The effect of instructional techniques question at the overview, integration and evaluation PBL to cross-link in the concept map

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Abstract. The aim of the research is a calculate the score of cross-link in the Concept Map (CM) students by instructional technique in overview, integration and evaluation in Problem Based Learning. The research is a classroom action research, there are pre-cycle, cycle I and cycle II. The research procedures are planning, act, observation and reflection. The research subjects were 20 students in senior high school. Collection data by observation learning activities, assessment CM, interview and documentation. Validation using triangulation techniques: verification of cross-link scores with expert CM, CM documentation and interviews. Data analyzed uses qualitative descriptive by reducing, presenting data and conclusions. The result shown cross-link scores of students from pre-cycle, a cycle I and cycle II are 0%; 4,54% and 10%. The instructional techniques question in overview, integration and evaluation increased higher-order thinking skill students, so the cross-link scores of the CM can improve.

Keywords: questions, problem based learning, crosslink, concept map

1. Introduction

Concept map (CM) is a visual representation that shows a concept related to other concept [1]. CM illustrates the students in arranging, linking, and synthesizing the knowledge they get during learning [2]. CM has assessment indicators that consist of valid relationship (VR), hierarchy (H), branching (B), patterns (P), cross-link (CL) and specific example (E) [3]. Cross-links show the meaningful relation between one concept and another concept with different segments in their hierarchy, thus the material comprehension can be seen from the CL component.

CM can be used as instructional techniques [4] and an assessment [5] in the final learning results [6]. As an assessment, CM is used to reflect all the knowledge that has been understood [7], and the reflection of knowledge understood is a part of the overview [8].

The learning results reflected in CM describes the students' ability to find and link the concept that they get through unstructured problem analysis [9]. Unstructured problems can be accommodated by problem based learning [10]. Problem based learning (PBL) has several steps that consist of meeting the problem, problem analysis and learning issues, discovery and reporting, solution presentation and reflection, overview, integration and evaluation. Overview is a reflection of all knowledge understood by students [8].

The observation results show that PBL is solely applied for the students' ability to find and link the concepts by making CM. Yet, although 100% of the students can make the CM, none of them makes the CL components. Therefore, the PBL has not been optimal in building the ability to find and link the concepts by making CM, especially the CL components.
In order to prepare the CM and CL component, it needs the reflection of the knowledge learned. Knowledge reflection is carried out in the overview, integration and evaluation stages, so the instructional techniques in the form of questions are needed to focus [11] and make the students easier to link concepts [12] in the materials that they learn. Instructional technique questions can be applied at all stages of PBL [13].
Adding the instructional techniques at the overview, integration and evaluation stages can accommodate students to conclude, integrate knowledge from various disciplines and reflect the knowledge that they understood during learning, so CL, as a supporting component of CM, increase.

2. Research Method

This research is a classroom action research comprising of pre-cycle, cycle I and cycle II to measure the scores of CL components on the students' CM. Each cycle has several stages, namely: (1) Planning, (2) Action and Observation, and (3) Reflection. The pre-cycle use PBL without instructional techniques. Cycles I and II use PBL with additional instructional techniques at the overview, integration and evaluation stages. The materials used in the pre-cycle is the types of pollution; cycle I, that is the source and type of pollutants; and cycle II with environmental pollution indicator material.
The research subjects were 20 students of 10^{th} grade High School. The data were collected by observation of learning activities, assessment in the form of CM, interviews and documentation of learning activities, especially of the CL component. The data of CL were taken from the CM constructed by the students at the end of learning. The validity test was conducted using data triangulation techniques that include verification of cross-link scores on the CM with an expert concept map, documentation of learning activities and interviews about PBL and the students' CM construction. The techniques of data analysis comprised of data reduction, data presentation, and drawing conclusions.
Research achievement indicators can be seen from the CL component scores on the students' concept map based on the expert concept map. CL components assessment in the pre-cycle, cycle I and cycle II are shown in Table 1.

Table 1. CL components as assessment in the pre-cycle, cycle I and cycle II based on expert CM

Treatment	Expert CM		
	CL	Score	Calculation
Pre-cycle	5	50	50/50 x 100% = 100%
Cycle I	11	110	110/110 x 100% = 100%
Cycle II	7	70	70/70 x 100% = 100%

3. Result And Discussion

3.1 Result

The CL component shows the meaningful relation between one concept and another concept with different segments in their hierarchy [3]. The results of the application of instructional techniques in the overview, integration, and evaluation show an increase of percentage of students' CL score. The percentage of students' CL component scores from pre-cycle, cycle I and cycle II are shown in Figure. 1.

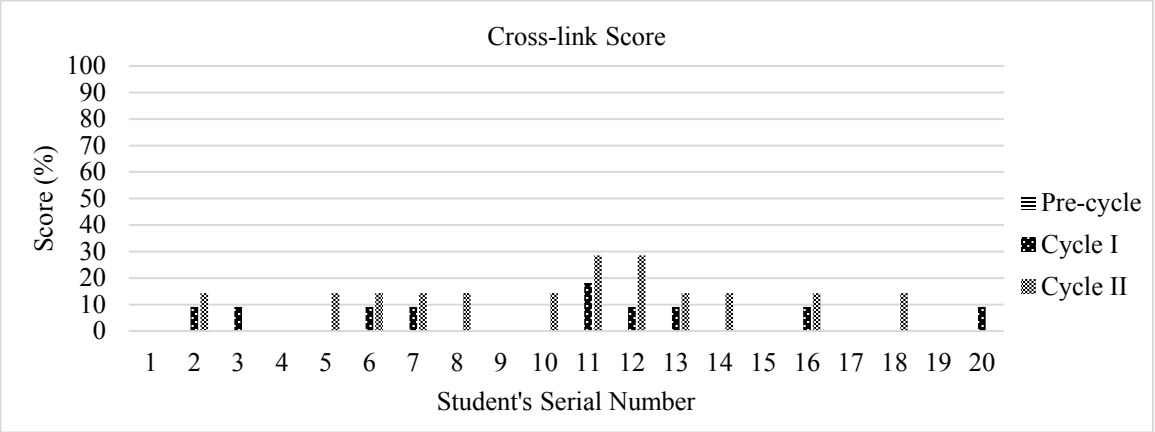

Figure 1. The percentage of students' CL component scores from pre-cycle, cycle I and cycle II

Figure 1 shows the percentage results of CL component score in students' CM starting from pre-cycle, cycle I and cycle II. The percentage results of the pre-cycle CL component scores with PBL show that 100% of students have not been able to make the CL component in CM. The students' CL component scores in CM are optimized using instructional techniques in the form of questions in the overview, integration and evaluation stages applied in Cycle I.

The percentage of students' CL component score in Cycle I has a class average of 4.54% of the CL scores in expert CM. The percentage of CL component scores above the average is obtained by 45% of students with serial numbers 2, 3, 6, 7, 11, 12, 13, 16, 20 and the percentage of CL component scores below the average is obtained by 55% of students with serial number 1, 4, 5, 8, 9, 10, 14, 15, 17, 18, 19. 45% of the students can make CL components and 55% of the students cannot make CL components in *CM*. Thus, there is an increase in the percentage of CL component scores and the number of students who can make CL from pre-cycle to cycle I. The average percentage of CL component scores from pre-cycle to cycle I increases, but the class average is still low. So, further research for Cycle II is needed. Cycle II is carried out by implementing instructional techniques in the form of questions in the overview, integration and evaluation stages in PBL.

The percentage of students' CL component score in Cycle II has a class average of 10% of the CL scores in expert CM. The percentage of CL component scores above the average is 60% of the students with serial numbers 2, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 18 and the percentage of CL component scores below the average is 40% of the students with serial number 1, 3, 4, 9, 15, 17, 19, 20. The percentage results of CL component score in Cycle II show an increase the average class and 60% in the number of students who were able to make CL. Cycle II, with the application of instructional techniques, still needs improvement. However, the time allocation given by the school for this research is limited, so it stops on Cycle II.

The highest percentage of CL component score is 28.57% from 10% of the students with serial number 11 and 12 in Cycle II. 45% of students experienced an increase in CL component scores from pre-cycle to cycle I and 60% of students experienced an increase in CL component scores from cycle I to cycle II. The average percentage of students' CL component in pre-cycle is 0%, 4.54% in cycle I, and 10% in cycle II. The percentage of students who are able to make CL components from pre-cycle, cycle I and cycle II are 0%, 40%, and 60% consecutively. Therefore, the CL component increases from pre-cycle to cycle I and cycle II.

3.2 Discussion

The students' ability in linking the concepts of different segments in the hierarchy is visualized with the CL component. The average percentage results of students' CL component scores increase linearly from pre-cycle to cycle I and cycle II. The increase in the CL component is influenced by the students' ability to think at a higher level/ HOTS and their creativity to construct CM [14]. CL is an important

component in CM because CL shows students' high-level thinking skills [15]. HOTS show students' deep understanding of a material that is seen from the relationship between the concept of the different hierarchy in CM [15]. CL is the result of HOTS which consists of analytical, synthesis and evaluation capabilities [16]. Analysis of the concept organization that has been written in CM. Synthesis consists of the ability to unite concepts by organizing and connecting concepts to become a good CM and CM evaluation that has been made is in accordance with the learning material [17].

HOTS develops the ability of students to analyze a learning material through questions and problem solving based on critical thinking skills [18]. Students who are able to think critically are shown by being able to create and connect concepts logically that are visualized through CL [19]. CL shows students' deep understanding of a material [20] and creativity helps students to understand new concepts [21], so students who are able to make CL show an understanding of the subject matter. Besides that the increase in the CL component is also caused by questions at the overview, integration and evaluation stages.

Questions are an important element in higher-level thinking and connecting concepts [15]. Questions encourage students to think more deeply about learning material [22]. Questions will focus the students in organizing and linking concepts [23]. Students who are able to organize and link concepts well show a high concepts understanding [24]. Students' understanding of concepts regarding the material learned can be seen from the ability to link one concept with another concept that is visualized from the CL component [25]. Questions at the overview, integration and evaluation stage accommodate students to integrate knowledge from various scientific disciplines and reflect knowledge understood during learning that is evident from the presence of CL components, thus the application of instructional techniques in the form of questions in the overview, integration and evaluation stages increase the percentage of CL component scores in students' CM.

Students who have not been able to make CL components from pre-cycles, cycle I and cycle II are caused by the lack of understanding of the material being studied [26]. The students' understanding are related to the complexity of learning materials [27]. Complex learning material causes low motivation to follow the lesson [28]. Students' motivation are important to build creativity [29]. Thus, low motivation leads to low student creativity. Low student creativity has an impact on the ability to link the concepts visualized in CL [14].

The students' ability to link concepts in the form of CL is also influenced by the time allocated to construct CM. Lack of time allocation to construct CM has an impact on the time needed by students to link the concepts in form of CL [30], so the CL component is not found. Besides that, students who have not been able to make CL are due to lack of focus when learning. Students who are less focused in learning will have less material understanding [31]. Understanding of the material being studied can be seen from the CL component in students' CM [25], thus the increase in CL in students' CM is influenced by the questions in the overview, integration and evaluation stages.

4. Conclusion

The conclusion of the study is the application of instructional techniques questions in the overview, integration and evaluation stages increases of the higher-order thinking skill students, so the CL component scores in CM can improve.

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6. Reference

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