Instructional Technique Question Application in Stage of Deciding in Project Based Learning to Increase Score Concept Map

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Abstract. The study aimed to improve the concept map score through the application of instructional techniques questions in stage of deciding the study group way of collecting data and data analysis in project based learning. The research subjects consisted of 34 high school students. The study is a Class Action Research with three cycles, including: planning to develop lesson plan and its completeness, implementation of actions, observations, and reflections. Data collection is done by observation, assessment to calculate the concept map score, interviews, and documentation. Data validation uses triangulation techniques: verification of suitability of concept map scores and documentation based on expert concept maps and interviews. Data analyzed used qualitative descriptive conducted by data reduction, data presentation and conclusion drawing based on complete data concept map. The results of the study showed that the instructional technique of the questions in the deciding the study group the way of collecting data and data analysis stage on project based learning increased the students’ concept map score of students.

Keywords: questions, deciding, project based learning, concept map.

1. Introduction

Deciding the study group the way of collecting data and analysis data is one of the stages in project based learning that accommodates students to collect and analysis data to produce learning products [32]. Learning products include cognitive products, for example concept maps [24]. Concept map is a graphic form that visualizes the relationship between concepts and is arranged hierarchically [20].

Concept map consists of six components, namely valid relationship, hierarchy, crosslink, branching, pattern and example [20]. The concept map component can be quantitatively measured through scores on each component. The concept map score obtained by students on project-based learning in observation at school showed 3.14%. The concept map score obtained by students is a cognitive product in learning [24]. Planning learning products from the material that has been studied is discussed at the deciding the study group stage the way of collecting data and data analysis [34], thus the activities of collecting and analyzing data from various sources to make products need to be optimized through communication [6].

Communication during the learning process is in the form of questions [23]. Questions are part of instructional techniques [11]. The addition of an instructional technique in the form of questions on the project-based learning learning model, especially the deciding the study group stage, the way of collecting data and data analysis, leads students to collect and analyze data from various sources to make products [34]. The activity of collecting and analyzing data from various sources to make products carried out independently is often not optimal because students have difficulty compiling data collection plans, tend to present incomplete data and conclusions made do not match the data [31].
The activity of collecting and analyzing data is optimized with an instructional technique in the form of questions from the teacher directing students to form answers in the form of a list called instructional technique concept map list [40]. *Instructional technique concept map list facilitates students to form answers in the form of concept maps.* The concept map score is assumed to increase through the application of instructional technique questions in the decision deciding the study group the way of collecting data and data analysis on the project based learning learning model, so that the research aims to improve the concept map score through instructional technique questions at the decision deciding the study group the way of collecting data and data analysis project based learning.

2. Metode

The study is a Class Action Research consisting of three cycles with collaborative action research approach. Each cycle uses a research procedure consisting of planning, action and observation stages in each cycle called a spiral model. Pre-cycle research applies pure Project-based learning, uses material musci, research in cycle I and II applies project-based learning with the addition of instructional techniques in the form of teacher questions in the deciding the study group stage of the way of collecting data and data analysis using material Anthocerophyta and cycle II using material Marchantiophyta which is a class X material in high school. Class X high school who are 34 research subjects consisting of 12 male students 22 female students.

Students are given a task at the end of the study to construct a concept map so that the concept map score can be obtained based on analysis using the expert concept map. Supporting data includes the results of interviews submitted to teachers and students, documentation during the learning process. Student concept map scores are obtained from verification of suitability of concept map scores with expert concept map, documentation of concept maps created by students and interviews to represent understanding of relationships between concepts. The data that has been obtained is reduced to selecting complete data, presenting data and drawing conclusions based on the complete concept map score. Data analyzed used qualitative descriptive. The concept map score that increased from cycle I to the next cycle indicated the success of the study. Calculation of concept map scores based on Novakian namely valid relationship obtaining a score of 1 for each line of inter-concept relationships in one hierarchy, while different hierarchies (crosslink) obtained a score of 10. Each hierarchy obtained a score of 5, each branching obtained score 3 points for the first branching and 1 point for the second branching and so on. Concept maps that are arranged in detail and harmonious from general to special can get a score of 5. The concept map calculation by adding up all the scores of each component is divided by the number of expert concept maps and multiplied by 100%. Expert concept map total from pre-cycle to cycle II is as follows: 2395, 641 and 1359

3. Result and Discussion

3.1. Result

The result of this research is a concept map score (CM) which has six components: valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern (P) and example (E) [3]. The results of the study include pre-cycle, cycle I and cycle II by applying question instructional techniques in the deciding the study group stage the way of collecting data and project based learning data analysis. The concept map score generally increases, but varies in each component. Variations in the concept map component scores from pre-cycle to cycle II are shown in Figure 1, Figure 2 and Figure 3. The acquisition of the concept map score below the average is shown in Figure 1, the acquisition of scores above the average is shown in Figure 2 and the comparison from pre-cycle to cycle II is shown in Figure 3, as follows:
Figure 1. Score concept map below average.

Description: valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern and example (E)

Figure 1 shows the CM scores obtained by students in a class of 34 individuals, but the results of each individual vary. Variations in concept map scores obtained by students include: valid relationship that scores below the average (below standard deviation) in pre-cycle, cycle I and cycle II respectively 17.65%, 0% and 2.94% of the total students. The hierarchy component that scores below the average (below standard deviation) in pre-cycle, cycle I and cycle II respectively 5.88%; 5.88% and 0% in cycle II, scores on the crosslink component, no students get scores below the average from pre-cycle to cycle II.

Branching components that get scores below the average (below standard deviation) in pre-cycle, cycle I and cycle II respectively 5.88%; 2.94% and 2.94%. The pattern component that gets a score below the average (below standard deviation) in pre-cycle, cycle I and cycle II respectively 5.88%; 0% and 0%. The component example that gets a score below the average (below standard deviation) in pre-cycle, cycle I and cycle II respectively 17.65%; 0% and 38.23%.

Figure 2. The concept map score is above average

Description: valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern and example (E)

Figure 2 shows the average score for student concept-map. The valid relationship component score is above the average score in pre-cycle; cycle I, and cycle II respectively: 2.94%; 11.76%; 8.82%. In the hierarchical, there are no students who get a score above the average from pre-cycle to cycle II. Students who scored above the average of the cross-link components in pre-cycle, a cycle I and cycle II.
respectively:
2.94%; 1.76% and 8.82%.

Students who obtain branching and pattern scores above the average are 0%. The score of the example component from pre-cycle to cycle II is above the average are 0%, 0%, and 38.23%.

Figure 3. Comparison of CM scores results between cycles

Description: valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern (P) and example (E)

Figure 3 shows the comparison of the results of inter-cycle actions by applying instructional techniques to the questions in the deciding the study group stage the way of collecting data and project-based learning data analysis in project-based learning models shows an increase in CM average scores that visualize the ability to find and connect concepts from pre-cycle to cycle II. The achievement of each CM component, valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern (P) and example (E) changes every cycle. The score of each CM component varies greatly individually and classically. Variations in the score of each CM component classically are: relationship valid score from pre-cycle to cycle I decrease then increases in cycle II. Crosslink scores increase from pre-cycle to cycle II. Hierarchy, branching, pattern and example scores from pre-cycle to cycle I increase then decrease in cycle II.

3.2. Discussion

The concept map score obtained by students is an accumulation of 6 CM components, namely: valid relationship (VR), hierarchy (H), crosslink (C), branching (B), pattern (P) and example (E) [20]. The hierarchy component relates to the students' initial knowledge that is compiled from general to specific [14], branching is a branch that shows the link between general concepts and more specific concepts [7], pattern is a pattern in the concept map that is related to students' understanding of concepts [16] whereas example relates to students' ability to explain the meaning of the concept [20] so that the components of hierarchy, branching, patterns and examples show students' ability in finding concepts [7].

Valid relationship component is a line that connects between concepts and is related to the meaning of a concept [28], Crosslink is a line that connects between different hierarchy concepts and related student creativity, understanding the inter-concept relationship [20] and meaningful learning gained by students [38], so that the valid relationship and crosslink components show students' abilities in connect concepts.

The ability to find students' concepts from the pre-cycle to the first cycle has increased scores because the questions make students actively involved during the learning process [1]. Students who are actively involved are able to understand the material well [8]. Students' understanding can be seen from P score [5], the ability to explain the meaning of a concept [36] which is represented by the E
The increase in P and E scores supported by an increase in performance assessment, namely making and using the classification system increased from 68.46 to 70.66 observed during the learning process. The skills of making and using a classification system are related to understanding concepts and the ability to explain the meaning of a concept [12] so that students are able to construct concepts from general to specific hierarchically.

The ability to connect students' concepts from pre-cycle to cycle I have increased because the questions are able to help students to come up with ideas [39]. The ideas produced by students are the result of students' creative thinking [18]. Student creativity is visualized from score C [20]. Score C shows a meaningful relationship between different hierarchical concepts [22], meaning that the question is able to increase the C score which represents the relationship between concepts. The increase in C score related to the students' creativity results is supported by an increase in performance assessment, namely the skill of displaying products that increased from 23.98 to 24.45. Skills for displaying products resulting from project design [15]. The project accommodates students to think creatively [17], thus an increase in C score is supported by an increase in the skill score of displaying products.

Scores for H and B increase from pre-cycle to cycle I because questions help students bring up students' initial knowledge, find more concepts (Nielsen, 2016) and are able to focus students on compiling answers in the form of concept maps [3]. Concept maps are arranged hierarchically [26] and have branches or so-called branching, so the questions increase the scores of H and B which represent the ability to find concepts.

CM scores on VR components, C from cycle I to cycle II have increased scores because questions facilitate students to understand the concept more deeply [9]. Students 'understanding can be seen from the students' ability to connect one concept to another [35], while the different conceptual relationships of visualized hierarchies of C scores on CM [3] thus the question is able to cause VR and C scores on CM to increase meaning that the ability to connect concepts increases.

Increased VR and C scores related to concept understanding are supported by an increase in oral presentation skill scores. The increase in oral score presentation from cycle I to cycle II is from 76.55 to 77.22. Oral presentation skills demonstrate students' verbal understanding (Poonpon, 2017), thus increasing the presentation skills oral scores related to increasing VR and C scores.

The average percentage of total CM scores based on the expert concept map from pre-cycle to cycle II respectively 3.139%; 16.826%; 19.503%. The increase in the total concept map score is caused by the question focusing students to organize and connect the concepts (Schwendimann, 2014). The arrangements and relationships between concepts form a concept map [35], thus the total CM score generally increases in each cycle due to teacher's questions but, fluctuating in some CM components, meaning the ability to find and connect concepts increases.

Fluctuations in CM component scores as in VR components which decrease from pre-cycle to cycle I are due to the more complex classification of Musci compared to Anthocerophyta. More complex classifications make students connect more content between taxon levels. The line that connects between the content and valid gets a score of 1 [4], so the more complex classification the more scores are gained on the VR.

The detailed discussion of components H, B, P and E was analyzed in succession as follows, in component H 5.88% got a score below the average in pre-cycle and cycle I then 0% in cycle II. 94.12% obtained a normal score on the pre-cycle and the first cycle then became 100% in the second cycle, there were no students who got a score above the average from pre-cycle to cycle II. The average hierarchy component from pre-cycle to cycle II is 27.941; 29; 20, thus the hierarchy score increases from pre-cycle to cycle I and then decreases in cycle II.

Branching components 5.88% get scores below the average in pre-cycle, 2.94% in cycle I and cycle II. 94.12% got a normal score then it became 97.05% in cycle I and cycle II, no students got scores above the average from pre-cycle to cycle II. The average branching component from pre-cycle to second cycle respectively is 5.294; 10.2; 7.2, thus branching scores increased from pre-cycle to cycle I and then decreased in cycle II.

The pattern component of 5.88% got a score below the average in pre-cycle, 0% in cycle I and cycle II. 94.12% got a normal score then it became 97.05% in cycle I and cycle II, no students got scores above the average from pre-cycle to cycle II. The average component pattern from pre-cycle to
The concept in cycle II is more complex than in cycle I because Marchantiophyta material is more complex than Anthocerophyta, so the concept map of students is arranged hierarchically to form branching called branching and form a pattern called pattern [28] more complicated and cause the scores of H, B, and P to decrease.

Each CM component from pre-cycle to cycle II experiences fluctuating changes, however, the average CM score which describes the ability to find and relate students' concepts especially to scores of H, C, B, P and E increases both classically and individually. Classical average increase from pre-cycle to cycle I for H from 27.941 to 29, increase for B from 5.294 to 10.2, increase for P from 4.647 to 4.88, increase for E from 6.235 to 8 and increase for VR from cycle I to cycle II is 15,471; 40,147 and the increase for C from pre-cycle to cycle II respectively is 5.294; 36.5; 188, thus question instructional techniques are able to increase CM scores which represent the ability to find and connect students' concepts.

Individual increase from pre-cycle to cycle I for VR by 32.35% of total students, increase for H as much as 11.76%, increase for C by 11.76%, increase for B and P 11.76% increase for as much as 58.82% E, while the increase from cycle I to cycle II to VR is 88.23% of total students, increase for H is 11.64%, increase for C is 85.29%, increase for B and P by 5 , 88% and the increase for E is 47.05%, thereby applying the instructional technique of questions in the decision deciding the study group, the way of collecting data and data analysis on project based learning increases the concept map score.

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