

The Profile of Senior High School Students' Critical Thinking Skills after the Implementation of Problem Solving-Based Students' Worksheet Using Reading Infusion

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Abstract: The results of a preliminary study at one of high schools in Bandung City showed that learning in school did not enhance students' critical thinking skills. Problem solving strategy using reading infusion is one of the solutions to overcome this issue. This study is aimed at finding out the improvement of students' learning achievement and critical thinking skills as a result of the implementation of problem solving strategy using reading infusion. To this end, this study employed the one group pretest-posttest pre-experimental design. This study took place at one of senior high schools in Bandung, involving tenth grade students. The learning achievement was measured using a multiple-choice test, and critical thinking skills were measured using the Cornell Critical Thinking Test. The result revealed that problem solving strategy could maintain students' learning achievements and critical thinking skills.

1 INTRODUCTION

Physics teaching in high schools is intended as a means to train students to acquire physical knowledge, concepts, and principles, scientific competence, science process skills, and critical and creative thinking skills to solve everyday problems (Depdiknas, 2006).

The result of an observation at one of senior high schools in Bandung revealed that during the instructional process, students tended to only receive information, take notes of the teacher's explanation, and do exercises. This made students passive and less involved in the instructional process so that their thinking capacity was not in maximum use.

The results of a quiz showed an average score of 60.97, and only 39.02% of students who achieved the minimum mastery criteria of 70. This indicated their low learning achievement.

The results of questionnaire revealed that 35% of students liked reading, 30% liked reading course books, and 20% liked reading course books before lessons. This indicated their low reading interests especially in course books despite the fact that reading is a very important learning activity.

Based on the aforesaid description, students were not well facilitated to develop their potentials. Therefore, it requires an instructional process that can facilitate their potentials like problem-solving instructional strategy.

Bolton J and Ross (Selcuk et al., 2008:151) stated, "Problem solving instruction uses complex ways to solve problems. Therefore, students should be trained to solve problems using these ways." In addition, another definition is put forward by Dhillon (Selcuk et al. 2008:151). Based on this description, problem solving strategy can be defined as a way to present instructional materials by exposing students to problems they need to solve to achieve the learning objectives. Students are expected to conduct an authentic investigation to find solutions to a given problem. They analyze and identify problems, develop a hypothesis, collect and analyze information, compile references, and draw a conclusion (Hudojo, 2003). Similarly, Heller and Heller (1999:20) also explain that the problem solving strategy consists of the following phases: visualizing problems, describing physical concepts based on students' problems, planning the solutions, executing the solutions, and evaluating the solutions.

The problem solving strategy used in this study was adopted and adapted from both scholars using a problem solving-based students' worksheet adapted from the problem solving laboratory of the University of Minnesota.

In the instructional process, students should be trained to face problems, so they can think critically to make decision (Ennis, 2011). Problem solving instruction can train students to think critically.

Reading is a process of acquiring the writer's message through written textual media (Tarigan, 2008). It is a complex process involving the reader's comprehension, interpretation, reaction, and application in real life conditions. He is also involved in the textual information testing, language, ideas, insights, application of his prior knowledge and experience, and knowledge storage and recall.

Francais P. Robinson (1946) develops the SQ3R method to study texts. SQ3R stands for survey, question, read, recite, and review. Some studies revealed that this method could improve memory and reading comprehension.

This study needed to be conducted to give an idea about an improvement in learning achievement and to find out the profile of students' critical thinking skills

after the implementation of problem solving strategy using reading infusion. This strategy is expected to be an alternative in the instructional activities.

2 METHODS

This study used the one group pretest-posttest pre-experimental design. The population in this research is all tenth graders at one of senior high schools in Bandung, from which 36 of them enrolled in one class was taken as the samples.

The treatment was given during three class meeting times. The pretest was conducted before the treatment. The purpose was to find out students' initial knowledge about rectilinear motion concept and their initial critical thinking skills. After the pretest, on the same day, students were asked to read a module on kinematic motion using SQ3R technique under the teacher's guidance. The posttest was conducted after the treatment. The instructional activity completion was checked using an observation sheet. The instructional process was observed by three observers.

The research procedure is illustrated in Figure 1.

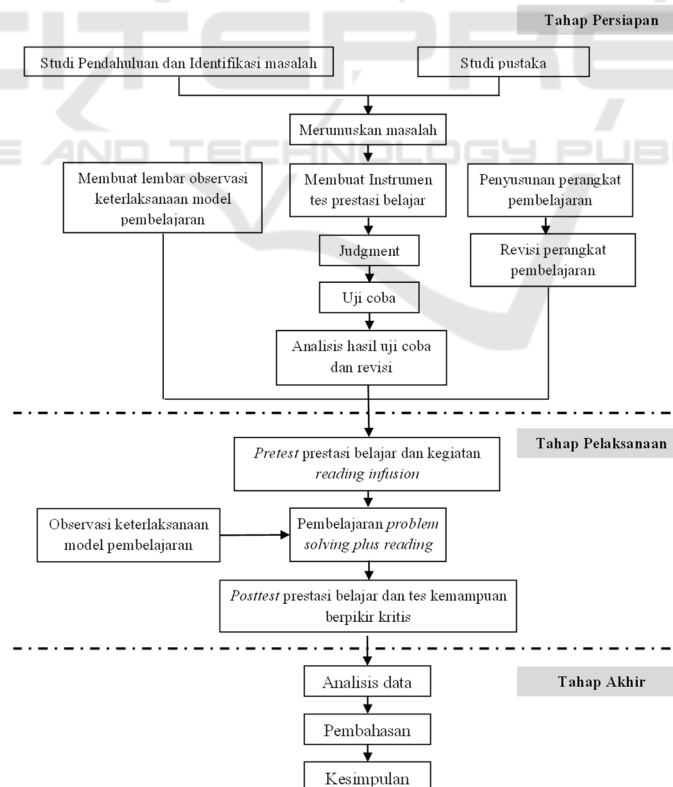


Figure 1: Research Procedure.

The research instruments included an achievement test, the Cornell Critical Thinking Test Level X, and observation sheets. The achievement test was previously tried out and analyzed before use. This included analysis of validity, reliability, difficulty level, and discriminating power. This test consisted of 20 multiple choice questions. The critical thinking test consisted of 20 inductive critical thinking items.

3 RESULTS AND DISCUSSION

During reading activities, the samples were provided with a relevant module. The teacher guided them to

read using the SQ3R technique. The observation result revealed that the reading completion reached 81.82%. This indicated that most of the SQ3R phases were completed. Only at the *Recite* phase did the students find difficulties to use their own words to answer questions. Due to the time constraints, the *Review* activity could not be done.

During the instructional process, students were divided into six groups of six to seven persons. What was done at the first instructional phase included visualizing problems, describing problem-based physical concepts, finding solutions, executing the solutions, and interpreting and evaluating the solutions. The overall instructional completion of each class meeting is outlined in Table 1.

Table 1. Result of Observation of Instructional Strategy Completion

Instructional Phase	1		2		3	
	TA	SA	TA	SA	TA	SA
Visualizing Problems	71.43	50.00	85.71	78.57	92.86	85.71
Describing problem-based physical concepts	75.00	50.00	100.00	100.00	100.00	100.00
Finding Solutions	66.67	66.67	83.33	66.67	83.33	83.33
Executing the Solutions	100	100	100	100	100	100
Interpreting and Evaluating the Solutions	37.50	12.50	75.00	37.50	87.50	50.00
Average	70.12	55.83	88.81	76.55	92.74	83.81

Note: TA : Teacher's activity
SA : Students' activity

The average percentage of the instructional strategy completion is illustrated in Figure 2.

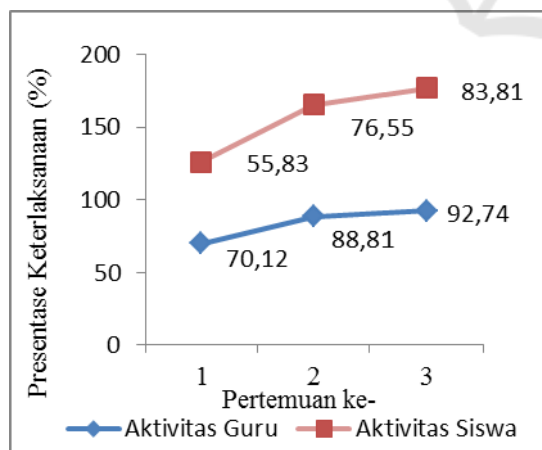


Figure 2. Instructional Strategy Completion.

3.1 Result of Learning Achievement Test

The improvement of students' learning achievement was measured using the normalized gain of pretest and posttest scores. The achievement tests consisted of 20 multiple choice questions: 4 questions measured C₁ (remembering), 7 question items measured C₂ (understanding), 6 questions measured C₃ (applying), and 6 questions measured C₄ (analyzing).

The improvement of students' learning achievement is illustrated in Figure 3.

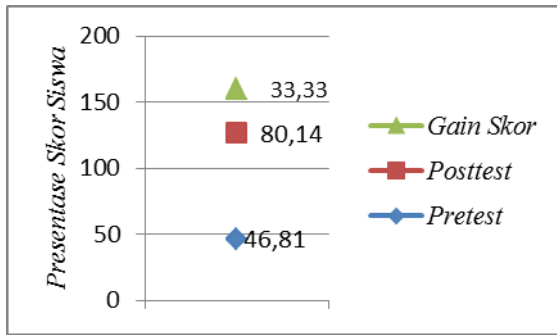


Figure 3: Improvement of Learning Achievement

Table 1: Learning Achievement in Every Cognitive Aspect.

Aspect Cognitive	Average Pretest	Average Posttest	Gain	<g>	Category
C ₁	77.08	95.83	18.75	0.82	High
C ₂	56.35	88.49	32.14	0.74	High
C ₃	28.97	67.06	44.44	0.63	Moderate
C ₄	4.37	18.65	33.33	0.35	Moderate

The data in Table 2 can also be presented in the form of diagram as shown in Figure 4.

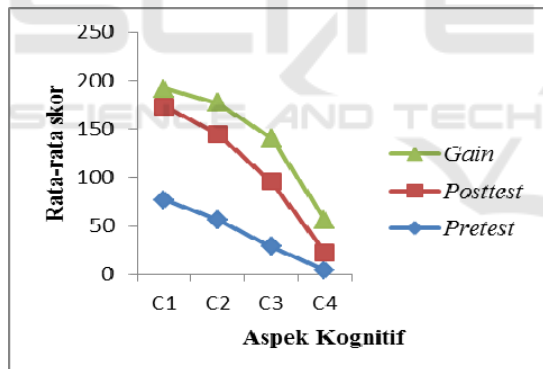


Figure 4: Average Score of Students' Learning Achievement in Every Cognitive Aspect.

Based on the result of data analysis presented in Table 2, it can be seen that the average score of pretest was 46.81, of the posttest was 80.14, and the gain score was 33.3. It means that students' learning achievement improved after the implementation of problem solving instruction using reading infusion. Looking at the normalized gain score of 0.63, this improvement was moderate. This was due to the less optimum teacher and students' activity completion. The teacher and students' activities during the lesson really influenced the learning achievement. This is in line with Joyce's opinion that an instructional model

The average score of the posttest was higher than that of the pretest. The improvement is shown by the percentage of the average gain score by 33.33. The normalized gain score was 0.63 or moderate.

The improvement of learning achievement was also measured in terms of cognitive aspects. The measurement result is illustrated in Table 2.

is a representation of learning environment that includes teacher and students' activities when the model in question is implemented (Joyce et al., 2009:30).

3.2 Profile of Critical Thinking Skills

The maximum score of the critical thinking test was 25, and the minimum was -12.5. The test score could be minus (-) because the scoring used the R-W/2 formula.

Ennis (1996) said, "No test honestly can give you score range categories like Superior, Good, Poor etc. You must decide for yourself." Since the Cornell Critical Thinking Test does not have standard category to determine one's critical thinking level (low, moderate, and high), groupings with reference to Arikunto (2010) was done to profile the inductive critical thinking skill level.

Based on the result of the study, students' critical thinking level could be categorized as follows:

Table 2. Students' Critical Thinking Level.

No	Category	Number of Students	Percentage (%)
1.	Low	7	19.4
2.	Moderate	23	63.9
3.	Good	6	16.7

Table 3 shows that, with the percentage of 63.9%, the majority of students have moderate inductive critical thinking level.

4 CONCLUSIONS

Based on the results of the study, it could be concluded that the implementation of problem solving strategy using reading infusion could improve students' learning achievement.

It requires further studies to pay more attention to reading activities and other aspects of critical thinking skills.

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