students fully understand the concepts that will be conveyed to students. This is an important factor. Why should the teacher make it? Because of the condition of students in a class, it is the teacher who understands what is needed by students to be able to understand a lesson, what models are suitable, and what kind of learning scenarios can be applied to the conditions of their students. This is the background a teacher must be able to design. In contrast to the purchased LKPD, in general, the LKPD is not necessarily in accordance with the conditions of students in a class being taught. One form or type of teaching material that is often used by teachers in teaching in the classroom is the student worksheet (LKPD). So, from the description that has been put forward, researchers are interested in developing mathematical worksheets with a scientific approach that can be used in learning.

METHOD

The type of this research is research and development. The development method is the basis for developing the product to be produced. The development model used is ADDIE which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. The development steps with the ADDIE model (Branch, 2009) can be seen in Table 1.

Table 1. ADDIE Steps

	Analysis (a)	Design (b)	Development (c)	Implementation (d)	Evaluation (e)
	Identify possible reasons for a performance gap	Verify desired performance and proper test method	Produce products and validate learning research products	Prepare a learning environment and engage students	Assessing the quality of learning products and processes before and after implementation
C O N C E P T	<ol style="list-style-type: none"> 1. Curriculum Analysis 2. Employment Gap Analysis 3. Setting Goals 4. Analysis of Student Needs and Characteristics 5. Analysis of Available Resources 6. Work Plan 	<ol style="list-style-type: none"> 1. LKPD Design Validation 2. Design Validation 	<ol style="list-style-type: none"> 1. Individual Trial 2. Small Group Trial 3. Field Trial 	<ol style="list-style-type: none"> 1. Preparing Teachers and Learning 2. Prepare Students 	<ol style="list-style-type: none"> 1. Perception 2. Knowledge

The data types in this research are quantitative data and qualitative data. Quantitative data were obtained from the results of material expert validators and learning media experts, responses from teachers in the field of mathematics studies, results of student perception questionnaires, student learning outcomes, and the results of pretest and posttest or test questions used to measure critical thinking skills of students. While the qualitative data were obtained from the results of the validators of material experts and learning media experts, responses from teachers in the field of mathematics studies, student responses, and the results of the questionnaire on student perceptions of the mathematics worksheets that had been made. The instruments used in this research were

questionnaires, pretest, and posttest questions in the form of descriptions used to improve students' critical thinking skills before and after using the developed LKPD.

Data analysis was conducted to determine whether the LKPD developed by the researcher had met the valid, practical, and effective criteria. The data obtained from the results of the questionnaire given to the expert team were analyzed to determine whether the learning media with a scientific approach was said to be valid or not, while the data obtained after the product was applied in the field were analyzed to determine the practicality and effectiveness criteria of the developed worksheets. The following is an explanation of the data analysis of each instrument.

RESULTS AND DISCUSSION

1. Student Worksheet Design (LKPD) With Scientific Approach.

Making LKPD with a scientific approach on the material of a system of linear equations with three variables (SPLTV) as follows:

a. LKPD Cover Design

In the cover of this LKPD, the authors include the author's name and study program, the logo of the University of Jambi, the LKPD subjects that is Mathematics, SMA/MA, the class used is class X, odd semester. The material studied is a system of linear equations with three variables (SPLTV), for the 2021/2022 academic year, student identity consists of name, class, absentee number, and school origin. Furthermore, the authors also include the writings of LKPD with a scientific approach. LKPD cover designed according to Figure 1 below:



Figure 1. LKPD Cover

b. Display Preface

On the foreword page, it contains a string of the author's words that contain the author's goal in making LKPD for teachers and students, as well as the author's gratitude to all those who have helped in completing this LKPD. The introduction display can be seen in

Figure 2 below.

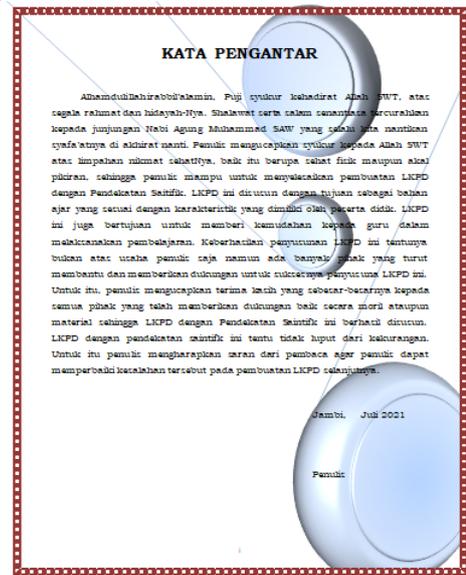


Figure 2. Preface

c. LKPD User Manual Display

On the study guide page, there is an LKPD user manual for teachers and students. The LKPD user manual display is shown in Figure 3 below.

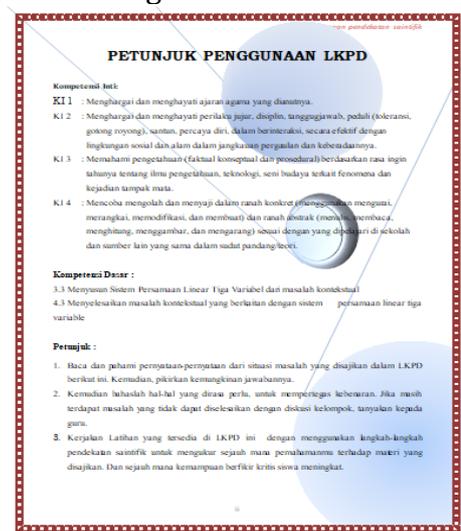


Figure 3. LKPD User Manual

d. Learning Step Display

On the learning steps page, it contains learning steps with a scientific approach found in the LKPD along with critical thinking indicators that are applied to each learning step. The display of the learning steps is shown in Figure 4 below.



Figure 4. Learning Steps

e. Table of Contents Display

On the table of contents page, the authors arrange each subchapter of the discussion of a system of linear equations with three variables (SPLTV) material along with the subchapter's page. The table of contents display is shown in Figure 5 below.

DAFTAR ISI

- KATA PENGANTAR i
- PETUNJUK PENGGUNAAN ii
- LANGKAH PEMBELAJARAN iii
- DAFTAR ISI iv
- PETA KONSEP v
- KOMPETENSI INTI DAN KOMPETENSI DASAR vi
- PERTEMUAN 1 1
- Mengetahui SPLTV 1
- PERTEMUAN 2 9
- Menyelesaikan SPLTV dengan metode Substitusi 9
- PERTEMUAN 3 10
- Menyelesaikan SPLTV dengan metode Eliminasi 10
- PERTEMUAN 4 27
- Menyelesaikan SPLTV dengan metode Eliminasi-substitusi 27
- PERTEMUAN 5 51
- Menyelesaikan masalah SPLTV dalam kehidupan sehari-hari 51
- DAFTAR PUSTAKA 56

Figure 5. Table of Contents

f. Concept Maps

On the concept map page, the author describes the sub-materials of a system of linear equations with three variables (SPLTV) such as the form of a system of linear equations with three variables (SPLTV), a system of linear equations with three variables (SPLTV),

problems related to a system of linear equations with three variables (SPLTV). The concept map display can be seen in Figure 6 below.

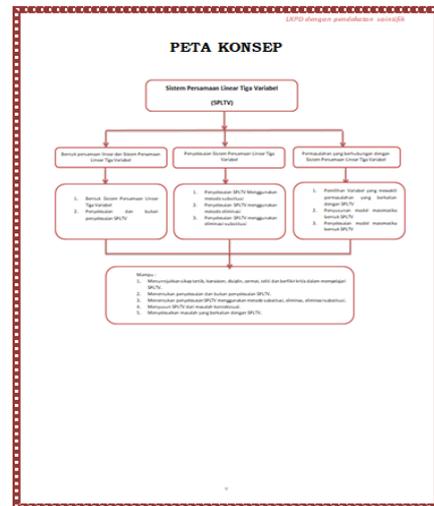


Figure 6. Concept Maps

g. Core Competencies and Basic Competencies

The Core competencies and basic competencies page contain core competencies and basic competencies that will be achieved in learning. The display of core competencies and basic competencies can be seen in the following Figure 7.



Figure 7. Basic Competencies

h. Material Display

The material page in the LKPD that the author designed consists of 5 sub-materials, namely knowing a system of linear equations with three variables

(SPLTV), solving a system of linear equations with three variables (SPLTV) with the substitution method, solving a system of linear equations with three variables (SPLTV) with the elimination method, solving a system of linear equations with three variables (SPLTV) with the substitution-elimination method, and solving a system of linear equations with three variables (SPLTV) problem with the scientific steps of observing, questioning, gathering information, associating and

communicating. This is in accordance with research conducted by Magdalena et al. (2018) entitled developing specialization mathematics learning tools based on a scientific approach for class XI of high school students, which states that the subject matter presented in the LKS is designed according to the sequence of steps of a scientific approach. Scientific approach-based learning begins with observing. A glimpse of the material can be seen in the following Figure 8.



Figure 8. Material Display of a System of Linear Equations with Three Variables (SPLTV)

2. Trial Stage

a. Individual Trial Analysis

This individual test was conducted with the subject of mathematics teachers who teach in Class X of SMAN 6 Jambi City. The subjects for this individual trial

were Mathematics Teachers and were asked to observe and assess mathematics worksheets with the material of a system of linear equations with three variables (SPLTV) as a whole. After that, the researchers gave a questionnaire to the

individual trial subjects to give an assessment. The questionnaire consists of 15 questions with indicators, namely, appropriateness of content, language, the effectiveness of use, and graphics. The teacher's assessments and suggestions are used as guidelines for making improvements to the LKPD that has been developed to be made according to the needs of students and can improve students' critical thinking skills.

In general, the subject's assessment of the developed LKPD is very positive and good, but there is suggestion given by the subject so that the developed LKPD can be better, namely to improve little color combinations in each narrative. His intention is that LKPD is a source of student learning so that it looks more interesting for students to learn so it creates student interest in learning.

Furthermore, the mathematics teacher also mentioned verbally that the LKPD that was made was very interesting because it used steps of a scientific approach so that students would more easily understand the material for a system of linear equations with three variables (SPLTV). It is also expected to improve students' critical thinking skills.

b. Small Group Trial Analysis

After conducting individual trials then followed by small group trials. This trial was conducted in class X of IPA 2 SMAN 6 Jambi City with a total of 8 students with low, medium, and high abilities who were known based on information from the mathematics teacher who taught the class.

Each student is given an LKPD that the researchers have developed. This product trial lasted for 2 hours of lessons by providing an overview of the material, student activities in the LKPD. Furthermore, students are asked to observe the LKPD thoroughly and provide an assessment in the form of

student responses to the LKPD that has been developed. Before giving an assessment using a questionnaire, the researchers explained to students how to fill out and explain each statement in the questionnaire.

It can be concluded that the comments given in this small group trial gave a positive response and they were interested in learning to use mathematics LKPD with a scientific approach. Based on the responses of the small group trial participants, in general, it can be concluded that the developed LKPD is good for learning resources, the delivery language used in the LKPD is easy to understand, the display of the LKPD attracts students' interest in learning, the presentation of the material is easy to understand with examples of questions, the learning steps in the LKPD can make students excited to learn, exercise on the LKPD in accordance with the material for a system of linear equations with three variables (SPLTV), LKPD can encourage students to be active in learning, LKPD can be used as independent study material for students, and make students easier to understand the material of a system of linear equations with three variables (SPLTV) and can be applied in everyday life.

c. Large Group Trial Analysis (Field Trial)

After the small group trial, then continued with the large group trial. This trial involved 27 of 32 students in class X IPA 1 of SMAN 6 Jambi City. This trial lasted for approximately 2 hours of lessons by providing an overview of the LKPD, learning activities in the LKPD, and the application of LKPD in the learning process. After all the large group trial participants observed the LKPD given, it was continued by giving an assessment in the form of student responses to the LKPD used.

Assessments from students were obtained from a questionnaire to determine student responses regarding the developed LKPD. Before giving an assessment using a questionnaire, the researchers explained to the participants how to fill in and explained the meaning of each statement in the questionnaire. Then each large group trial participant fills out the questionnaire according to their respective understandings and assessments.

Based on the students' responses, it can be concluded that the comments given in this large group trial gave a positive response and they were interested in learning to use LKPD with a scientific approach. Based on the responses of the large group trial participants, in general, it can be concluded that the developed LKPD is good for learning resources, the language used in the LKPD can stimulate students to think critically, the display of the use of the LKPD is attractive, the presentation of the material on the LKPD is easy to understand and can improve critical thinking skills of students, exercises on LKPD in accordance to the material of a system of linear equations with three variables (SPLTV), presentation of the material is easy to understand, LKPD can also encourage students to be active in learning, LKPD can be used as independent study material for students, and make it easier for students to understand a system of linear equations with three variables (SPLTV) and can be applied in everyday life. LKPD with a scientific approach was developed with several processes. The material in the LKPD is a system of linear equations with three variables (SPLTV) for class X of Senior High School. The material is explained by referring to the steps of scientific learning, namely observing, asking questions, gathering information, associating, and communicating.

The development of this mathematics LKPD aims to help students during learning, students not only take notes and listen to explanations from the teacher, and also learning with this scientific approach requires students to be more active in learning, the teacher is only a facilitator, this is in accordance with the results. LKPD serves as a learning guide for students and also makes it easier for students and teachers to carry out teaching and learning activities. Research from Fitriana et al. (2016) stated that in the 2013 curriculum the learning process is expected to be student-centered where the teacher becomes a facilitator in guiding students to interact with their learning objects through scientific stages. In addition, this LKPD is also expected to improve students' critical thinking skills. And also in line with research conducted by Rahayuningsih et al. (2018) which stated that scientific approaches can be integrated with LKPD which can be developed independently. Then there will be student interaction (student-centered) and the teacher's role is only as a facilitator.

The development procedure in this study is the ADDIE development procedure which consists of the analysis, design, development, implementation, and evaluation stages. The purpose of all these stages of development is to produce valid, practical, and effective mathematics LKPD.

Based on the results at the analysis stage, it is produced the initial conditions of the students and the LKPD to be developed. The purpose of this analysis stage is to identify the possible causes of the gaps that occur (Branch, 2009). The analysis carried out are curriculum analysis, performance gap analysis, analysis to set goals, analysis of student needs and characteristics, analysis of available resources, and work planning.

After conducting the analysis, then proceed with designing the design. The results of the design are validated by a team of experts. That product validation can be done by presenting several experts or experienced experts to assess the new product designed so that its weaknesses and shortcomings can be identified (Sugiono, 2014).

The LKPD that the researchers designed has been validated by material experts and design experts. Where the material expert validator stated that the product is suitable for use without revision, and the design expert validator stated that the product was feasible to use with several revisions according to the comments and suggestions from the design validator. After completing the validation stage, the development stage continues. This stage is carried out by conducting a formative evaluation. There are 3 special stages of formative evaluation, namely individual trials, small group trials, and large group trials (Branch, 2009). From this trial stage, assessments or responses from the teacher and students were obtained with a very good response with some improvements to make the LKPD even better. Products developed can be seen in attachment 36.

The next stage is the implementation which is carried out in class X IPA 1 of SMA Negeri 6 Jambi City with a total of 27 students. At this stage, learning is carried out for 10 JP with the material of a system of linear equations with three variables (SPLTV). Learning is carried out by following all activities in the LKPD and being guided by the lesson plans that have been made. Before implementing learning using LKPD, the researchers gave a pretest to 27 students. While the posttest was carried out after all learning activities using LKPD were carried out. The results of the pretest and posttest have been analyzed and show an improvement in students'

critical thinking skills in the high category. It appears that students are interested in learning to use the LKPD that have been made.

The next developed LKPD quality assessment is effectiveness. The effectiveness of learning media is measured by student learning outcomes after learning by using learning media products. Learning outcomes that are measured in tests to measure the effectiveness of the developed LKPD are test instruments in the form of critical thinking skills. This instrument is used as pretest and posttest questions. In making the pretest and posttest questions, content validation was carried out. This is in accordance with the opinion of Sugiono (2014) which states that in certain cases for tests that are prepared in accordance with the curriculum (materials and objectives) in order to fulfill content validation, experts in the field of study can also be asked for assistance to examine whether the concept of the proposed material is adequate or not as a test sample.

The results of the test instrument validation assessment state that the instrument is good and can be used in research. In the implementation of learning at SMA Negeri 6 Jambi City using LKPD with a scientific approach, it can be implemented well and students can follow every lesson in the LKPD. Then after the data obtained from the pretest and posttest results, then the data were analyzed, namely by comparing the initial test scores and the final test scores. The improvement in learning outcomes is calculated by the factor formula (N-gain) and the following results are obtained:

Table 2. Gain Test Results

Stage	Gain Test	Category
Implementation	0.73	High

Based on the results of the analysis in Table 2, it was found that there was an improvement in students' critical thinking skills in the high category, students expressed their interest in learning to use the developed LKPD. This is also in accordance with the results of research conducted by E. R. Dewi et al. (2020) entitled Developing Student Worksheets (LKS) with a Scientific Approach to Derivative Material at High School. Based on the results of research on the developed LKS, it can be concluded that the learning outcomes test conducted at the end of the study, the developed LKS was declared effective. This is indicated by the percentage of students' classical mastery of 84.62% so that students' classical mastery is in good classification.

This is also in accordance with the research conducted by Syamsu (2020) entitled The Development of Discovery Learning Oriented Student Worksheets to Improve Students' Critical Thinking Skills which states that the effectiveness

of the developed LKPD teaching materials met the effective category as seen from the positive response of students with more than 85 % categorized as high.

The improvement of students' critical thinking skills is obtained by checking the answer sheets for pretest and posttest questions that have been adjusted to the scores of each critical thinking indicator. The details of the scores are attached in appendix 24 and appendix 28. The test used is in the form of a written test in the form of an essay. The questions tested are descriptive questions that have criteria that are included in the critical thinking indicators. Then analyzed to see the improvement in critical thinking skills. Thus, can be seen the improvement in students' critical thinking skills. Based on the analysis of critical thinking indicators, the percentage of critical thinking indicators can be seen in Table 3 below.

Table 3. Percentage of Critical Thinking Indicator

No.	Critical Thinking Indicator	Pretest Percentage	Posttest Percentage
1	Analyze	41.48 %	81.48 %
2	Synthesize	47 %	61.11 %
3	Recognizing and Solving Problems	45.55 %	86.29 %
4	Conclude	29.25 %	92.22 %
5	Evaluate	17.59 %	76 %

In the previous analysis indicator, before using the LKPD it was only 41.48% and after using the LKPD it increased to 81.84%, the synthesized indicator before using the LKPD was only 47% and after using the LKPD it increased to 61.11%, the indicator of recognizing and solving the problem originally before using the LKPD was only 45.55% and after using the LKPD it increased to 86.29%, the concluded indicator before using the LKPD was only 29.25% and after using the LKPD it increased to 92.22%, the evaluation indicator before using LKPD was only 17.59% and after using LKPD increased to 76%.

This is also in accordance with research conducted by Herdiansyah et al. (2016) entitled *The Development of LKPD Based on Problem Based Learning Models to Improve Critical Thinking Skills*, which says learning using LKPD based on Problem Based Learning models provide higher critical thinking skills than with learning that does not use LKPD based on the Problem Based Learning (PBL) model on the subject matter of opportunity for class X SMA.

In addition, research conducted by Suryaman & Ningsih (2021) entitled *The Development of Student Worksheets Using a Scientific Approach to Improve Critical Thinking Skills for Class V Elementary School Students*, which states that the average score of students' critical thinking skills test results from five aspects shows that the total average score of N-Gain is 0.95 in the High category. The high critical thinking skills of students have been achieved in every aspect of critical thinking skill based on the questions given. In the implementation of the limited group test, LKS uses a scientific approach to improve the critical thinking skills of fifth-grade elementary school students by looking at the results of the pretest and posttest of students' critical thinking skills. Based on the results of the pretest the average score of critical

thinking skills is 35, in the posttest results the average score is 96.66. While the N-gain score increases critical thinking skills by 0.95 with the "High" category.

CONCLUSIONS AND SUGGESTIONS

The LKPD development process with a scientific approach uses the ADDIE model which consists of analysis, the development stage, namely by conducting trials on products that have been designed and revised with individual trials, small group trials, and large group trials. The next stage is implementation and the last stage is evaluation. LKPD developed in this research is included in the good category. The effectiveness obtained based on the developed product can improve students' critical thinking skills from the results of the pretest and posttest which were tested with the N-gain test. After being analyzed with the N-gain test, it is obtained in the high category and the developed LKPD is effective. LKPD with this scientific approach can improve students' critical thinking skills. From the results of the research, it appears that students' thinking skills have improved very well.

Based on the development research that has been done, the suggestions from researchers for further research is to develop a scientific approach to learning media in combination with other learning models. For example, cooperative models, discovery learning, inquiry, and so on or can use different media, such as android-based learning applications.

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