

Effectiveness of Problem Based Learning Model with Worksheet Assisted on Students' Critical Thinking Ability

Satutik Rahayu¹⁾, Ni Nyoman Sri Putu Verawati²⁾, Andi Fatimatul Islamiah^{3*)}

^{1,2&3)}Program Studi Pendidikan Fisika, Universitas Mataram

*Email: andi.fatima4@gmail.com

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Abstract

This research aims to know the effectiveness of the learning problem based learning model assisted worksheet for the critical thinking ability of physics students of grade X SMAN 1 Lingsar. This was an experiments research that using design research Posttest-Only Control group Design. The population in this research were the whole grade X SMA Negeri 1 Lingsar in academics year 2016/2017. Sampling taken with using cluster random sampling technique with the students of class X MIA.A as experiment class and X MIA.D as control class. Research hypothesis was analysis with the t-test for one party (the party right). Based on the hypothesis test results obtained $t_{count} > t_{table}$ at significance level of 5%, then it can be inferred that the model of learning problem based learning assisted work sheet effective for critical thinking ability of physics students SMAN 1 Lingsar.

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INTRODUCTION

The rapid development of science and technology demands an increase in the quality of education. This is in line with the continuing development of educational curricula in Indonesia. The education curriculum provided must be able to equip students to follow changes and growth in society, namely the ability to think at a high level, one of which is to build critical thinking skills. This is in accordance with the implementation of the 2013 curriculum in learning which includes competency attitudes, knowledge, and skills in learning.

The learning process is expected to be an intermediary in developing the ability to think specifically the ability to think critically to seek, discover, and build students' knowledge independently. The ability to think critically is a basic ability that is needed especially in learning physics. Physics learning is not only the mastery of a collection of knowledge in the form of facts, concepts or principles, but learning is related to how to find out about natural phenomena systematically through problems that exist in everyday life. Thus, critical thinking skills are needed by students to solve the problems faced.

Based on the results of an interview conducted on one of the physics teacher at SMA 1 Lingsar, it was found that the teacher had never measured critical thinking skills because he was still focused on the physics learning outcomes. The teacher does not realize that actually has measured critical thinking skills. The ability to think critically can be demonstrated in the way students learn to analyze, synthesize, solve problems, infer and evaluate a physical problem. Students' critical thinking skills are still weak, this is shown by the lack of understanding of the problem given due to the low analytical power that is shown from how to identify problems that are still low. In addition, students' calculations are still weak, whereas in physics learning calculations are very important in solving

problems. Thus, the ability to think critically is needed because it is useful to improve the ability to connect physical problems with real life, for that critical thinking skills must begin to be emphasized by training and measuring students' critical thinking skills. Learning to think in critical analytical and evaluative ways means using mental processes such as attention, categorization, selection, and assessment. Many people have the potential to develop more effective critical thinking but are hampered for various reasons other than lack of ability. Critical thinking is a skilled and active interpretation and evaluation of observation and communication, information and argumentation (Fisher, 2007). Critical thinking is a systematic process that allows students to formulate and evaluate their own beliefs and opinions. Critical thinking is an organized process that allows students to evaluate the evidence, assumptions, logic and language that underlie the statements of others (Johnson, 2010). Critical thinkers scrutinize the thought processes of others to get the most complete understanding. They try to think sequentially and objectively and suspend personal prejudices and emotions in the search for belief (Alwasilah, 2008).

Based on some of the opinions above, the researcher concludes that critical thinking skills are high-level thinking skills that must be built on students to become a character or personality that can be used to solve all problems by analyzing, synthesizing, solving problems, evaluating any information they receive then conclude systematically.

The basic critical thinking skills of critical thinking include: (a) analytical thinking skills (b) synthesis thinking skills (c) problem solving skills (d) inferring skills (e) evaluation or valuing skills (Hendra, 2013). One learning model that can build critical thinking skills is a problem based learning model. The learning model can be interpreted as a concept that explains the learning process, both explaining thought patterns and patterns of action (Abidin, 2014). In addition, the learning model can be interpreted as a pattern used for curriculum preparation, organizing material, and giving instructions to teachers in the classroom (Suprijono, 2012). So it can be concluded that the learning model is a pattern or plan used as a guide in planning learning activities so that learning objectives can be achieved. While problem based learning is a learning model that requires students to work on authentic problems to compile their own knowledge, develop inquiry, and ability to think higher, develop independence, self-confidence, and students use their skills such as working together to solve problems (Trianto, 2010). In addition, the problem based learning model is a type of classroom management that is needed to support the constructivism approach in teaching and learning (Hariyanto, 2012).

Problem based learning model is a learning model that uses problems in the real world as learning media. Problems raised by students must be able to arouse students' understanding of problems, awareness of gaps, knowledge, goals to solve problems, and perceptions that they are able to solve these problems (Rusman, 2011). Based on some of the opinions above, the researcher concludes that the learning model is a problem based learning is learning that begins with a problem that is used as a means of investigating learners. Problems presented at the beginning of learning are authentic and meaningful problems. Each student or group must solve these problems independently. By trying to solve problems independently, students are expected to be able to get their knowledge more meaningfully. This is confirmed by the results of research Rahmawati et al. (2015) which states that the problem based learning model is effective for improving critical thinking skills and student learning outcomes. This is because, the problem based learning model can practice the students' critical thinking skills in solving problems, attracting students' interest in learning by interacting between students to find solutions, and requiring students to be actively involved in the learning process. Likewise, according to Azmi (2016) Problem-based learning model provides an opportunity for all students to be active in the learning process, moreover to solve the problems provided in the learning

process by conducting experiments and discussions so that students can prove themselves by conducting their own experiments to prove as well as conducting discussions to solve problems that have been provided in Student Worksheets and Student Discussion Sheets (LDS), This certainly has an influence on student physics learning outcomes which can be proven by the average value of the two samples above the minimal completeness criteria (MCC.)

A good learning process must be able to provide opportunities for students to play an active role in every learning that is carried out. The activeness and independence of the students must be visible in each learning process, so the help of learning resources is needed. Student Worksheet is an alternative learning resource that can be applied because it can help students to add information about concepts learned through systematic learning activities. Worksheet is usually in the form of instructions, steps to complete an assignment, a task ordered in the activity sheet must be clear the basic competencies that will be achieved. In addition, the worksheet is a student guide used to conduct investigations and problem solving activities (Trianto, 2010). So it can be concluded that the worksheet is a worksheet that contains problems to hone students' critical thinking skills which can simplify the learning process.

METHOD

This type of research is true experimental. It is said true experimental because researchers can control all external variables that affect the course of the experiment (Sugiono, 2014). The research design used is posttest-only control design. This research was conducted at SMAN 1 Lingsar. The population in this study were all grade X students of SMA Negeri 1 Lingsar. The sample in this study was Class X MIA.A as an experimental class and class X MIA.D as the control class. The sampling technique in this study is cluster random sampling. The instrument used in this study was the description test. Before it is given to students, the instrument is tested first. The instrument trials in this study included validity, reliability, difficulty and different power levels. The results of critical thinking skills collected were then analyzed using analysis prerequisite tests, namely homogeneity test using F test, normality test using Chi-Square Test and hypothesis testing with using the right-side t test with a significance level of 5%.

The level of critical thinking ability of students can be analyzed descriptively with a percentage to describe the level of achievement of each indicator of critical thinking ability.

$$\text{Critical Thinking Val.} = \frac{\text{score}}{\text{max. score}} \times 100$$

After obtaining the results of the percentage of students' critical thinking abilities, the researcher determines the category of students' critical thinking abilities. The category giving aims to determine the percentage of students' critical thinking abilities qualifications. The categories of critical thinking skills can be divided into 4 categories such as Table 1.

Table 1. Critical Thinking Categories

Scale	Categories
$81,25 < x \leq 100$	Very critically
$62,50 < x \leq 81,25$	Critically
$43,75 < x \leq 62,50$	Less critically
$25,00 < x \leq 43,75$	Very less ritically

(Yuliati, 2011)

RESULTS AND DISCUSSION

This research was conducted at 1 Lingsar High School by using two classes as samples. The first sample is the MIA.A class as an experimental class that is treated using a problem based learning model assisted by Worksheet and class X MIA.D as a control class that is given treatment using a conventional model that is commonly applied. This study was conducted to determine the effectiveness of the Worksheet -assisted problem-based learning model of students' critical thinking physics abilities at SMAN 1 Lingsar.

Data from the experimental class and control class consists of post-test results. Post-test is a test conducted after the treatment is given to the experimental class and the control class which aims to determine the effect of the treatment given to the experimental class in the form of a learning model based on Worksheet-assisted learning. The results of the experimental class and the control class post-test are presented in Table 2.

Table 2. Post-test Results Data Experiment Class and Control Class

Component	Experiment class	Control class
N	25	26
Highest val.	92,86	85,71
Lowest val.	46,43	46,43
Average	70,29	61,54
Deviation standard	8,97	10,13
Variance	84,44	102, 63
Homogeneity test	Homogen	
Normality test	Normal	
Hypothesis test	$t_{hit.} > t_{tab.}$ H_0 rejected & H_a accepted	

Data on the results of the critical thinking skills of the experimental class and control class students are grouped into qualifications, the percentage of critical thinking skills of the experimental class and control class students can be seen in detail in Table 3.

Table 3. Data Results of Students' Critical Thinking Ability

Component	Experiment class	Control class
Very critically	0%	0%
Critically	12%	46%
Less critically	72%	50%
Very less ritically	16%	4%

Based on the posttest data on the critical thinking ability of the experimental class students and the critical thinking ability of the control class students in each indicator can be seen in Table 4.

Table 4. Data for each indicator of students' critical thinking skills

Component	Experiment class	Control class
Analysis	67%	66%
Syntesis	76%	67%
Problem solving	73%	65%
Making conclusion	69%	66%
Evaluate	63%	51%

Based on the results of the study showed a difference in the average value of students in the experimental class and the control class. On the capitulation of the students' grades the average value of the experimental class students was 70.29 with the highest value of

92.86 and the lowest value of 46.43. While the average value of the control class obtained the highest value of 85.71 and the lowest of 46.43 with an average of 60.54. Based on statistical tests (t-tests) that have been conducted, the price of t-count = 2.36. This price is greater than the price table = 1.678. This shows that there is a positive influence on students' critical thinking skills following the Worksheet -based problem based learning model, where the average critical thinking ability of students as a whole or on each indicator of critical thinking ability shows that the critical thinking ability in the experimental class is higher than control class. In other words, the LSD-based problem based learning model is more effective on students' critical thinking skills than the conventional learning model.

The difference in students' critical thinking skills is due to the different treatment given between the experimental class and the control class. The experimental class is given a special treatment that is using a learning model based on Worksheet -assisted learning, while the control class uses a conventional learning model. The problem based learning model of Worksheet-assisted learning in the learning process can attract students' interest and curiosity to solve the problems given in the form of worksheets. The problem based learning model has 5 stages with each stage supporting students to be able to develop critical thinking skills. Stage (1), namely organizing students to problems in accordance with the real world of students, students' critical thinking skills developed at this stage is analyzing a problem that can be shown from the responses given by students. The response shown by students in the experimental class is better than the control class that uses conventional learning models because communication between students and students or students and teachers runs smoothly. Stage (2), namely organizing students independently and in groups to learn, in learning students are divided into 5 groups in which each group consists of 5 people. Each group is required to learn to work together in solving given problems. Stage (3), which is to assist independent or group investigations, in this stage students are encouraged to gather information in order to solve the problems given. Indicators of critical thinking skills that can be developed at this stage are analyzing, synthesizing and solving problems because students are emphasized to hone their critical thinking skills by thinking openly in order to be able to analyze, synthesize, and solve given problems. Stage (4), namely developing and presenting the results of his work, indicators of critical thinking skills that can be developed that can conclude a problem because students at this stage can plan and present the results of their work either orally or in writing by describing the results of their discussion. Stage (5), namely analyzing and evaluating learning related to the results of the discussion presented. Indicators of critical thinking skills that can be developed at this stage are analyzing and evaluating a problem because students are required to find the relationship of the problem that has been solved with the concept of the material being mastered. The five stages of the problem based learning model are effective for improving critical thinking skills because indicators of critical thinking skills can be achieved. This is what underlies the Worksheet-based problem based learning model effectively used against students' critical thinking skills.

This is different from learning in the control class using conventional learning models. In this learning, the teacher is considered as the main source of learning, while students only become recipients of the lessons given by the teacher without requiring special equipment. The ability to think critically in the learning process is not no more effective on the ability to think critically because the critical thinking ability data of the experimental class students is higher than the control class. The ability of students to think critically in the experimental class consisted of 16% of students who have the ability to think critically, 72% of students who have the ability to think critically, 12% of students who have the ability to think less critically, and 0% of students who have the ability to

think very uncritically. Whereas in the control class, the category of students' critical thinking skills consisted of 4% students with very critical thinking abilities, 50% of students with critical thinking abilities, 46% of students with critical thinking abilities, and 0% of students with very critical thinking abilities. This is because, students only accept the material as it is without gathering information in advance related to the material being taught. In addition, communication between students and students and between students and teachers does not work because students tend to be passive in their learning activities. This has made conventional learning ineffective in using students' critical thinking skills.

These results are consistent with the results of research Rahmawati et al. (2015) which states that the problem based learning model is effective for improving students' critical thinking skills because, the model of learning based learning can train students' critical thinking skills in solving problems, attracting students' interest in learning by interacting between students to find solutions, and demanding students to be actively involved in the learning process. In addition, Santoso et al. (2015) also states that the problem-based learning model aided by computer media influences students' critical thinking skills because, during the learning process students are required to solve given problems and then explain them according to their concepts, this is in line with Fatimah (2016) which states that By being used problem based learning models with cognitive conflict strategies, will make students more active so that critical thinking skills are higher than learning with conventional models, as well as according to Herayanti (2015) Research data shows that an increase in critical thinking skills in both classes with a percentage different. For the experimental class the highest increase occurred in the categorical indicators The ability to find similarities and differences by 40%. Based on the description above, the researcher concludes that the problem based learning model of Worksheet -assisted learning is effective against students' critical thinking skills.

CONSLUSSION

Based on the results of research that has been carried out, data analysis, and hypothesis testing at a significance level of 5% and the discussion it can be concluded that the problem based learning model of worksheet assisted learning is effective against the critical thinking abilities of students of physics at SMAN 1 Lingsar.

RECOMENDATION

Need further research on the indicators of analysis and conclude, considering the two indicators are not significantly different between the experimental class and the control class.

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