

STUDENTS' CREATIVE THINKING ENHANCEMENT USING INTERACTIVE MULTIMEDIA OF REDOX REACTION

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ABSTRAK

Penelitian ini bertujuan untuk menggunakan multimedia dalam meningkatkan kemampuan berpikir kreatif siswa. Subjek penelitian adalah siswa kelas XI yang belum belajar konsep redoks di salah satu SMA di Bekasi. Kelompok eksperimen terdiri dari 50 siswa dan kelompok kontrol terdiri dari 51 siswa. Kegiatan multimedia dapat digunakan untuk meningkatkan kemampuan berpikir kreatif siswa dengan merancang multimedia berdasarkan kegiatan berpikir kreatif. Peningkatan kemampuan berpikir kreatif siswa adalah sama dengan peningkatan kognitif siswa dan penelitian menemukan bahwa peningkatan semua aspek berpikir kreatif siswa dengan menggunakan pembelajaran multimedia interaktif berbeda secara signifikan dengan pembelajaran PowerPoint. Hal ini ditunjukkan oleh peningkatan kemampuan berpikir kreatif dengan kriteria tinggi dan sedang. Peningkatan tertinggi ditemukan pada kefasihan (N-gain = 85,83%) dan peningkatan terendah ditemukan pada fleksibilitas (N-gain = 54,93%).

Kata kunci: Multimedia Interaktif, Peningkatan Berpikir Kreatif, Reaksi Redoks

ABSTRACT

The aim of this study was to apply multimedia in enhancing students' creative thinking skills. Research subject were eleventh-grade students that yet to learn redox concept, at one of senior high school in Bekasi. Experimental group was consisted of 50 students and control group was consisted of 51 students. Multimedia activities can be used to enhance students' creative thinking by designing multimedia based on creative thinking activities. Students' creative thinking enhancement is equal to students' cognitive enhancement and research findings suggested that enhancement in all students' creative thinking aspects by using interactive multimedia learning was significantly different than by PowerPoint learning. It was reflected by creative thinking enhancement of high and moderate criteria. The highest enhancement was on fluency (N-gain= 85.83%) and the lowest was on flexibility (N-gain= 54.93%).

Keywords: Interactive multimedia, Creative Thinking Enhancement, Redox Reaction.

INTRODUCTION

Several study found that misconceptions still occurs in students when learning redox reaction (Schimdt, 1997; Barke, 2012; Widiarti *et al.*, 2016) and Barke (2012) pointed out that a more creative approach should be used in teaching redox reaction. Computer-based learning assist students in visualize abstract content through computer aided instruction. The uses of computer as interactive multimedia in presenting learning material allows multimedia to interact directly with students, so it will be able to assist students in visualizing the problem and finding its solution. In addition, interactive multimedia can enhance chemistry teaching effectiveness (Griffin, 2003; Iriany and Liliasari, 2009; Munir, 2005; Rusman, 2009; Zacharias, 2003).

According to Mayer (2009), multimedia learning allows students to process information visually and verbally, as well as maximizing the use of students' brain in learning. Using multimedia in accordance to student needs will also resulted in effective learning. Daryanto (2009) stated that the use of multimedia makes learning process more interesting and interactive, and improve the quality of student's learning and attitudes.

Using interactive multimedia can stimulate students to use their thinking ability. Students become active learners and use their higher thinking skills such as ability to think creatively through analysis, synthesis, evaluation and reflection in solving a given problem. Interactive multimedia also encourage students to create creative ideas (Isa, 2010; Mokaram, 2011). Creative thinking can be applied in teaching and

learning process. It can specifically applied where seeing, thinking and innovating are combined in teaching learning process (Wheeler, 2002). Therefore, in this study interactive multimedia was used to enhance students' creative thinking in learning redox reaction concept.

METHODS

This study was conducted in one of private high school in Bekasi. This research used quasi-experimental method with control and experimental group design. Research design was pretest-posttest nonequivalent control group design. Control group consisted of 51 students and experimental group consisted of 50 students. Pretest was used to probe students' initial ability. Interactive multimedia learning was given in the experimental group and PowerPoint learning was given in control group. Interactive multimedia contains animation of submicroscopic level of reaction and information about redox reaction that could be accessed directly by students.

Power Point learning consist of redox reaction that should be explained by teacher. But in interactive multimedia, students can make prediction and write the chemical equation based on animation. Interactive multimedia provide student to do all of the activity such as predicting chemical equation, grouping chemistry compound, predicting redox reaction, and other activity directly on the multimedia and those activity is recorded by the program. It is also possible for teacher to track their students' activity. After learning using Power point or Interactive Multimedia, both groups were given a final test (posttest).

Pretest and posttest consisted of 25 objective multiple choice questions, in which creative thinking skills were integrated in those questions. Pretest and posttest results were used as basis for N-Gain calculation. To measure difference in N-Gain based on learning media, N-Gain of both groups were statistically tested.

RESULTS AND DISCUSSION

Creative Thinking Enhancement

Indicators of creative thinking measured in this study were fluency, flexibility, and elaboration. Those indicators were embedded in test' questions, and therefore, students' cognitive

enhancement is equivalent with students' creative thinking enhancement. Based on pretest and posttest scores, N-gain of students' creative thinking can be calculated. Pretest, posttest and N-gain results of control and experimental group is presented in Figure 1.

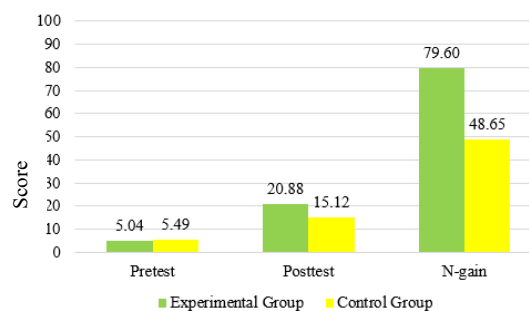


Figure 1. Pretest, posttest, and N-gain Score of Experimental and Control Group

Compared to pretest score, both groups experienced score improvement. Students' creative thinking enhancement was indicated by N-gain average, in which experimental groups' N-gain was 79.6% while control groups' N-gain was 48.6%. Although there was an enhancement in students' creative thinking from both treatment, enhancement in experimental group was higher than that of control group. It means interactive multimedia can enhance students' creative thinking skills more than PowerPoint media can, as also reported by Iriany and Liliarsari (2009). Tests' questions consisted of three creative thinking indicators, i.e. fluency, flexibility and elaboration. N-gain for each indicator is presented in Figure 2.

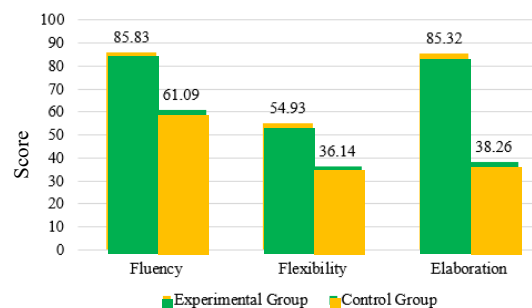


Figure 2. N-gain for Each Creative Thinking Indicators In Experimental and Control Group

Based on Figure 2, we can see that all creative thinking indicators were enhanced by interactive multimedia learning. The highest enhancement is in terms of fluency (85.8%) and the lowest is for flexibility (54.93%). It showed that interactive multimedia can enhance students' creative thinking for fluency, flexibility and elaboration skills in a varying degree. Activities in interactive multimedia were adjusted with creative thinking indicators so that it stimulate students to use their thinking skills to solve problems presented in the multimedia. Multimedia ability in presenting concepts in a more attractive way help the students to understand the concepts effectively. Hsu et al., (2011) proposed that concepts were presented in software such as multimedia, because it allows dynamic graphics load, helping students to visualize concepts, combine resources and increasing creativity, especially in problem solving.

Learning with multimedia creates student-centered learning, i.e. students become active learners and able to build their own knowledge on redox reaction. Activities in multimedia trained the students to analyze problems and find solutions in a new way. This is in line with what expressed by Isa (2010), that using interactive multimedia stimulates students in using their thinking skill. Students become active learners and use higher level thinking skills such as to think creatively through analysis, synthesis, evaluation and reflection in solving a given problem.

Mokaram et al., (2011) stated that interactive multimedia deliver information in different ways, and therefore encourage students to make their own creative ideas in which it will help them to enhance their thinking skills especially creative thinking skill.

Creative thinking skill can be enhanced through practical application and multimedia can also facilitate it. Interactive multimedia enables students to have an immediate 'hands on' facility, even if interactive multimedia is actually designed by the teacher, when students use interactive multimedia, they will feel that they are controlling their own learning (Wheeler, 2002).

Interactive multimedia also give feedback for students' answers so that it is as if their own teacher is present. This indicates that students' can learn by themselves, whether the teacher is present or not. It is also possible for teacher to check and track students' task because interactive

multimedia saves students' activity automatically so that teacher do not lose their control in learning process. These advantages are not applicable for learning with PowerPoint. Therefore, interactive multimedia is more effective for teaching and learning and also can enhance students' creative thinking skill more than PowerPoint possibly can.

Fluency Skill Enhancement

N-gain for fluency skill can be calculated based on pretest and posttest score. N-gain of Experimental and control group was 85.83% and 61.09%, respectively. Fluency enhancement for control group was categorized as moderate but enhancement for experimental group was categorized as high. N-Gain were then compared statistically. Based on statistical test for N-gain score, fluency skill enhancement between control and experiment group were significantly different ($p= 0.000$; $p < 0.05$). It showed that interactive multimedia learning can enhance students' fluency skill better than PowerPoint learning.

Interactive multimedia includes activities that can develop students' fluency skills. Henkel (2012) stated that activities that can develop fluency skills are predict, explain, and compare. In interactive multimedia, students were asked to predict the reaction that takes place in the experiments which supported by animations as submicroscopic point of view. In this activity, students were able to collect information and then the students can quickly develop and deduce the reaction into equivalent chemical equation. This finding is consistent with Sumalee et al., (2012) who found that the fluency skill is marked with student's ability to respond appropriately and quickly.

In doing exercises in interactive multimedia, students should be able to predict compounds that are changing and the resulting compound. This prediction may be as a result of oxidation numbers change. Thus, students are able to determine changes in redox reactions correctly. In determining changes in redox reactions, students can use a third redox developmental theory that they have studied beforehand. Students compare these theories in explaining the reduction and oxidation of redox reactions. One of features activities in enhancing fluency skills is presented in Figure 3.

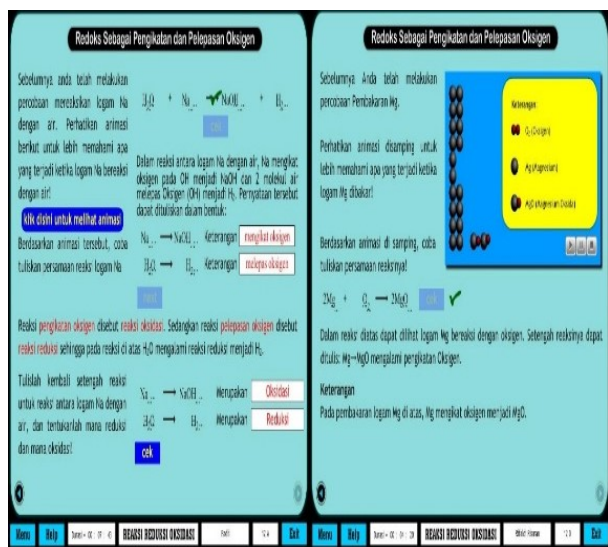


Figure 3. Activities in Interactive Multimedia that can Enhance Fluency Skill

Flexibility Skill Enhancement

N-gain for flexibility skill can be calculated based on pretest and posttest score. N-gain of Experimental and control group was 59.93% and 36.14%, respectively. Flexibility skill enhancement for control group was categorized as moderate while for experimental group was categorized as high. Based on statistical testing, flexibility skill enhancement between control and experiment group was significantly different ($p= 0.001$; $p< 0.05$). It showed that interactive multimedia learning can enhance students' creative thinking in flexibility skill better than PowerPoint learning.

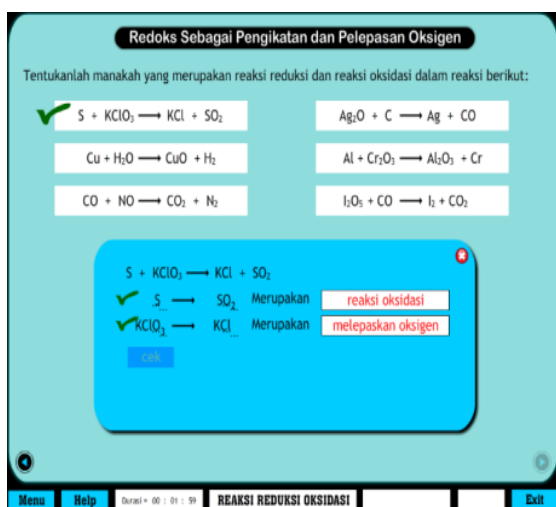


Figure 4. Activities in Interactive Multimedia that can Enhance Flexibility Skill

Activities illustrated in Figure 4 encourage students to find the answer from different point of view and to look for alternatives in the solving the given problem. These activities enhance flexibility indirectly and help the students in solving exercises presented in the multimedia.

Elaboration Skill Enhancement

N-gain for Experimental and control group was 85.32% and 38.26%, respectively. Elaboration skill enhancement for control group was categorized as high whereas for experimental group was categorized as moderate. Based on statistical test, elaboration skill enhancement between control and experiment group are significantly different ($p= 0.000$; $p< 0.05$). It showed that interactive multimedia learning can enhance students' creative thinking in elaboration skill better than PowerPoint learning.

Interactive multimedia can enhance elaboration skill because it contains activities that enhance elaboration skill such as define and categorize. In determining the reduction and oxidation reactions in redox reactions, students elaborate their knowledge of redox concepts development, so they can use these theories in determining the reduction and oxidation reactions.

One of features activities enhancing elaboration skills is presented in Figure 5.

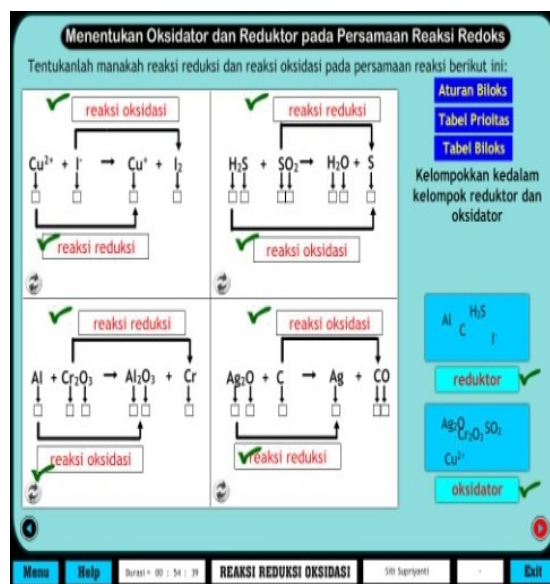


Figure 5. Activities in Interactive Multimedia that can Enhance Elaboration Skill

CONCLUSIONS

Creative thinking enhancement occurs at high and moderate criteria with the highest enhancement in fluency skill and the lowest in flexibility skill. Interactive multimedia learning can enhance students' creative thinking skill because interactive media encourage students to manage and control their own learning. The weakness of interactive multimedia in this study is that it can be used only as an offline learning, not online learning. Therefore, its use for much wider learners is still limited.

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