Teacher’s question in the stage of solution presentation and reflection problem-based learning for increasing valid relationship score on concept map

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Abstract. The aim of the research is to measure the increase of valid relationship (VR) concept map (CM) scores using a teacher’s question in the stage of solution presentation and reflection problem-based learning. The research is a classroom action consisting of pre-cycle, cycle I, and cycle II. The research procedure included planning, implementing actions, observations, and reflecting on 36 high school X grade students. The research data was VR scores calculated based on expert CM, supported by syntax implementation and performance assessment. Validation of data used triangulation methods which confirmed VR scores with documentation and interviews. The data analysis used data reduction, data presentation, and conclusion. The results showed that the number of students who has an increase in VR scores in linear, trend, and fluctuating fashion as follows: 44.44%; 22.22%; and 33.33%. The teacher’s question in the stage of solution presentation and reflection increased VR scores, therefore the teacher can apply the action to train student’s ability to connect concepts in class.

1. Introduction

VR is a component of CM that represents a student’s ability in creating a valid inter-concept relationship [1]. A valid inter-concept relationship visualized by VR establishes the meaning of a concept [2]. The students easily study the subject since the meaning of the concept is interrelated [3]. Hence, VR is very important CM component.

The increasing VR score requires a learning process that accommodates student’s ability in creating a complex inter-concept relationship [4]. The ability to create a complex inter-concept relationship have achieved by the students during a process of solving a complex problem [5]. The complex problem is ill-structured [6]. The ill-structured problem has accommodated through PBL implementation [7].

PBL is carried out by five stages namely meeting the problem; problem analysis and learning issue; discovery and reporting; solution presentation and reflection; overview, integration, and evaluation [8]. The fourth stage of PBL, solution presentation, and reflection is the stage that accommodates the students in conducting a presentation of the result and thought of meeting the problem activity; problem analysis and learning issue; and discovery and reporting, that later is ended by reflection [9].

Solution presentation involves a discussion activity of everyone in the classroom by connecting the concepts proposed by each group. Discussion activity aims to solve problems based on problem analysis and learning issues arranged in the discovery and reporting stage [10]. Reflection in the solution presentation stage is a reflection of the result of the learning process that makes it meaningful...
The activities conducted in solution presentation and reflection encourage the students to create a complex inter-concept relationship [10]. Hence, it increases the VR score on CM.

The result of the highest VR score on PBL is 16.33% of 100% as the maximum expert. The percentage of VR score that is less optimal have caused by the less optimal student’s ability in creating a valid inter-concept relationship [1]. Therefore, it requires a modification at the solution presentation and reflection stage to increase the percentage of VR score.

Modification at the solution presentation and reflection stage had conducted by adding an instructional technique of questions raised by the teacher. The application of questions raised by the teacher technique in the PBL solution presentation and reflection stage makes students think and answer questions in a complex way [12]. Complex thoughts had used to build complex reflections [10]. The results of complex reflection had visualized on the VR of students [13]. Therefore, the application of the instructional technique of questions raised by the teacher at the PBL solution presentation and reflection will increase the VR score percentage.

2. Research Method

Research is a class action consisting of pre-cycle, cycle I, and cycle II. Cycles 1 and 2 are equipped with instructional techniques for teacher questions at the PBL solution presentation and reflection stage.

Research procedures include planning, implementing actions, observing, and reflecting. Action planning includes the preparation of lesson plans, expert concept maps, the rubric of performance assessment, and guidelines for open interviews with teacher and students. The action was carried out by the application of instructional techniques to the teacher's questions at the solution presentation and reflection stage which ended with the provision of CM assessments for 36 first-year high school students of Natural Science.

VR score is counted as based on expert CM supported by syntax application and performance assessment score for group-working, making observation and inferences, and oral presentation. The assessment of the VR score percentage on every cycle is shown in Table 1.

| Cycle     | VR Score | Max VR Score in The Expert CM | Calculation      | Percentage |
|-----------|----------|-------------------------------|------------------|------------|
| Pre-cycle | 49       | 49                            | (49/49) x 100%   | 100%       |
| Cycle 1   | 71       | 71                            | (71/71) x 100%   | 100%       |
| Cycle 2   | 49       | 49                            | (49/49) x 100%   | 100%       |

The data validity test uses the triangulation method to confirm the VR score by using the interview results and documentation. The indicator of research achievement is an increase in students’ VR scores in the form of percentages.

3. Result and Discussion

The result of VR score following the application of the action on pre-cycle, cycle 1, and cycle 2 is the increasing of the average percentage of VR score. The result of VR score have shown in Figure 1.
The number of students who has an increase in VR scores in linear, trend, and fluctuating fashion as follows: 44.44%; 22.22%; and 33.33%. The percentage of VR score increases linearly. It means the ability of students in making valid relationships between concepts increases [14]. Increased ability to connect concepts with one another has obtained from the work and thoughts of meeting the problem, problem analysis, and learning issue; discovery and reporting presented and discussed in the solution presentation and reflection stage [9] assisted with the application of teacher questions [15]. The application of questions raised by the teacher technique in the PBL solution presentation and reflection stage makes students think and answer questions in a complex way [12]. Complex thoughts have used to build complex reflections [10]. The results of complex reflection have visualized on the VR of students. Hence, the application of the technique of questions raised by the teacher in the PBL solution presentation and reflection stage increase the percentage of students' VR score by 4.08 - 12.24%.

The percentages of VR score that increase in a trend means that the percentage of VR score in cycle 1 is smaller than the pre-cycle, while cycle 2 increases above the pre-cycle. The decrease in the percentage of VR scores in cycle 1 is due to the very complex learning material and the lack of detail in the teacher's questions. The complexity of the learning material makes it difficult for students to find and connect all concepts in cycle 1 [16], while complex learning material requires detailed questions to help students understand the concept [17]. Teacher questions that are complex but not detailed are not optimal to help students understand the learning material [18]. Hence, the complexity of the learning material and the less detailed questions affect the reduction in the percentage of VR score. The increase in the percentage of VR scores in cycle 2 is due to the application of teacher questions in the PBL solution presentation and reflection stage in a more detail way. Therefore, it helps students to relate the concepts to one another to form VR easily [19], so the application of the technique of questions raised by the teachers in the PBL solution presentation and reflection stage increase the percentage of VR score in a trend of 2.04 - 8.16%.

The percentage of VR score that dynamically change caused by several factors, as follows: student’s pre-knowledge [20] and student’s interest in the material [21]. Student’s pre-knowledge which is less than optimal causes students to have difficulty in connecting new concepts with existing concepts and vice versa [22]. Therefore, the student’s pre-knowledge affects increasing and decreasing the percentage of VR score.
Student’s interest in the learning material affects the attention of students in the learning process [23]. Lack of attention causes students to have difficulty in finding and connecting the concepts [24]. Thus, the students who are less interested in a material affect the decreasing percentage of VR score.

The percentage of VR score have supported by performance assessment indicators as follows: group work, oral presentation, and making observations and inferences activity. The results of the average score of performance assessment of pre-cycle, cycle 1, and cycle 2 had shown in Figure 2.

Figure 2 shows the average score of students’ performance assessment in pre-cycle, cycle 1, and cycle 2. The average score of group work, oral presentation, and making observation and inference increases linearly from pre-cycle to cycle 2. Increased group work scores linearly due to the increasing ability of students to work together [25]. The ability to work together encourages students to interact and exchange ideas with other students [26]. Interaction and exchange of thoughts between students encourage them to find and make inter-related concept relationships [27]. Relationships between concepts that had formed had virtualized through VR. Therefore, group work affects the percentage of VR score.

Oral presentation scores increased linearly from pre-cycle to cycle 2, due to the ability of students to understand the material increasing [28]. Understanding the material requires the ability of students to relate concepts to one another to form the meaning of concepts [22]. The ability to relate one concept to another is visualized through VR. Hence, the increased score of oral presentations is a sign of increased VR score.

The score of making observation and inference activity increases linearly from pre-cycle to cycle 2, due to the ability of students to identify new information and relate it to the information that they already have [29]. The relationship between new information and old information is visualized through VR. Therefore, making observation and inference activity affects the percentage of VR scores that increase.

4. Conclusion

The results of the application of instructional techniques of questions raised by the teacher at the PBL solution presentation and reflection stage shows that there is an increase in the percentage of linear, in trend, and fluctuating VR score. The increased VR score is caused by internal and external factors. Internal factors are namely student’s pre-knowledge and student’s interest at the material, while external factors are namely the complexity of the material and the teacher's less detailed
questions. The increasing percentage of VR score have supported by performance assessments, including group work, oral presentations, and making observation and inference activity.

The increasing percentage of VR scores shows that the application of instructional techniques of questions raised by the teacher at the PBL solution presentation and reflection stage can increase the ability of students to connect the concepts to understand the material. Therefore, the teacher can apply instructional techniques of questions rose by the teacher at the PBL solution presentation and reflection stage to train student’s ability to connect concepts.

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