Wati Sukmawati - THE USE OF CONCEPTUAL CHANGE TEXT (CCT) BASED TEACHING MATERIALS TO IMPROVE MULTIPLE ABILITY OF PHARMACEUTICAL CHEMICAL REPRESENTATION STUDENTS

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THE USE OF CONCEPTUAL CHANGE TEXT (CCT) BASED TEACHING MATERIALS TO IMPROVE MULTIPLE ABILITY OF PHARMACEUTICAL CHEMICAL REPRESENTATION STUDENTS

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ABSTRACT

The study analyzes the effect of text-based concept-based teaching (CCT) on first-semester pharmaceutical students' concept changes in understanding various chemical representations of the concepts of reduction and oxidation (redox). In the initial stage, Performed diagnostic tests on students, interviews with ten first-semester students, and data obtained from these interviews and related literature were used to develop CCT-based redox teaching materials. In this study, a concept understanding test was used. This test is given to 50 first-semester pharmacy students. The experimental group consisted of 25 students who received CCT-based teaching materials, and the control group consisted of 25 students who received conventional teaching materials. Before instruction, students in both groups were pre-tested to determine their prior understanding of redox. The results showed that students in both groups had the same redox knowledge. After the study, the data were analyzed using a two-way analysis of covariance using multiple representations of student scores as covariates. The results showed that some student representations of chemical redox concepts developed with CCT-based teaching materials were able to reduce what students experienced, resulting in a much more significant understanding of redox concepts when compared to the control class.

Keywords: Conceptual Change Text (CCT), Multiple Representations, Oxidation-Reduction

1. INTRODUCTION

Introductory chemistry is a subject taught in the first semester by pharmacy students. Chemistry is nothing new for first-year students, as they have studied chemistry concepts before at the high school level. Based on this fact, the understanding of the chemistry concepts of first-semester pharmacy students will be influenced by the understanding of the concepts they have obtained at the previous level. For this reason, it is essential to equate the concept of chemical concepts in first-semester students. This conceptual change is done to avoid misconceptions that will hinder understanding other concepts at a higher level. One of the chemical concepts that often causes misconceptions among students is reduction and oxidation (Al-balushi et al., 2012). The misconceptions experienced by students occur because of an incomplete understanding of concepts (Sukmawati, 2019). To convey a complete chemical concept, it must pay attention to macroscopic, submicroscopic, and symbolic representations (Talanquer, 2011) (Kolomuc et al., 2012). In teaching complete chemistry concepts, you must pay attention to chemical representations. Media is needed that can facilitate students and can minimize and reduce misconceptions experienced by students.

Conceptual Change Text (CCT) is an effective way to minimize student misconceptions because students can realize the misconceptions they experience and change them with the correct concept (Ozkan & Selcuk, 2015). Conceptual Change Text occurs when students experience dissatisfaction with their understanding of the concept (dissatisfaction); then students find new concepts that are correct and easy to understand (understand); the concepts they understand are also plausible; thus generating new knowledge (fruitful) (Strike & Posner, 1982). One of the learning strategies to change the conception is to develop CCT-based teaching materials. CCT developed in teaching materials is considered practical by students because each concept displayed can be easy to understand (Wati Sukmawati et al., 2020). Besides that, CCT-based teaching materials are also developed by considering multiple chemical representations so that the concept is given in its entirety. To find out the effectiveness of using CCT-based teaching materials on conceptual changes for first-semester pharmacy students in understanding multiple chemical representations of the concepts of reduction and oxidation (redox).

METHOD

The subjects in this study consisted of 50 first-semester pharmacy students. Then the subjects were grouped into an experimental group and a control group with 25 students each. CCT-based teaching materials were used in the experimental class, while the control class used conventional teaching materials. In the research, all classes are taught by the same lecturer, the learning time is the same, and the assignments are the same. Data that can be obtained from students in data from student interviews and data on understanding concepts in understanding multiple chemical representations of students' reduction and oxidation concepts.

1. Interview

Interview activities are carried out at the beginning of the semester when they start to research and are carried out to 10 primary chemistry teachers who are not included in the control class or experimental class. The students were asked questions about the level of difficulty in understanding the redox subject matter concepts. Among them are redox concepts, oxidation numbers, balancing redox reactions, types of anodes and cathodes, types of comparison electrodes, electrochemical events, and electrolysis. Based on interviews, obtained results show that concepts considered the most difficult to understand are redox equalization, electrochemistry, and electrolysis events.

2. Problem Understanding Redox Concepts with multiple representations

Based on data from interviews and literature review (Amir & Tamir, 1995), the questions of understanding the concepts designed by the researchers that will be given have been adjusted to the level of difficulty of students. The questions given were 25 questions in the form of multiple-choice (Yamtinah et al., 2019). The questions given will analyze students' conceptual understanding and understand multiple chemical representations of redox concepts.

RESULTS AND DISCUSSION

In conducting control class research using learning strategies with the help of conventional teaching materials, lecturers provide material using meaningful discussions and lectures. Students take the pretest and then are asked to study the material before starting the lesson. After that, the lecturer discussed the material and occasionally asked questions to create discussion in class. After the learning activities are completed, students are given a question of evaluating understanding after learning. In the control class, explanations from the teacher and reading materials and questions and answers that took place in class became the main factor in learning without paying attention to misconceptions that might occur in students and did not explain the concept of redox in multiple representations. While in the control class, the explanation from the lecturer, questions on teaching materials, and discussions on concept changes experienced by some students so that they can overcome the misconceptions experienced by using CCT-based teaching materials (Gulcan et al., 2015), which emphasizes multiple chemical representations so that students fully understand the redox concept. In the experimental class, students who are aware of errors in understanding and are not satisfied with the concept will accept new concepts that are easy to understand and are assisted by lecturers in convincing the new concepts presented in the CCT-based teaching materials (Anam et al., 2020), so that students can overcome misconceptions they experience with new concepts more confidently (Ozkan & Selcuk, 2015). To find out the results of using CCT-based teaching materials on understanding redox concepts in multiple representations, an analysis of the pretest and post-test results was carried out in the control and experimental classes.

Table 1. Understanding the Redox Concept of Experiment and Control Class

	n	Mean Pretest	SD	Mean Postest	SD	N-Gain
Control Class	25	52,64	5,96	59,84	4,5	0,1
Experiment Class	25	53,36	5,38	73,52	5	0,4

In table 1 shows is known that the average value of the pretest of the control and experimental classes is not significantly different. The posttest results show that the student's initial understanding in both classes is the same. Significant changes in the experimental class based on the pretest and posttest values showed a better significance value with an N-gain value of 0.4 compared to the control class, which had an N-gain value of 0.1. Based on these results, it shows that learning using CCT-based teaching materials can improve concept understanding (Özmen & Naseriazar, 2018) and students' multiple representation abilities compared to the control class. The handling of misconceptions carried out in the experimental class turned out to be effective for increasing students' understanding and multiple representation abilities (Stojanovska et al., 2017). In the experimental class, the misconceptions experienced by students are analyzed, then students are given the correct concept provided in a complete book with multiple representation explanations, then students are allowed to convince the new concept they understand. Based on the results of data analysis, information is also obtained that there are still many students who have difficulty relating chemical representations to one another (Beerenwinkel et al., 2011). Many students have difficulty writing equations for redox reactions, especially in placing the position of electrons and balancing the number of electrons involved in the reaction (Barke, 2012). Students' difficulty in understanding the redox concept shows that the ability of submicroscopic and symbolic representation is still limited.

The learning of redox concepts that have been accepted by students in general only involves the macroscopic and symbolic levels, while the submicroscopic level is not considered. Understanding the redox concept will be difficult to understand well if only using the macroscopic and symbolic levels. This fact is consistent with the finding that errors in understanding chemical concepts are caused by a weak submicroscopic ability to visualize structures and processes. (Talanquer, 2011). The concepts of redox reactions will not be well understood if the explanation only moves from one representation to another without connecting them. One form of representation is an explanation for other representations. The findings of this study can be used as a basis for designing appropriate learning strategies in teaching the concept of redox reactions in universities by involving three levels of representation. (Garba Shehu, 2015). The importance of using three levels of representation is that students gain a solid understanding of chemical concepts. A strong understanding of chemistry content will enable an educator to explore and develop learning with various strategies in teaching chemistry concepts.

CONCLUSION

Introductory chemistry students in control and experimental classes had initial abilities that were not significantly different. After the experimental class was treated using CCT-based teaching materials, it improved students' conceptual understanding and understanding of multiple chemical representations better than the control class. Learning with CCT-based teaching materials is also able to reduce misconceptions that arise in students in redox learning.

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