



Application of Discovery Learning Model to Improve the Understanding Concept of High School Students on Buffer Topic

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Abstract

This study aimed to describe the increase in understanding of students in class XI SMA 7 Palu on the buffer solution material after applying the discovery learning model. This type of research was pre-experiment with the design of one group pre-test-post-test. This study was conducted in two replication classes, namely, class XI MIA 1 as replication class 1 (n = 26) and class XI MIA as replication class 2 (n = 24). Testing of the data from research results data used descriptive statistical analysis of the understanding concept. The criteria for understanding the concept was good if the percentage of students who have the category of moderate, high, and very high is not less than 60%. The data results of analysis understanding of each concept obtained in the replication class 1. The concept of buffer, score 65.38% increased to 96.15%. The concept of the properties of the buffer score 3.84% increased to 96.15%. The concept of acid-base buffer solution, score 0% increased to 92.3%. The concept of pH acid buffer, score 0% increased to 88.46%. The concept of pH base buffer, score 0% increased to 84.61%. In replication class 2, the concept of buffer solution score is 20.83%, increased to 91.66%. The concept of acid and base buffer solution, score 12.5% increased to 91.66%. The concept of pH base buffer, score 4.16% increased to 83.33%. The results of the analysis showed that there is an increase in understanding the good concept by applying the discovery learning model in the buffer material.

Keywords: Discovery Learning, understanding concepts, buffer.

Introduction

Chemistry is a branch of natural science in which many studies matter and its changes. Chemistry is fundamental because it is closely related to everyday life and has many benefits for humans. However, according to Sunyono (2016), there are many facts that show that chemistry is seen as a problematic and unattractive science to study. This is also supported by Caster and Brickhouse's statement in Afadil & Diah (2017), which stated that the majority of students consider chemistry a complex subject.

The difficulties of students in learning chemistry resulted in many students experiencing failures in studying chemistry. Sirait & Hutabarat (2015) stated that the difficulty of students understanding and applying chemical concepts causes students to take the fastest steps by memorizing. This difficulty in chemistry is related to the characteristics of chemistry itself. According to Yakina et al. (2017) that most chemistry is abstract. This is also supported by research by Marsita et al. (2010), who argues that what causes

difficulties in studying chemical materials is the characteristics of the material, which are primarily abstract.

The results of an interview conducted with one of the teachers at SMA Negeri 7 Palu said that, in general, students had difficulty understanding concepts. The lack of understanding of these concepts is probably the main factor causing students difficulties in solving reaction equations and mathematical calculations in chemistry learning materials. One of them is in the buffer material. This is seen from the lack of students' ability to distinguish between the determination of the pH of the acid buffer solution and the alkaline buffer solution so that it has an impact on students' scores, which are about 75% of students who are below the minimum completeness criteria standard (KKM).

One of the chemical materials that requires an understanding of the concept is the buffer solution material. According to Isnaini et al. (2015) stated that the buffer material is one of the materials which most of the concepts are quite complicated, for example determining the pH of a buffer solution that is slightly acidic or wet. Students must master

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the precondition concept to understand the material of buffer solutions, namely the acid-base concept according to Bronsted Lowry, acid-base reaction equations, and other concepts.

The phenomenon of teaching that does not involve students directly in teaching and learning activities causes students to have less psychomotor and affective abilities. Students rarely discuss and cooperate with other students resulting in students becoming passive. This is supported by the results of research [Tambunan & Bukit \(2015\)](#), which state that the level of understanding of the concept by applying the direct instruction learning model is lower than the level of understanding by applying a model that involves students in the learning process. Therefore, teachers as educators need to create innovation, namely by choosing a strategy or way of conveying the material in order to obtain an increase in student understanding of concepts. For example by guiding students together to be actively involved in the learning process and helping students develop thinking skills according to their intellectual level will further strengthen students' understanding of the concepts being taught ([Balim, 2009](#)).

One of the things that the researcher thinks can solve this problem is the application of the discovery learning model. Discovery learning refers to learning that occurs when students are involved in experiences, where they gain their own knowledge and concepts ([Mubarak & Sulistiyo, 2014](#)).

According to [Hamalik \(2003\)](#), the discovery learning model emphasizes the importance of understanding a concept through active student involvement in the learning process. This learning model emphasizes the formation of student knowledge from experience during learning. Learning activities by means of this discovery can increase students' interest in learning chemistry in a way that is more fun than conventional methods. In science lessons, activities, which are based on inquiry using the discovery learning method, can be used with the aim of attracting students' attention

and enabling them to participate more in class ([Zuljafri, 2016](#)).

The stages in the implementation of the discovery learning model include stimulus, statement problems, data collection, data processing, verification, and the last stage is a generalization ([Kurniasih & Sani, 2014](#)). In the data processing stage, a conceptual understanding can be formed, especially in the material of the buffer solution, such as understanding the concept of a buffer solution, the concept of an acid buffer solution, an alkaline buffer solution, and the concept of pH of a buffer that is added a little acid or base. It is hoped that the application of discovery learning models can improve students' understanding of the concept of the buffer material.

According to [Mahmoud \(2014\)](#), the discovery learning model helps obtain activities where students learn for themselves and apply what they know in new situations, which will lead to effective learning achievement. The purpose of the present paper is to describe the application of the discovery learning model to improve students' understanding of learning concepts in the material of buffer class XI SMA Negeri 7 Palu.

Methods

The method used in this research is pre-experimental method with research design *one group pre-test-post-test design*. The subjects of this study were 26 students in the replication class 1 and 24 students in the replication class 2 at SMA Negeri 7 Palu, the instruments used were multiple choice questions and the learning implementation observation sheet.

Results and Discussion

Analysis of the Learning Implementation Observation Sheet

The results of the study of the observation sheet for the implementation of learning in class replication 1 and class replication 2 at each meeting. The results obtained are presented in [Table 1](#).

Table 1 The percentage of the results of the analysis of the learning implementation observation sheet

Meeting	Percentage (%)	
	Replication Class 1	Replication Class 2
Meeting 1	100	100
Meeting 2	100	96
Meeting 3	100	100
Average	100	98

Based on the [Table 1](#), it shows that the implementation of learning in replication class 1 is 100% carried out, while the implementation of learning in replication class 2 is 98% carried out.

Based on the results obtained in [Table 1](#), it shows that from the first to the last meeting in

class 1 replication 100% was carried out, but in replication class 2 it was only done 98%. The application that was not carried out properly was at the second meeting with the sub-material for determining the pH of the buffer solution. The presentation of teaching material that is not in

accordance with the steps contained in the RPP and the mismatch of the evaluation time allocation with the time allocation in the RPP. This is due to the lack of understanding of the students' initial concepts of determining pH, especially in doing mathematical calculations. In the learning process, a lot of time is spent in completing the pH calculation of the buffer solution, resulting in insufficient time spent evaluating. This also happened in the research of Sukawati et al. (2016).

One thing that must be considered in the application of discovery learning is that teachers must be competent in managing student learning time to suit the steps of this method (Susanti et al., 2016). The limited learning time is a drawback of the discovery learning model, as Hosnan (2014) stated that one of the shortcomings of the discovery learning model is it takes up a lot of time because teachers are required to change their teaching habits, who generally act as information givers, into facilitators, motivators, and mentors.

The unfamiliarity of students being directly involved in the learning process is also a significant factor in this research. Especially in obtaining learning resources because previously learning was only teacher-centered or, in other words, the teacher dominated learning, the

teacher delivered more material directly to students, which resulted in students having difficulty developing their own concepts. According to Tambunan & Bukit (2015), the phenomenon of teaching that does not involve students directly in teaching and learning activities causes students to lack psychomotor and affective abilities. Students rarely discuss and cooperate with other students, which results in students becoming passive. Apart from these factors, the researcher lacks the ability to manage the class as a major factor.

Descriptive Statistical Analysis of Conceptual Understanding

Concept understanding is a person's ability to understand or understand something that has been known or remembered (Rahmi et al., 2015). Students can be said to understand the concept if they can solve concept understanding test questions, as is Qashdi (2016) states that the student's ability to understand a chemical concept is crucial in the process of solving chemical problems.

The following is the percentage of the results of the analysis of the number of students who have a moderate minimum concept understanding category obtained from scoring each concept can be seen in Table 2 and 3.

Table 2 The percentage of the results of the analysis of the number of students which has a minimum category of understanding the concept of being replicated class 1

Concept	Pre-test	Post-test
a	65.38	96.15
b	3.84	96.15
c	0.00	92.30
d	0.00	88.46
e	0.00	84.61

Table 3 The percentage of the results of the analysis is the number of students who have a minimum category of understanding the concept of being in replication class 2

Concept	Pre-Test	Post-Test
a	20.83	91.66
b	0.00	8.33
c	12.50	91.66
d	0.00	33.33
e	4.16	83.33

Based on these data, a comparison of increased understanding between the pre-test and post-test for each concept can be seen in Figure 1. Information:

- a : buffer solution concept
- b : the concept of the properties of the buffer solution

- c : the concept of acid and base buffer solutions
- d : the concept of pH of an acid buffer solution
- e : the concept of pH of an alkaline buffer solution

The comparison of the percentage of students' concept understanding was obtained by each student (SS) in the replication class 1,

namely the buffer solution concept 65.38% increased to 96.15%, the concept of the properties of the buffer solution 3.84% increased to 96.15%, the concept of 0% acid and base buffer solutions increases to 92.3%, in the concept of 0% acid buffer solution pH increases to 88.46%, in the concept of 0% alkaline buffer solution pH increases to 84.61%. The percentage of students' understanding of the concept was obtained by each student (SS) in the second replication class, namely the buffer solution concept 20.83% increase 91.66%, the concept of

the properties of the buffer solution 0% increased to 8.33%, the concept of a 12.5% acid and base buffer solution increases to 91.66%, the pH concept of a 0% acid buffer solution increases to 33.33%, the concept of pH of 4.16% alkaline buffer solution increases to 83.33%. Based on the results of these percentages, in the replication class 1 to 5 the concepts were categorized as an increase in concept understanding because the percentage of understanding each concept was more than 60% (Ijirana, 2016).

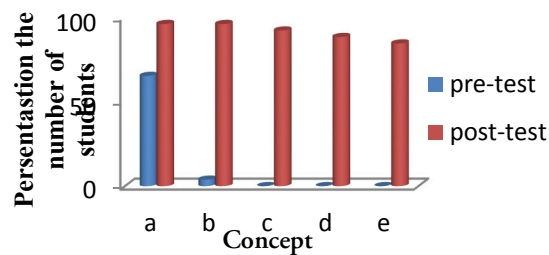


Figure 1. Increasing understanding of each replication class concept 1

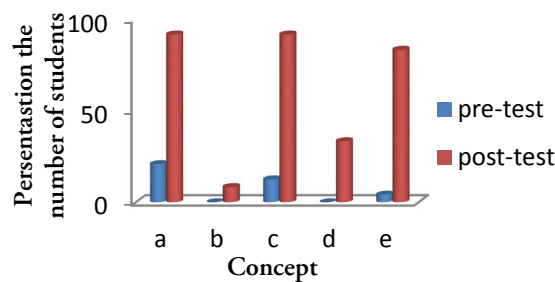


Figure 2. Increasing understanding of each replication class concept 2

The understanding of the good concepts obtained in class replication 1 can be seen from the learning process at the first meeting to the third meeting, where at the first meeting through the stimulus provided by the researcher, students can find for themselves the concepts of understanding and components of the buffer solution through group discussions. At the second meeting, the students seemed more active than in the previous meeting. There were some students who asked questions about things they had not understood, and some students began to enthusiastically respond to the results of discussions from other groups. At the third meeting, most of the students were also active in group discussions and class discussions. This shows that slowly students begin to get used to the learning model that is applied. This is in accordance with the statement of Novayani et al. (2015), which states that when students are motivated and do participate in discovery, discovery learning will lead to an excellent

learning process. However, in replication class 2, the learning process was not as active as students in replication class 1, so that it affected students' final conceptual understanding because knowledge and understanding were a strength to be able to work on and solve a problem (Hunt, 2003).

Improved understanding of good concepts in replication class 2 is only on the concept of buffer solutions, the concept of acid and base buffer solutions, and the concept of pH of alkaline buffer solutions, while for the concept of the properties of buffer solutions and pH of acid buffer solutions cannot be categorized well because the presentation of understanding the concept is less than 60% namely 8% and 54%. This shows that there are external (environmental) factors that affect students' understanding of concepts, such as different student conditions. Not all students can follow lessons using model discovery learning (Hosnan, 2014).

Based on the data obtained, the descriptive test of conceptual understanding shows that the application of the discovery learning model can improve students' conceptual understanding. This is in accordance with Istiana et al. (2015), namely, model discovery learning can improve student achievement in cognitive, affective, and psychomotor aspects.

Conclusion

There is an increase in understanding of the concept before and after the application of the discovery learning model, namely in replication class 1 especially on the concept of buffer solutions 65.38% increased to 96.15%, the concept of the properties of the buffer solution 3.84% increased to 96.15%, the concept of 0% acid and base buffer solutions increases to 92.3%, in the concept of 0% acid buffer solution pH increases to 88.46%, in the concept of 0% alkaline buffer solution pH increases to 84.61%. In class 2 replication is the concept of a buffer solution 20.83% increase 91.66%, the concept of a 12.5% acid and base buffer solution increased to 91.66%, in the concept of an alkaline buffer solution pH of 4.16% increased to 83.33%.

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