



The Effectiveness of Problem Based Learning Teaching Model to Increase Students' Rational Thinking Skills

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Abstract: Problem Based Learning is learning that is delivered by presenting a problem, asking questions, facilitating investigation, and opening dialogue. This study aims to determine the effect and effectiveness of PBL learning models on students' rational thinking skills and students' responses to the learning process applied. The research design used was one group of time series designs. The population of the study was all students of XI Science class MA Hubbul Jiron NW Pringgarta, while the samples were 21 students of XI Science class in the MA. The Problem Based Learning (PBL) learning model was applied to the sample class by three learning series that began with a pretest and ended with a posttest. Students' rational thinking skills are measured using a test in the form of multiple choice questions with 23 items that have been validated and tested. The effectiveness of the Problem Based Learning model in improving students' rational thinking skills is obtained through normalized gain analysis of pretest and posttest scores. The results of the study showed that PBL learning model is effective to improve students' rational thinking skills with the average normal gain values (N-gain) is 0.57, and questionnaire analysis showed 97% of students enjoyed PBL learning. Students are highly motivated to participate actively in the learning process.

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INTRODUCTION

Human rationality or ability to think rationally is a characteristic that is considered important, especially in the field of science. In line with this, Sulaiman (2011: 1) states that rational thinking is very important so that someone is able to compete to move forward in social life. Due to the importance of rational thinking way in life, it would be good if the ability of rational thinking is to be developed through the learning process at school. By learning rational thinking, students are expected to have the ability to solve problems by using common sense, logical, and systematic strategy considerations.

According to Novak (1979) rational thinking is a set of mental activities begins from simple to complex, including 10 skills namely memorizing (recalling), imagining, classifying, generalizing, comparing, evaluating, analyzing, synthesizing, deducing and inferring.

According to Presseien (in Karli, 2012) Thinking skills are grouped into basic thinking and complex thinking. The basic thought process is a picture of rational thinking containing a set of mental processes from simple to complex. In teaching science, basic thinking skills are intended as the ability to: (1) remember and repeat concepts, principles and procedures; (2) understand and choose concepts, principles and procedures; and (3) applying concepts, principles and procedures (Krulik and Rudnik, 1996). Rational thinking skills can be trained to solve problems in which the teacher invites students to think and only provides more opportunities for students to think through planned activities.

Based on observations obtained that most of the physics learning process applies lecture / one-way learning method which emphasizes the delivery of learning materials, students are not given the opportunity to discover their own physics concepts, students directly receive the ready-made knowledge conveyed by the teacher, as consequent the students' rational thinking skills are poorly trained.

To solve these problems, it is needed a learning process that is student-oriented and emphasizes the process of discovery. One learning model that is predicted to be able to train students' rational thinking skills is the Problem Based Learning (PBL) learning model.

Problem Based Learning (PBL) is learning that is delivered by presenting a problem, asking questions, facilitating investigation, and opening dialogue. The problems studied should be contextual problems that found by students in everyday life. Learning with PBL model involves students to be actively exploring knowledge, actively seeking new information, integrating new knowledge with what they know, organizing information that is known, explaining to other friends, and involving technology in the learning process. PBL model is closely related to rational thinking skills because the existing skills in rational thinking are also included in the realm of PBL.

The role of the teacher in PBL is to present various authentic problems or facilitate students to identify authentic problems, facilitate investigations, and support learning conducted by students. In applying PBL, the teacher can make an assessment on how active students are in learning, cohesiveness in solving problems with groups and students' attitudes towards group friends and individuals. Therefore, a good

judgment used is authentic assessment. Where the authentic assessment itself is a comprehensive assessment carried out to assess the aspects of attitudes, knowledge, skills begin with input (input), process, and output (output) learning (Ridwan A.S, 2014: 203). In accordance with the above, the writer tries to maximize the process of learning physics by paying attention to the concepts and theories of learning.

METHOD

The research method used was a quasi-experimental method by one group time series design. The patterns as shown in table 1.

Table 1. Research Design one group time series

| Pretest | Treatment | Posttest |
|----------|------------|----------|
| T1 T2 T3 | X1, X2, X3 | T1 T2 T3 |

The population in this study were all students of XI (Science) class MA Hubbul Jiron NW Pringgarta, while the samples were 21 students of XI (Science) class. In the sample class, the researcher implemented PBL learning model as many as three learning series that began with a pretest and ended with a posttest.

Students' rational thinking skills were measured by using a test instrument in the form of multiple choice questions totaling 23 items that had been validated and tested.

The effectiveness of PBL learning model in improving rational thinking skills was obtained through normalized gain analysis of pretest and posttest scores using equations:

$$<g> = \frac{Tf - Ti}{SI - Ti} \dots\dots\dots (1)$$

With $<g>$ = normalized gain, Tf = posttest score, Ti = pretest score, and SI = ideal score (maximum score).

Students' responses to the learning process of the PBL model were obtained through a questionnaire in the form of a closed statement that have to be answered yes or no accompanied by the reason for the answer.

RESULT AND DISCUSSION

Based on the results of the research that has been done, students' rational thinking skills have increased as seen from the N-gain score in table 2.

Table 2. N-gain Rational Thinking Skills

| No | Learning Series | Average N-gain | Category |
|----|-----------------|----------------|----------|
| 1 | Series 1 | 0,48 | Medium |
| 2 | Series 2 | 0,58 | Medium |
| 3 | Series 3 | 0,67 | Medium |
| | Average N-gain | 0,57 | Medium |

The achievement of students' rational thinking skills for each learning series can be seen from the distribution of test scores as shown in Figure 1.

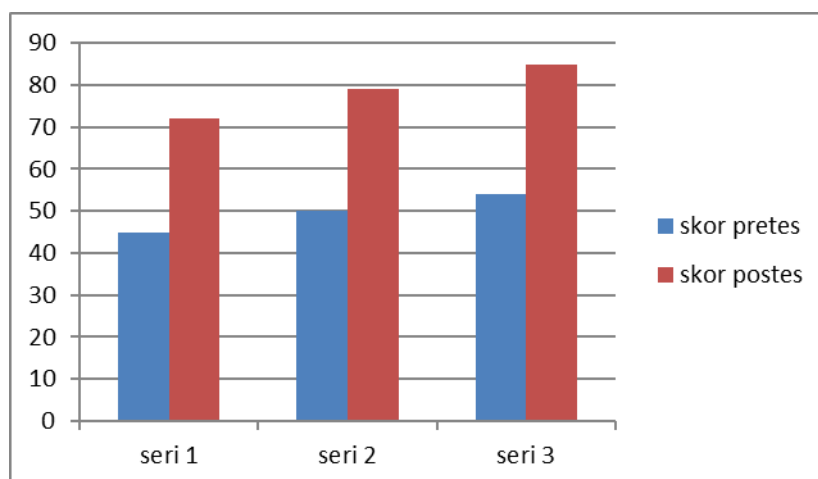


Figure 1. Distribution of the pretest and posttest scores of students' rational thinking skills in each learning series

Based on table 2, The students' rational thinking skills after the PBL learning model has been implemented in all learning series with moderate effectiveness has increased. When compared to each learning process, the N-gain scores of students' rational thinking skills have a tendency to increase for each learning, starting from 0.48 in the first series of learning, 0.58 for the second series, and 0.67 for the third series. This shows PBL learning has the effectiveness to increase students' rational thinking skills that are getting better for each learning that has been done. If seen from the development of students in the learning process from remembering to making conclusions students can already do it when given a problem in the student worksheet The Increasing of students' rational thinking skills accompanied by the achievement of scores of rational thinking skills are quite high. Based on Figure 1, the achievement score of students' rational thinking skills in the first learning series is in the range of 72, in the second series is in the range of 79, and continues to grow to around 85 in the third learning series. Improvement and achievement of students' rational thinking skills that are high enough can not be separated from learning activities with PBL model that involves students to be active in the learning process, inquiry, experiments, until the process of students discovering the concepts of physics they learn. Improvement and achievement of students' rational thinking skills can also be analyzed for each aspect as shown in table 3.

Table 3. Recapitulation of students' rational thinking skills scores.

| Aspect of Rational Thinking Skills | The Learning Process | | | | | | | | | Rata-Average N-gain |
|------------------------------------|----------------------|----------|--------|----------|----------|--------|----------|----------|--------|---------------------|
| | Series 1 | | | Series 2 | | | Series 3 | | | |
| | Pretest | Posttest | N-gain | Pretest | Posttest | N-gain | Pretest | Posttest | N-gain | |
| Memorizing | 48,9 | 91,1 | 0,83 | 77,8 | 100,0 | 1,00 | 66,7 | 100,0 | 1,00 | 0,94 |
| Forecast | 48,9 | 81,1 | 0,63 | 33,3 | 82,2 | 0,73 | 48,9 | 86,7 | 0,74 | 0,70 |
| Classifying | 46,7 | 75,6 | 0,54 | 68,9 | 95,6 | 0,86 | 60,0 | 91,1 | 0,78 | 0,73 |
| Generalizing | 42,2 | 58,9 | 0,29 | 62,2 | 80,0 | 0,47 | 57,8 | 97,8 | 0,95 | 0,57 |
| Comparing | 53,3 | 71,1 | 0,38 | 40,0 | 71,1 | 0,52 | 40,0 | 84,4 | 0,74 | 0,55 |
| Evaluating | 36,7 | 52,2 | 0,25 | 31,1 | 55,6 | 0,35 | 51,1 | 80,0 | 0,59 | 0,40 |
| Analyzing | 55,6 | 73,3 | 0,40 | 46,7 | 73,3 | 0,50 | 48,9 | 84,4 | 0,70 | 0,53 |
| Synthesize | 51,1 | 80,0 | 0,59 | 35,6 | 55,6 | 0,31 | 52,2 | 60,0 | 0,16 | 0,35 |
| Reducing | 33,3 | 75,6 | 0,63 | 57,8 | 86,7 | 0,68 | 66,7 | 93,3 | 0,80 | 0,71 |
| Summing up | 26,7 | 60,0 | 0,45 | 44,4 | 86,7 | 0,76 | 42,2 | 80,0 | 0,65 | 0,62 |

Based on table 3, PBL learning model has different effectiveness in improving aspects of rational thinking skills. Referring to the category of learning effectiveness set by Hake (1998), it is obtained that the highest increasing were in memorizing, classifying, and deducing aspects, while the other seven aspects of rational thinking skills were in the moderate category. Of the ten aspects of rational thinking skills, the largest N-gain score occurs in the memorizing aspect (recalling) with an average score of 0.94. This is because the ability to memorize is the simplest ability, students only restate the information they have learned.

The aspect of rational thinking skills with the lowest N-gain score occurs for the synthesizing aspect with an average score of 0.35. Unlike the other aspects of rational thinking skills, the ability to synthesise also has a downward tendency for each learning. It is predicted that this is because students have difficulty in gathering quite a lot of information during learning, so that it does not form something intact. In addition, the ability to synthesize involves many other abilities, namely the ability to classify, generalize, compare and evaluate.

Results Analysis of student responses related to PBL learning can be seen in the following table 4.

Table 4. Recapitulation of Student Questionnaire Analysis

| No | Statement | Student Response | |
|----|--|------------------|------|
| | | Yes | No |
| 1 | I like the learning model (PBL) | 94 % | 6 % |
| 2 | I like to do experiments because it can increase my confidence in taking and determining the answer to a problem | 83 % | 7 % |
| 3 | I am happy if the learning activities begin by raising problems that demand to be solved | 89 % | 11 % |
| 4 | The PBL learning model provides an opportunity for me to find my own answers to problems that exist | 92 % | 8 % |
| 5 | This learning model makes me lazy to learn | 13 % | 87 % |
| 6 | The learning model that is done makes me more enthusiastic in learning | 88 % | 12 % |
| 7 | The learning model used is very boring | 15 % | 85 % |
| 8 | Learning models that have been done encourage me to think | 91 % | 9 % |
| 9 | The learning model that has been done makes me better understand and comprehend the learning material to be taught | 87 % | 13 % |
| 10 | The learning model carried out make me not serious in solving existing problems | 23 % | 77 % |
| 11 | When learning takes place, I often look at my watch and hope that the fast learning time is finished | 33 % | 67 % |
| 12 | The learning model carried out trains me to think rationally (according to logic) | 92 % | 8 % |

Based on table 4, almost all students (94%) like the PBL learning model for a variety of reasons, including learning not boring, fun, better understanding learning material, providing opportunities to find themselves, and making learning more enthusiastic. This goes along with Bruner's statement that the knowledge obtained by students with learning that emphasizes discovery will be more durable, easier to remember, easier to apply in different conditions, can bring up motivation to learn and can practice thinking skills openly.

CONCLUSION

PBL learning model as a whole is quite effective to improve students' rational thinking skills, this is seen from the average normalized gain score of 0.57. Considering from every aspect of KBR, the increasing effectiveness shown in memorizing, classifying, and deducting aspects, while for aspects of predicting, generalizing, comparing, evaluating, analyzing, synthesizing, and concluding have moderate effectiveness. PBL learning model has positive responses from students, almost all students of the sample study expressed pleasure and got positive things from PBL learning.

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