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Analysis of Students' Concept Understanding in Redox Materials and Compound Nomenclature After Application of the Blended-Problem Based Learning Method

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Abstract

Understanding the concept is a very important factor to achieve maximum learning goals. In the learning process required a learning method that is applied by a teacher so that students easily understand the concept. This study aims to determine the understanding of the concept of class X students on redox material and compound nomenclature after the application of the Blended-Problem Based Learning method. This type of research is a case study that uses a combination of qualitative and quantitative methods involving 36 high school class ten students from the 2018-2019 academic year. The sampling technique is done by purposive sampling. Understanding students' concepts using reasoned questions, that are three layers of multiple choice tests. The results of the analysis of students' understanding of concepts on redox material and compound nomenclature after the application of the Blended-Problem Based Learning method showed that of 27 of 36 students (75%) understood the concept of redox and compound nomenclature, 8 out of 36 students (22%) misconceptions, and 1 of 50 students (0.3%) did not understand the concept of redox and compound nomenclature. Application of the Blended-Problem Based Learning model can help students to understand the redox reaction material and compound nomenclature.

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INTRODUCTION

In this 21st century, the world of science and technology has experienced rapid development in various aspects of life. Given the progress in the global era, the quality of human resources, directly and indirectly becomes an important need to face challenges. Human resources are obtained from the quality of educational outcomes to improve educational excellence which is an important factor in determining the progress and success of national development. Teachers and students are given the opportunity and are required to be able to develop their skills in mastering technology. Forms of technological development for example is the development of gadged, ranging from laptops, cellphones, and tablets.

At this time students tend to use gadgets for communication media and play online games, whereas if students want to use gadgets to the maximum, it will certainly be useful to support the learning process, for example to find the latest learning materials and do assignments online will be more effective and efficient. Technology is used as an assistive method, visualization that is interactive and helps students understand concepts (Jihad et al., 2018)

According to Sardiman (2007) explains that students or students are one of the human components that occupy a central position in the teaching and learning process. Students or students become the subject matter and as a focus of attention. In the teaching and learning process, students as those who want to achieve their goals, have goals and want to achieve them optimally. So in the teaching and learning process the first thing to pay attention to is the student, how is the situation and abilities. The information received by students is more embedded in his mind through a series of processes of building information based on the experience he has gained. Through direct experience will bring students' closeness with the material that they will learn, so that what they learn has a special meaning for themselves. According to Trianto (2010), meaningful learning will not be realized only by listening to lectures or reading books about other people's experiences. Therefore we need certain learning methods or models so that students feel the meaning of what they have learned. Someone who is happy about something, will be motivated to do these activities so that students who are usually passive turn out to be more active (Hamzah & Nurdin, 2012). Learning approaches that integrate various strategies, models and methods of learning in a learning process are known as blended learning (Bernard et al., 2017).

Blended learning is learning that combines e-learning, online mixed learning with face-to-face learning in the classroom involving IT-based learning tools (Afdhila et al., 2018; Bain et al., 2018). Shen (2016) mentions that blended learning is effective for learning, while Jeffrey (2014) states that the blended learning method can maximize teaching by teachers through online and regular learning in the classroom. According to Nurhayati et al. (2013) PBL is a learning model that puts students in the best learning position because they are connected with the learning process and find knowledge for themselves, not when the teacher explains the material in class and provides knowledge for them. This is in accordance with the skills students must have in the 21st century.

Chemistry studies the material of the structure, properties, changes and energy that accompany these changes. Chemicals use very different terms chemistry and language, as well as a number of abstract concepts (Chang, 2005). Chemistry has characteristics that are not shared by other branches of science, namely the concept in chemistry involves the study aspects of both macroscopic (observable properties), microscopic (particle forming elements) and symbolic (substance identity symbols) (Rusminiati et al., 2015). Therefore, the many concepts involved make students and even teachers also find it difficult to solve them. The difficulty of students in using conceptual knowledge to solve problems is not due to lack of concept knowledge but beginner knowledge structures that can inhibit the transfer to the problem at hand (Guritno et al., 2015).

There are several ways that can be used to diagnose misconceptions that occur in students, namely in the form (Stover & Saunders, 2000), interviews (Atwood & Atwood, 1997), open questions (Kucukozer, 2007), multiple choice tests (Brunsell & Marcks, 2005), the Two-tier test (Franklin, 1992), and the Three-tier test (Eryilmaz, 2010; Pesman & Eryilmaz 2010;

Arslan et al., 2012; Caleon & Subramaniam, 2010). One of the methods used in the diagnosis of misunderstanding is using a three-tier diagnostic test. Three-tier diagnostic tests are diagnostic tests that consist of three level questions. The first level (one-tier) is the usual choice of double, the second level (two-tier) in the form of a choice of reasons, and the third level (three-tier) in the form of questions is an affirmation of the answers that have been made at levels one and two (Kirbulut 2014). Three-tier diagnostic tests have several advantages: 1) allows to calculate the percentage of true and negative false without doing interviews with students, which can be used to determine the validity of the test (Pesman & Eryilmaz, 2010), 2), evaluating misconceptions, understanding the reasons given by students, and to distinguish between a lack of student knowledge and student misunderstanding (Guncay & Gulbas, 2015)

METHODS

This research was conducted at SMA Negeri 2 Ungaran, Semarang Regency. The sample in this study were 7th grade students of Natural Sciences who had studied the material of redox reactions and compound nomenclature with the Blended-Problem Based Learning method. This type of research is a case study using qualitative quantitative methods. The independent variable in this study is the learning method applied to the process of teaching and learning activities, namely the Blended-Problem Based Learning method. The dependent variable is students' understanding of concepts. Researchers teach students with the Blended-Problem Based Learning method. After getting redox material learning and its compound arrangement using the Blended-Problem Based Learning method, students are given a test using three layers of multiple choice questions totaling 20. In answering the test questions, students are asked to answer at level 1 is the answer questions, in level 2 is the reason for the answer chosen, and in level 3 students are asked to provide a level of confidence by choosing confident and unsure choices. Analysis of concept understanding uses a combination of data which answers consist of understanding concepts, misconceptions, not understanding concepts. The analysis technique used is to calculate the percentage score of students who understand the concept using the following formula:

Understanding the concept = =

$$\frac{\sum \text{Students Understand the Concept}}{\sum \text{questions test x } \sum \text{students}} \text{ x } 100\%$$

Next, determine the average percentage criteria based on Table 1.

Table 1. Qualification of test results

Score Range (%)	Criteria
$66.68 \leq Z \leq 100$	High
$33.34 \leq Z \leq 66.67$	Medium
$0 \leq Z \leq 33.33$	Low

RESULTS AND DISCUSSION

The results of the analysis of students' understanding of concepts on redox material and compound nomenclature after the application of the Blended-Problem Based Learning method showed that of 27 of 36 students (75) understanding the concept of redox and compound nomenclature, 8 out of 36 students (22%) misconceptions, and 1 of 36 students (0.3%) do not understand the concept of redox and compound nomenclature. This shows that students' understanding of concepts is included in the high category. Understanding concepts is the ability of students who are able to explain the material being studied using their own language (Susilaningsih et al., 2018).

Analysis of conceptual understanding uses a combination of answers to test questions. Interpretation of the combination of test answers is shown in Table 2. Interpretation of the combination of answers as the basis for analysis for conceptual understanding. The distribution of redox and nomenclature compounds according to the concept understanding indicator is presented in Table 3.

Table 2. Interpretations of combinations of student answers

Answer	Reasons	Beliefs	Category
True	True	Sure	Understand the Concept
True	False	Sure	Misconception
False	True	Sure	Misconception
False	False	Sure	Misconception
True	True	Not sure	Lucky
True	False	Not sure	Don't Understand the Concept
False	True	Not sure	Don't Understand the Concept
False	False	Not sure	Don't Understand the Concept

Adapted from Arslan et al. (2012)

Table 3. Indicators of Understanding the Concept of Redox Material and Compound Nomenclature

Indicators of Understanding the Concept	Question number
Restate a concept	1, 2, 4, 17
The ability to set examples and not examples	19
Presenting concepts in various forms of mathematical representation	7, 8, 18, 20, 25
The ability to classify objects according to certain properties according to the concept	3, 14, 19, 22, 23
The ability to apply concepts in problem solving	5, 12
The ability of students to develop the necessary or sufficient conditions of a concept	9, 11, 13, 15, 16
Use, utilize, and select certain procedures or operations	10, 17

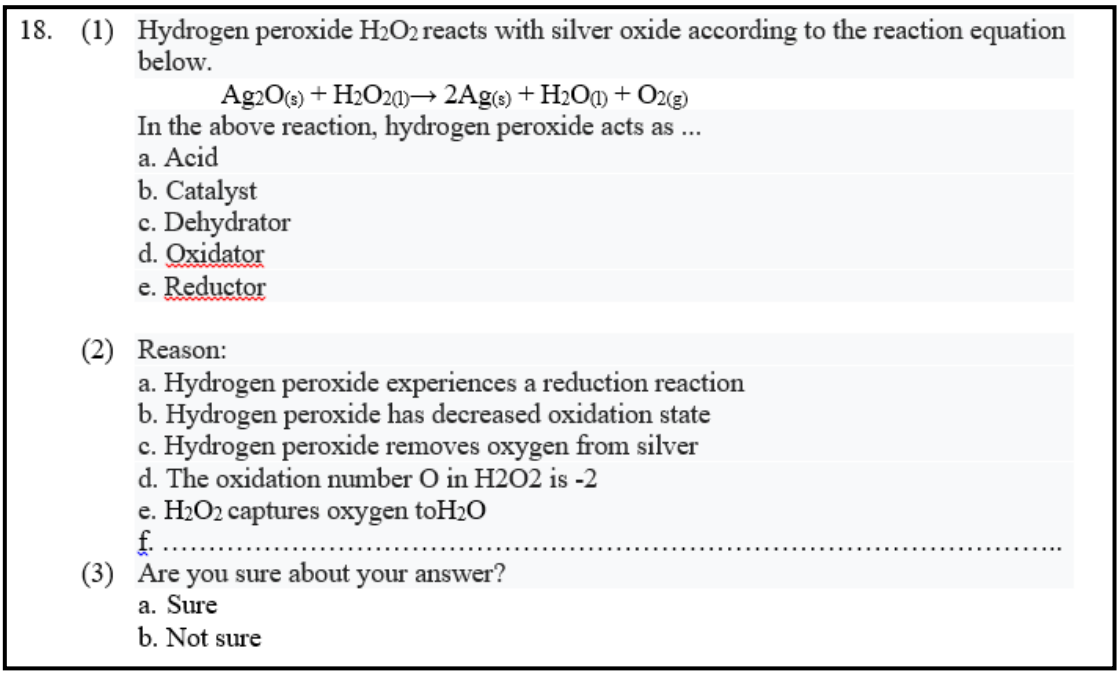
Based on Table 3, each item represents each indicator and understanding of the concept. The material analyzed was the redox reaction and the nomenclature of the compound. A recapitulation of students' understanding of the concepts of each item is presented in Table 4.

Table 4. Recapitulation of students' understanding of concepts

Criteria	Question Number																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
UC	30	28	25	15	30	33	30	33	30	31	29	32	20	36	31	20	23	10	27	30
M	4	6	11	21	5	3	4	6	6	5	7	4	13	0	4	15	10	24	6	2
L	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DUC	1	2	0	0	1	0	2	0	0	0	0	0	3	0	1	1	3	2	3	2

Information:
UC: Understand the Concept
M: Misconception
L: Lucky
DUC: Don't Understand the Concept

The results of the analysis of students 'understanding of concept in item number 18 related to the indicator restating a concept obtained the lowest results, only 10 of 36 students (0.27%) understood the concept, most of the students' misconceptions were 24 of 36 students with a percentage of 0.67 % and others don't understand the concept. If students still use memorization to solve problems, students will easily forget (Khansa et al., 2018). One of the reasons why students do not understand the concept is because students still use the memorization formula. The low understanding of this concept is due to the fact that there are still many participants who have not been able to analyze and solve problems well, especially in complex questions and require analytical skills (Permanasari, 2012). Changing students' habits requires considerable amount of time. Blended-Problem Based Learning becomes an effort so that students not only memorize but also understand concepts. Item number 18 is presented in Figure 1.



18. (1) Hydrogen peroxide H_2O_2 reacts with silver oxide according to the reaction equation below.

$$Ag_2O_{(s)} + H_2O_{2(l)} \rightarrow 2Ag_{(s)} + H_2O_{(l)} + O_{2(g)}$$

In the above reaction, hydrogen peroxide acts as ...
a. Acid
b. Catalyst
c. Dehydrator
d. Oxidator
e. Reductor

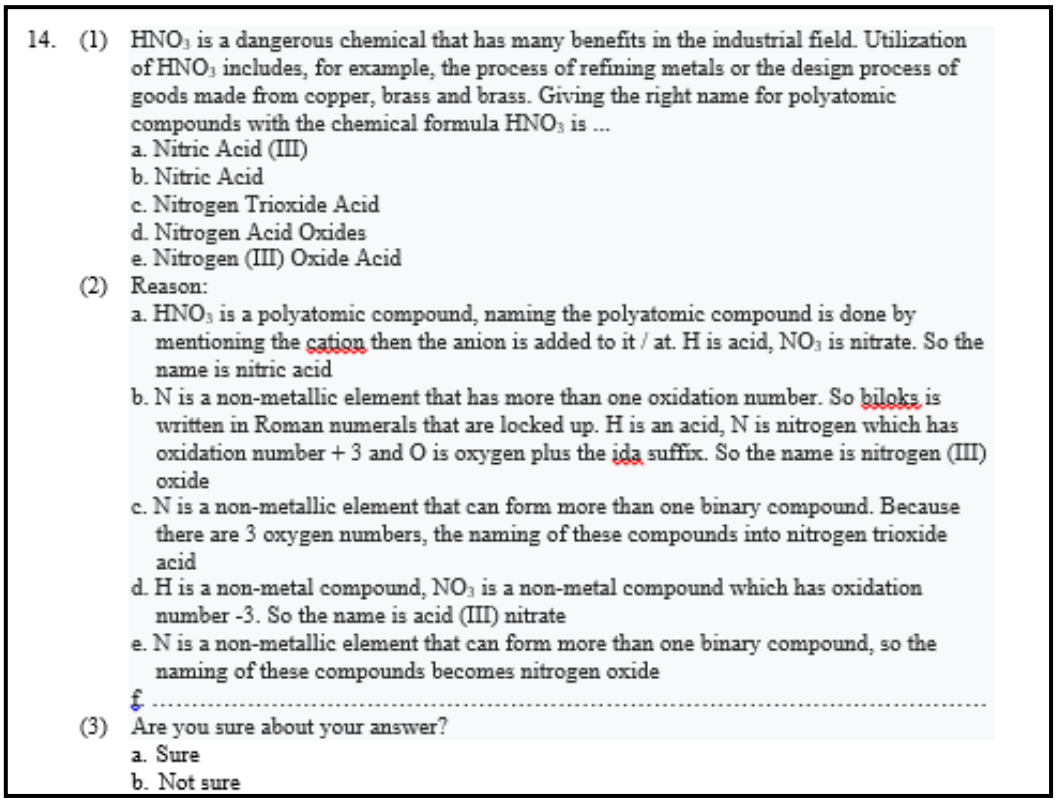
(2) Reason:
a. Hydrogen peroxide experiences a reduction reaction
b. Hydrogen peroxide has decreased oxidation state
c. Hydrogen peroxide removes oxygen from silver
d. The oxidation number O in H2O2 is -2
e. H_2O_2 captures oxygen toH_2O
f. ……..

(3) Are you sure about your answer?
a. Sure
b. Not sure

Figure 1. Problem Understanding the concept of Redox

Based on the picture above, it can be seen that students have difficulty determining oxidizing agents and reducing agents. Determination of oxidizing agents and reducing agents is closely related to the initial concept of a redox reaction (reduction and oxidation). This is very important because it will affect the level of understanding of students' concepts in subsequent redox material.

The highest level of concept understanding is found in item number 14. All students understand the concept. The indicator of understanding concepts in problem number 14 is the ability of students to develop the necessary or sufficient conditions of a concept. Problem number 14 is presented in Figure 2.



14. (1) HNO_3 is a dangerous chemical that has many benefits in the industrial field. Utilization of HNO_3 includes, for example, the process of refining metals or the design process of goods made from copper, brass and brass. Giving the right name for polyatomic compounds with the chemical formula HNO_3 is ...
a. Nitric Acid (III)
b. Nitric Acid
c. Nitrogen Trioxide Acid
d. Nitrogen Acid Oxides
e. Nitrogen (III) Oxide Acid

(2) Reason:
a. HNO_3 is a polyatomic compound, naming the polyatomic compound is done by mentioning the cation then the anion is added to it / at. H is acid, NO_3 is nitrate. So the name is nitric acid
b. N is a non-metallic element that has more than one oxidation number. So biloks is written in Roman numerals that are locked up. H is an acid, N is nitrogen which has oxidation number + 3 and O is oxygen plus the ida suffix. So the name is nitrogen (III) oxide
c. N is a non-metallic element that can form more than one binary compound. Because there are 3 oxygen numbers, the naming of these compounds into nitrogen trioxide acid
d. H is a non-metal compound, NO_3 is a non-metal compound which has oxidation number -3. So the name is acid (III) nitrate
e. N is a non-metallic element that can form more than one binary compound, so the naming of these compounds becomes nitrogen oxide
f. ……

(3) Are you sure about your answer?
a. Sure
b. Not sure

Figure 2. Item Number 14

Item number 14 is a question relating to the nomenclature of the compound. In determining the nomenclature of compounds there are standard rules that must be obeyed. All students understand the chemical nomenclature concept after applying the Blended-Problem Based Learning learning model. In the learning process students are invited to observe problems that occur in the surrounding environment. For example students are invited to see the rust of the fence. From the phenomena that have been seen by students, then students look for solutions on how to make the iron on the fence not rust. In addition, students are also invited to find out the formula of iron rust. After the students know the formula of iron rust students are guided to give the chemical name of iron rust based on the rules of chemical compound nomenclature. This has proven to be effective in helping students understand the concept of redox reactions and the nomenclature of compounds. Most students understand the concept of redox and compound nomenclature after obtaining the treatment of the method by Blended-Problem Based Learning. Blended Learning provides opportunities for students to learn more effectively and efficiently so that students are more motivated to learn (Naaj et al., 2012).

There are several assessments conducted by the teacher in the classroom. Two things teachers often do when teaching in class are by giving an evaluation at the end of learning using online media. The media used are Kahoot and Plickers. The use of the Plickers and Kahoot application in the classroom is shown in Figures 3 and 4.

Figure 3. Using the Plickers application in class

Figure 4. Using the Kahoot application in the classroom

The learning process using this model can help students understand the concept of redox and compound nomenclature. Students feel happy with the evaluation conducted by the teacher because it is interesting and fun.

CONCLUSION

Understanding the concepts of tenth grade students at State Senior High School 2 Ungaran after applying the Blended-Problem Based Learning method reached a high category of 75%. Overall learning with the Blended-Problem Based Learning method can effectively be used to help teachers teach their students to understand the concept of redox and compound nomenclature.

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