An Analysis of Looking Back Method in Problem-Based Learning: Case Study on Congruence and Similarity in Junior High School

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Abstract. This study aims to understand how learners do look back their idea of problem solving. This research is based on qualitative approach with case study design. Participants in this study were xx students of Junior High School, who were studying the material of congruence and similarity. The supporting instruments in this research are test and interview sheet. The data obtained were analyzed by coding and constant-comparison. The analysis find that there are three ways in which the students review the idea of problem solving, which is 1) carried out by comparing answers to the completion measures exemplified by learning resources; 2) carried out by examining the logical relationship between the solution and the problem; and 3) carried out by means of confirmation to the prior knowledge they have. This happens because most students learn in a mechanistic way. This study concludes that students validate the idea of problem solving obtained, influenced by teacher explanations, learning resources, and prior knowledge. Therefore, teacher explanations and learning resources contribute to the success or failure of students in solving problems.

1. Introduction

Looking back is one of the stages of problem-solving strategy introduced by Polya, covering activity tracking work steps that have been done, including to evaluate it [1]. The complete stages of problem solving according to Polya [2] consist of: 1) understanding the problem; 2) design the plan; 3) execute the plan; and 4) looking back. Bransford and Stein [2] formulate a similar heuristic known as IDEAL (Identify; Define; Explore; Act; and Look Back).

Looking back is an observation activity to ensure the accuracy of completion, so as to obtain a logical relationship between the solution and the problem presented. Polya suggests that educators are not much help in this process, so that learning independence can be gained. Learners should have the opportunity to evaluate their work [3], which is part of the meaning of learning.

In this study, researchers conducted a review of the validation process conducted by learners on problem-based learning on the subject of congruence and kesebangunan in junior high school. Specifically the researcher sets the research question "how do junior high school learners review the
solution they obtained in solving the problems of congruence and similarity on problem-based learning?"

2. Research Method
This study aims to understand how junior high school student conducts a looking back on problem-based learning (PBL). Based on these objectives, this study was conducted with a qualitative research approach, with case study design to obtain a specific description of the object under study. A total of 23 students became participants consisting of 11 men and 12 women, coming from a good quality junior high school in Indonesian education standards. Data collection is done by giving the problem to be solved in learning, as part of the PBL. The work of the students in answering the problems presented in the study was analyzed by coding and constant-comparison techniques by the researchers and the school's expert teachers. Some cases that represent the results of the analysis, validated by conducting interviews in the form of confirmation to students.

3. Result and Discussion
Polya and Bransford and Stein [2] explain that Look back or review is part of learning as one way to ensure that the solutions obtained are relevant to the problems presented. In this research, looking back is one step problem solving, as well as part of PBL. The results of interviews with teachers, obtained description of the implementation of PBL as follows:

Interviewer : What kind of learning do you apply?
Guru : PBL
Interviewer : How the learning steps?
Guru : PBL By following the steps: 1) provide the given problem relating to the student's real life; 2) grouping the discussion around the problem; 3) students are given maximum responsibility; 4) forming small groups; 5) demonstrating completed work; 6) make a report (collect the work)

According to the teacher, PBL has advantages over conventional learning, ie students are directly involved, develop critical thinking, better understand the problems in everyday life, and work together in completing the task. This teacher's opinion supports [4] and [5] stating that PBL is considered to be a conventional learning alternative. Other advantages as explained by [6] that there are three levels of guidance in learning PBL from structured (teacher-centered), guided (teacher guidance), to open-ended (teacher as facilitator).

As part of constructivism learning that emphasizes cognitive activity, PBL emphasizes the way of thinking in acquiring knowledge, which is to process information into new knowledge through exploration of the problems presented. Activities like this of course emphasize thinking processes involving several other capabilities related to problem solving. As a synthesis of how learners think in learning on PBL, obtained the steps of problem solving in the form: 1) understand the problem; 2) formulate the problem; 3) solve the problem; and 4) validation of Problem solving (look back).

3.1. Understanding the Problem
The solution search process begins with an interpretation of the problems presented. According to Harfold [7] there are 4 levels of learners in the interpretation of a concept namely, element mapping, rational mapping, system mapping, and multiple system mappings. Osborne and Wittrock [8] introduce cognitive stages in building meaning or representation consisting of four stages: (a) selective attention; (b) perception; (c) testing; And (d) memory stores of images, episodes, propositions, and skills. Based on this opinion, the process of representation will build a new cognitive structure that is the result of the connection between information that has been stored in memory.

The connection between the knowledge that the learners have with the problem or the material learned can be one indicator of the smoothness of learning [3]; [9]. Anderson [10] points out that "Research in cognitive psychology has shown that prior knowledge of the quantity and quality of new knowledge acquired." Without the introduction of old knowledge with new knowledge, it is impossible for
students to run the lesson well. One of the findings describes classroom learning, "only about 50% of students are proficient in complex reasoning and reasoning procedures, and less than 7% are proficient at multi-step problem solving and algebra" [11]

3.2. Formulating Problems
Modeling is another term of formulating, which determines the success of solving problems in mathematics learning. Steps to formulate the problem in accordance with the opinion of Bissell & Dillon, 2000; Edwards & Hamson, 1989; Lesh & Doerr, 2003; Pollak, 1997 [12] as follows: 1) Identify the real-world phenomenon; 2) Simplify or idealize the phenomenon; 3) Express the idealized phenomenon mathematically (i.e., “mathematize”); 4) Perform the mathematical manipulations (i.e., “solve” the model); 5) Interpret the mathematical solution in real-world terms; dan 6) Test the interpretation against reality.

3.3. Solve the problem
There are four types of knowledge used in solving problems namely, substantive knowledge, mechanical-syntactic, formal-rhetorical, and combine mechanical-formal [13]. Based on the four types of knowledge, in this study only substantive knowledge or mechanical-syntactic emerged from the answers of learners. This means that the way of thinking learners in solving problems that arise in this research is substantive or mechanical-syntactic thinking, while other types are not visible in learning.

3.4. Validation of Problem Solving
The results of the analysis conclude that there are three ways in which the learner evaluates the problem solving, namely a) done by comparing answers to the completion measures exemplified by the learning source; b) is done by examining the logical relationship between the problem and the solution c) Confirmation of the knowledge it understands.

3.4.1. Done by comparing answers to the completion measures exemplified by the learning source.
Based on the results of the analysis of the answer is known that some learners to evaluate to ensure the answer is correct by comparing answers to the steps of completion exemplified by the source of learning. The answer is assumed to be true after the corresponding process responds with an example that teaches the source of learning, one such example as shown in Figure 1. In Figure 1, the two answers present a uniform error in the different case, ie comparing the irrelevant sides. On the right answer answer, the result obtained side DE = 6 cm, whereas BC side of the length is 4 cm in size. Nevertheless, there is no correction to the answer, which means that learners do not relate the solution to the problem. Figure 1 shows the student's failure to understand congruence and similarity, even falling into the misconception category as a result of a false validation process.
3.4.2. Examining the logical relationship between the solution and the problem. The second way of reviewing examines the logical relationship between the problem and the solution, in which learners match the answers obtained with the problem presented. While this is not the way to provide the right assurance of completion, but learners have used logical reasoning in understanding the problem. The word "strange" (circled) in Figure 2, means that the solution obtained does not match the problem presented. This means that the participants did not agree with the answers obtained because they are not relevant to the problem presented.

Figure 1. Comparing Answers to the Completion Measures Exemplified by the Learning Source

Figure 2. Confirmation of the Knowledge it understands

3.4.3. Confirmation of the Knowledge it Understands. As in the second way, such learning emphasizes the problem association with the cognitive structure it possesses. The difference is the validation reference, the second way of using the link between the solution and the problem, while the third way is validating with the concept it understands, such as knowledge of the prerequisites. Figure 3 shows students' attempts at solving problems by applying the Pythagoras theorem, while learning is discussing congruence and similarity. The Pythagoras theorem can be applied as part of the problem
solving step in Figure 3, however, it still requires the application of the concept of civility. The student assumes that his work is done and the solution he got is the right answer.

![Diagram of a geometric figure with labels and calculations](image)

**Figure 3.** Confirmation of the Knowledge it understands

The interconnectedness between the knowledge that the learners have learned and the concepts learned can strengthen their cognitive structure. This connectivity also provides a good perception of the concepts being studied [3]. The lack of prerequisites on how to validation can be a barrier to learners' learning. Several cases found in the answers presented to the students made possible misconceptions. To overcome this, teachers must provide assistance to improve the mastery of learned concepts.

**4. Conclusion**

This study concludes that junior high school students have not been able to study independently, so in understanding the concept still mimics the explanation of learning resources mechanically. The role of teachers in providing explanations directly and clearly is still very necessary to avoid misconceptions on students. Misconceptions can occur because students do not understand how validation answers are obtained from the problems presented. There are three ways of troubleshooting validation from the answers, ie a) done by comparing answers to the completion measures exemplified by the learning source; b) is done by examining the logical relationship between the problem and the solution c) Confirmation of the knowledge it understands. The superiority of PBL that provides an opportunity for students to learn independently, should be accompanied by teacher loyalty in anticipation of misconceptions due to limited guidance of the learning process.

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