The Effects of Conceptual Understanding Procedures (CUPs) Towards Critical Thinking Skills of Senior High School Students

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Abstract. The aim of the study was to analyse the effect of the application of Conceptual Understanding Procedures (CUPs) learning to the students' critical thinking skills in the matter of category in SMA Negeri 1 Larangan. This study was quasi-experimental design using nonequivalent control group design. The population in this study was entire class X. The samples that were taken by convenience sampling were class X MIA 1 and X MIA 2. Primary data in the study was the student's critical thinking skills, which was supported by student activity, the level of adherence to the CUPs learning model, student opinion and teacher opinion. N-gain test results showed that the students' critical thinking skills of experimental class increased by 89.32%, while the control group increased by 57.14%. Activity grade of experimental class with an average value of 72.37 was better than that of the control class with an average of only 22.69 student and teacher opinions to the learning were excellegoodnt. Based on this study concluded that the model of Conceptual Understanding Procedures (CUPs) had an effect on the student's critical thinking skills in the matter of protest in SMA Negeri 1 Larangan.

1. Introduction

The quality of learning process which is implemented by a teacher is one of the important factors that determine the success of students' learning process. Teacher's mastery of teaching students represented about 30% of all the factors that influence the activity, the results the of learning process, and students’ creativity [1].

Biology teaching process in SMA N 1 Larangan is using lecturing, discussing, and task-based learning methods. The material that employed in this teaching-learning process is not contextual, and teacher uses the textbook as a source to deliver the materials. The discussing technique that occurs in the class is just simply transferring knowledge from teacher to students. Lecturing method, in this case, puts students in a passive role in the cognitive. It makes students pay less attention in learning activities and teacher hard to check students' perception and understanding of the material.

From the observation conducted in SMA N 1 Larangan, we got the result that the material about Protista was the most difficult material at Biology subject of tenth-grade students in the first semester. It is seen from the percentage of the students that have passed the test with the minimum score of 75 for Biology subject in the first semester of tenth-grade students in the academic year of 2012/2013. The percentage of classical learning completeness in daily test in the chapter of "Biology as the Science" was 31%, the proportion of the learning completeness of the material about the virus was 24%, the percentage of the material about bacteria was 52%, while on the Protista was only 17%.

Students thought that the material about Protista was the most difficult one because in their opinion some of the concepts were abstract. The discussion process was still weak since only a few of the students were actively involved in learning process. Students' reading interest was also still low because the material presented in a sort of lengthy discourse. Students had difficulty in finding the meaning of foreign languages or scientific names. They tend to memorise a kind of abstract concepts without letting them figured out their concepts, and thus, it is resulting in a lack of ability to think in a critical way. The skills of thinking include critical thinking, creative thinking, and reflective thinking.
[2]. Critical thinking is the basis of the ability to think creatively and reflectively. It means that critical thinking is necessary if a person needs to think creatively and reflectively.

The ability to think critically is essential for students as the next generation to face the challenges, problems, and competitions in free trade and global era since a significant amount of information, advertisement, conscious distortion, and even propaganda are continually sorted. Asean Free Trade Area (AFTA) which is planned to be held in 2015 is an actual effect of globalisation. AFTA is trading activity between countries in the ASEAN region without artificial obstacles (barriers that are created by the government), like the export-import tax, etc. [3]. Indonesian citizens are supposed to compete with the world community independently in various fields.

The development of critical thinking skills for students in the learning material, the use of language, the use of the logic structure of logical thinking, examining the accuracy of science, and the experience of the various aspects will influence the students to be independent [4]. Humans do not have any natural tendencies to think critically, so the critical thinking skills need to be improved [5]. To deal with these problems is the primary objective in teaching activities that encourages critical thinking to students. Learning material that is used in learning activities is supposed to cause the improvement of students' critical thinking skills.

The efforts to develop the essential thinking skills of students in the classroom require a contextual learning experience, encourage high levels of interaction and participation, and supports that will help students to understand these experiences [5]. Conceptual Understanding Procedures (CUPs) learning model consists of some methods that engage students' interaction and motivation [6]. Mills' research showed that basic tasks and cooperative approach, which used in CUPs learning model, provide many opportunities for students to improve their understanding of basic concepts. CUPs learning model is one of the learning models that uses a constructivist approach. Constructivist approach originated from a theory which developed by Jean Piaget, namely the theory of constructivism. This theory believes that every individual has the ability to construct their knowledge by encouraging interaction continuously with their environment. Constructivism approach is the importance of social interaction in the construction of knowledge. Social interaction among students is necessary for their development of knowledge [6].

The knowledge formed from individual's thought actively. People cannot simply get knowledge by passively receiving various information. Glasersfeld described the importance of social interaction in the formation of knowledge [7]. Social interaction among students is the main idea in building personal knowledge. In constructivist learning approach, students do not directly receive material from a teacher, but they proceed material in their way, so they are supposed to build their concepts. Every concept formed by each student may be different from one to another or even mistaken. It is teacher's duty to provide assistance and supports. Students' participation, which is directed by the facilitator, will ease students to gain a better understanding of the complex concepts [8]. Students' mistake is a part of a learning process that has to be appreciated to engage their interests in a learning activity. In constructivist class, the teacher encourages students to solve the problems in their way. The teacher does not only state a correct answer, but also she engages students in discussing, so the social interaction is built here. The discussion is going to lead them to the right concepts. Piaget says about constructivist theory requires students to actively develop their understanding concept by combining the experiences that they have had a new understanding [9].

CUPs learning model will support cooperative learning [6]. Collaborative learning aims to make students work together to achieve common goals [10]. Cooperative learning models are widely used to make teaching and learning activities centred on students, especially to make students have any eager to cooperate with others, and also to overcome the students who tend to be aggressive and do not care about others. Cooperative learning is one of the teaching models that leads the systems to learn and work collaboratively in small groups, and it will motivate them to learn [11]. Team working is a method that requires the teacher to put students in groups to learn a new material or to do any assignments. They interact with others in small groups to solve a problem. We can say that a team is efficient if every member of that group is responsible for their duty, they participate and cooperate effectively with other members, and they could be better in their behaviour.

Cooperative learning makes students more effectively in memorising materials that have been given rather than any traditional way. It can be seen from the posttest score of the experimental group,
which increased after the treatment, compared to control group. Cooperative learning is student-centered learning, while the traditional one is teacher-centered learning. Teachers’ conclusions and responses showed the importance of the transition phase from teacher-centered learning to student-centered learning [12]. The transformation of this learning model should be done gradually to make students easy to understand about the new learning model. Cooperative learning has its characteristics compared to the traditional one, as has been mentioned before, it has five characteristic elements.

These are the steps of CUPs learning models. That is students work individually, and then teacher divides students into several groups to discuss their individual works, each team consists of three persons, and the last step, all students in the classroom have to consider about their teamwork to determine the most appropriate and accurate one. The tasks are given in Conceptual Understanding Procedures (CUPs) are taken from our daily problems, which is also known as an authentic work, that is learning activities which is resulting in understanding used in the daily activity outside the classroom [5].

The observation showed that Conceptual Understanding Procedures (CUPs) learning model applied in teaching Biology in SMA N 1 Larangan. Hopefully, the use of CUPs learning model can give positive contribution in students' critical thinking skills. Therefore, the research which is entitled "The Effects of Conceptual Understanding Procedures (CUPs) towards Critical Thinking Skills of Senior High School Students' should be done. The aim of this research is to analyse the effect of the application of CUPs learning model towards students' critical thinking skills in the chapter of Protista in SMA N 1 Larangan.

2. Methods

This research is a quasi-experimental design which used nonequivalent control group design [13]. The research is conducted in the first semester in SMA N 1 Larangan in the academic year of 2014/2015, from October through November 2014. The population is all of the tenth graders of SMA N 1 Larangan. The researcher used convenience sampling to select the research sample. X MIA 1 and X MIA 2 are the samples of this study. Independent variable in this research is Conceptual Understanding Procedures (CUPs) learning model, and the dependent variable is students' critical thinking skills.

In addition to the data of students’ critical thinking skills, there are also supporting data like students’ learning activities, the success rate of CUPs learning model, and student and teacher responses. Students’ critical thinking abilities are presented in pretest and posttest result, it is analyzed by using homogeneity test, normality test, Wilcoxon's test, and n-gain test. N-gain test is aimed to determine the increase in critical thinking skills, while Wilcoxon's test is aimed to determine the difference between experimental and control class. The data of students' learning activities, the success rate, and students' responses toward CUPs learning models are analysed by using descriptive percentage. The data of teacher response toward CUPs learning model are analysed descriptively.

3. Result and discussion

3.1 Results of Students’ Critical Thinking Skills

Based on the research results, we know that before the treatment, the average percentage of students' critical thinking skills from experimental and control class in the chapter of Protista are relatively similar, that is 43.47% of the experimental class and 45.09% of the control class. The average percentage of both classes are regarded low. The results of homogeneity test toward critical thinking skills before treatment (pre-test) showed that there is no difference variety in both class, so we can conclude that student's critical thinking skills of both experimental and control class are similar. This fulfils one of the characteristics of experimental that equivalency subject in a different group is required so that if there are different results, it is not caused by the panel equivalent, but the treatment [14]. During the learning process, both of the samples given different treatments. The experimental class was given CUPs learning model, while the control class was given the traditional one.

| Source | Score |
|--------|-------|
|        |       |
Based on the results above, we can see that the average score of experimental class before the treatment was 43.74, which categorised as level, and after the treatment, the average score increased to 77. The improvement of critical thinking skills also happened in control class. The mean rating before they were given the treatment was 45.09, and after the treatment, the results increased to 63.91. The increase of students' critical thinking abilities of experimental class after the treatment is better than the control class. It is proved by the results of the tests showing that students' critical thinking skills of experimental class is different and better than students' critical thinking skills of the control class.

Based on N-gain test on Picture 1 below, we can see that 89.32% students in an experimental class are improved, 15.79% students are highly educated, while 73.53% are frequently developed. In control class, only 57.14% students developed, 8.57% are highly educated, while 48.57% are just average.

![Picture 1. Results of n-gain test](image)

Some factors that cause significant differences and improvement in critical thinking skills in the experimental class better than the control class are as follow:

a. CUPs learning model has several characteristics needed to develop critical thinking skills. CUPs learning model which applied in the preparatory course is more efficient compared to the traditional one which was used to teach in control class. This learning method works that way because it has the characteristics needed to develop critical thinking skills, while the traditional one does not have these features. Critical thinking requires a contextual learning experience, encouraging high levels of interaction and participation, and supports that help students to understand the materials [5]. Those statements appropriate with the characteristics of CUPs learning models. The application of CUPs learning models combining with cooperative learning and fundamental tasks can encourage active interaction and participation for all students, and also give them further understanding [6]. Direct learning model that applied in control class used lecturing method. That lecturing method is involving students passively and automatically, students tend just to memorise the theory that is given by teacher without knowing its function in their daily life [5]. Based on this statement, we can conclude that linear learning model using lecturing method does not have any characteristics needed to improve students' critical thinking skills since it does not make students participate actively in a learning process and it does not lead them to further understanding of the material.

b. Constructivist approach and cooperative value from CUPs learning model are supporting the improvement of students' critical thinking skills. In control class, students got information directly
from the teacher by using lecturing method, while in experimental class, they were taught by CUPs learning method which encourages them to build their understanding of the materials. Information-transferring from teacher to students directly in control class makes them involve passively in the learning process so that it is impossible for them to develop their critical thinking skills. Students of an experimental class are more likely to learn new things. They gain real experience of the material given. It leads students of experimental class to be more active in the learning process and develop their critical thinking skills. CUPs learning models, which is supporting cooperative learning, also makes experimental class increase their critical thinking skills compared to control class used direct learning method.

c. CUPs learning model leads all students to be more active in the learning process. By using this learning model, the learning process in experimental class can be more active because every student has to involve in the discussion to solve the problem. Every step of CPUs learning method insisted students to engage in the learning process in the classroom actively. In the direct learning method, teacher divided students into big groups and gave the groups tasks. Some students did not participate in their group work and only being "free-rider" in the groups, while the smart ones did the tasks and being dominant in the groups. It leads students of experimental class to engage a better critical thinking skills than students of control class.

d. CUPs learning model gives an opportunity to students to develop their critical thinking skills compared to direct learning method. By using CUPs learning model, students have bigger chance to think critically, because this learning model consists of three steps where each step engage students in improving their critical thinking skills. In the direct learning method applied in control class, the discussion only occurred in the groups, and the groups in control class were also bigger than the experimental one. The amount of group member who was too large and the discussion which did not start with the building knowledge of the field caused students did not involve in doing group work. The smart students tended to be dominant in the group, and the rests were just being a free rider. These conditions made students lazy to develop their critical thinking skills.

The score of each indicator of students’ critical thinking skills test

![Chart](chart.png)

**Picture 2.** The score of each indicator of students’ critical thinking skills test

This research used three aspects or indicators of critical thinking, that is investigation, interpretation, and decision [15]. Based on the test of each indicator, we can conclude that the result of the experimental class is better than the control class. CUPs learning model should be done step by step, and it automatically leads students to participate actively in the learning process. The first step is to make students work individually, so they require stating an opinion before they work in a group. Every task given in every step is similar, and students have to come out with an answer. Students insisted on thinking critically over and over again in one phase by using CUPs learning model so that they will get used to think critically and improve their critical thinking skills.

The results of three aspects of students’ critical thinking test showed that on experimental class, decision point has the highest percentage compared to the two aspects, that is 91.82%, the percentage of interpretation issue is 87.47%, and the percentage of investigation aspect is 83.41%. On control class, the highest percentage occurred in research issues, that is 91.25%, while the interpretation issue is 75.1%, and the decision aspect is 72.96%. Students of the experimental class have bigger chance to state their opinion and also choose the most appropriate answer. Choice point occurred in the last session, where students have to choose the most correct answer. They do not just easily accept a reply,
but they have also to provide the evidence and reasons of why they want that answer. Investigation and interpretation aspects mostly occurred in individual work. It made decision aspect on experimental class has the higher percentage than the two aspects.

On control group, students only had opportunities to think critically in group discussion. Each group consisted of more than three persons, without any building knowledge of the field, which made the group discussion less efficient since only smart students actively did the task. Students are more likely to get information from the teacher. Lecturing method made students tend to listen and to note any information, and then to memorise it [16]. This method is categorized in investigation aspect. These factors led students of the experimental class to have the critical thinking skills that dominant in the decision aspects, while students of control class are more likely dominant in investigation aspect. Therefore, a learning process which is experienced by students determines the level of their critical thinking skills. The experimental class, which is applied CUPs learning model, got better results compared to control class.

On CUPs learning model, students have to solve the problems themselves. They need to state their opinion and discuss it with their friends. Students do not just listen to the teacher's explanation like in direct learning method. This learning model is appropriate to Piaget learning theory, which stated that student-centered learning would gain better result [9].

3.2 Students' Learning Activity

In this research, students learning activity refers to three aspects of the primary activities of critical thinking that is investigation, interpretation, and decision [2]. Based on the test results, the percentage of students' learning activity on experimental class is 72.37%, and it categorised active, while on control class, the percentage is 22.69% categorized as less active one. The results showed that CUPs learning model improves students' learning activity compared to the direct learning method. Differences between the experimental and control class learning activities occur because the students in the experimental class like and are interested in group discussion and task-based learning with a gradual learning step. If students are interested in the learning process, they will be more motivated in a participant teaching-learning process.

| No | Aspects    | Experimental class | Control class |
|----|------------|--------------------|---------------|
|    |            | Score (%)          | Score (%)     |
| 1  | Investigation | 71                 | 42            |
| 2  | Interpretation | 53,3               | 58            |
| 3  | Decision    | 48,2               | 51            |

Based on the result in Table 2, we can conclude that investigation point has the highest percentage, that is 93.42% in the experimental class, while the percentage on interpretation issue is 70.17% and on the decision, aspect is 63.49%. The same thing occurred in control class, where the highest proportion is on investigation point, that is 36.43%, while the percentage on interpretation aspect is 22.38% and on decision issue is 16.07%.

According to research results, it can be seen that in both experimental and control class, the highest percentage is on investigation point, but the average rate in experimental class is greater than control class. It happened because students are not accustomed to interpretation and decision aspect. Students are more familiar with the investigation aspect which is often carried out by a teacher on direct learning method before this research conducted.

Teachers usually use lecturing method. It requires students to gain much information directly from the teacher. Receiving any information is regarding as investigation activity. Students in both experimental and control class are accustomed studying activity before this research, so that when we conducted this study, most of the students still use investigation activity.

4. Conclusion
Based on the study and discussion explained above, we can draw a conclusion that the implementation of Conceptual Understanding Procedures (CUPs) learning model in SMA N 1 Larangan gives positive effect to students' critical thinking skills in the material of Protista.

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