THE USE OF VIRTUAL LABORATORY TO IMPROVE STUDENTS' CONCEPTUAL UNDERSTANDING IN ACID BASE TITRATION SUBJECT

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Abstract: The research has been conducted to figure out the use of virtual laboratories on students' conceptual understanding of acid-base titration subject at SMAN 1 Tambusai. The study was an experimental research with one group pretest-posttest design. The sample consisted of one class, XI IPA$_2$, a class that was treated with a virtual laboratory. The data analysis technique used was the t-test. Based on the results of the final data processing using the t-test, it was obtained that sig $5 \leq 0.05$; where $0{,}000 \leq 0.05$; so it was concluded that there were significant differences between the mean scores of the pretest and posttest. This shows that there is an increase by the use of virtual laboratories towards the students' conceptual understanding.

Keywords: *Virtual Laboratory, Conceptual Understanding, Acid and Base Titration*

INTRODUCTION

The development of science and technology can create new innovations. The goal of national education can be achieved with the development and the progress of science and technology today (Hikmah Nur, 2017). The learning process must really pay attention to the involvement of students so that no more students are passive in participating in the class. The higher the active involvement of students, the more the student's learning experience is meaningful (Rahayu, 2013). The same goes to chemistry learning; chemistry is knowledge based on experiments where development and its application become the standard work of experimentations. Chemistry learning in schools ideally teaches theories and laboratory practices that can be used to underlie the investigation of further experiments (Pujiati, 2013).

In reality, the teaching and learning activities in schools still apply a lot of teacher-centered learning. Teacher-centered learning is still the main feature of learning in schools and rarely develops process skills in concept formation. As a result of this habit, students become less creative in solving problems, perform low participation and not optimal cooperation in groups. In addition, it can result in inefficient teaching and learning

activities and ultimately students' understanding of the concept of learning is low so learning outcomes are below the average.

In order for students to be able to learn actively in the learning process, the activities need to be supported by the principles of learning. According to Suprihatin Saputro (2000), active learning principles include: (1) presenting various activities; (2) creating a varied learning atmosphere; (3) encouraging students to be active in the learning process; (4) motivating students to be creative; (5) increasing the occurrence of better interactions in the classroom; (6) accommodating individual differences; and (7) utilizing various learning resources.

Besides learning models, learning media also play an important role in learning activities. Media are components of learning resources or physical instruments that contain instructional materials in students' environments that can stimulate the students to learn. Learning media can generate new desires and interests, arouse motivation and stimulation of learning activities, and bring psychological influences to students (Hamdani, 2011 in Rahayu 2013).

Learning media can be obtained from any forms, as long as they contain elements that strengthen the ability of students to understand the concept. According to Azhar Arsyad (2013), the use of learning media in the teaching and learning process can ignite new desires and interests, generate motivation and stimulation towards learning activities, and even bring psychological influences to students. In the last few years, not a few learning materials can be delivered using computer media. By using media computers, students can be more motivated because the use of computers has attractive features such as images, colors, and music. Besides, computer media can be designed according to the needs of the students and teachers like virtual laboratory media (Aprilia, 2015).

Virtual laboratories, or also known as "Virtual Labs", are a set of laboratory instruments in the form of interactive multimedia-based computer software that is operated using computers and can simulate activities in the laboratory as if the user is in an actual laboratory. Virtual laboratories have potential to provide significant improvements and more effective learning experiences.

The use of virtual laboratories is expected to be able to solve learning problems experienced by students and overcome the cost problems in the procurement of tools and materials to carry out practical activities for less fortunate schools. The learning process becomes more interesting, more interactive. The amount of teaching time can be reduced. The quality of learning can be improved and the teaching and learning process can be done anywhere and anytime. In addition, through virtual laboratories, research costs can be saved. Moreover, the research that was previously impossible because of the limitations of system conditioning is now possible to be done (Reismeiyanto, 2008).

Learning with a virtual laboratory can improve generic science skill, logical infers ability, and concept building ability better. Aldrich (in Suranti 2016) states that students who learn through virtual simulation models have a higher ability to explain and understand the material that has been learned. Virtual laboratories are very helpful for increasing skills interest and motivation by providing full security in terms of time. According to Oidov (in Suranti 2016), virtual laboratories are useful in giving students the opportunity to learn by doing and developing thinking and problem-solving skills (Suranti, 2016).

The use of virtual laboratories can also improve students' learning achievement and can have a positive impact on students' affection about chemical materials. This can be seen from the results of a research conducted by Fian et al (2012) which revealed that the use of virtual laboratories can improve student learning achievement on "colloid" topic. In addition, the results of a research conducted by Argandi et al (2013) on the subject of mixed separation reveal that the use of virtual laboratories can improve the quality of students' learning. A research conducted by Ikhsan et al (2016) shows that the use of virtual laboratory media can increase students' learning motivation on the subject of acid and base titration. Meanwhile, the research conducted by Rahardiana (2015) shows that the use of virtual laboratories can improve cognitive and affective learning achievements of students in the subject of "colloidal system".

The research conducted by Wulandari (2013) finds out that the use of virtual laboratories can improve students' cognitive and affective learning achievements in "reaction rate" subject. The research conducted by Nur Hikmah (2017) finds out that using virtual laboratories can improve students' understanding of the concept of reaction rates. According to Alkan Fatma (2014), laboratory practices carried out through virtual laboratories are more effective than traditional laboratories in improving the performance and affections of chemistry teachers towards educational technology as well as decreasing their anxiety levels about chemical laboratories.

Some of the research findings that have been conducted are related to the use of virtual laboratories and learning models, so the authors are interested in conducting a research on **"The Use of Virtual Laboratory to Improve Students' Conceptual Understanding in Acid-Base Titration Subject"**.

METHODOLOGY

The study was conducted at SMAN 1 Tambusai. The study was being carried out from March until May 2018. The type of the research was a quasi-experimental study with one group pretest-posttest design. The research subjects were 27 students in the science class, IPA_2. The objects of the research are virtual laboratory media on acid-base titration material and conceptual understanding. The sampling used the purpose sampling technique.

The data collection technique used in this study was a test technique. The data were obtained from:

1. *Pretest* - done in class IPA_2 before teaching the acid-base titration materials (before treatments are given). The pretest aimed to determine the students' basic competency in acid base titration material, which will later be used for data processing.

2. *Posttest* – given to class IPA_2 after the acid-base titration material was taught, and then the entire treatment process was given. The posttest questions were the same as the questions of the pretest. The score difference in posttest and pretest results was used to determine the increase in the students' learning outcomes having given the treatments with virtual laboratory media.

The data analysis technique used was an analysis prerequisite and statistical tests.

a. Analysis Prerequisite

Normality test: The first step in the research was the normality test to see whether the data were being normally distributed or not. The preliminary data in this study tested the normality using the Kolmogorov-Smirnov normality test with the hypothesis formula: $H_0 : f(X) =$ normal; with testing criteria ($\alpha = 0.05$): Accept H_0 if sig ≥ 0.05.

b. Statistical Test

Paired sample t-test (normal data) and Wilcoxon Test (if the data are not normal): to see an increase in learning outcomes after being given virtual laboratory media, where the testing criteria ($\alpha = 0.05$); Accept H_0 if sig ≤ 0.05.

The learning treatments used virtual learning media. The research hypothesis was tested by statistical tests (t-test) using SPSS Statistics 23. The provisions are as follows: 1) if the probability is < 0.05 then H_0 is accepted, and 2) if the probability is > 0.05 then H_0 is rejected.

This study did not use a comparison class but had used initial tests so that the magnitude of the effect or influence of the use of virtual learning media is certain. In this study, the subjects were first given the initial test (pretest) to determine the extent of students' initial competency before being given learning with virtual learning media. After being given the initial test, then the students were given treatments which are learning with virtual learning media. After completing virtual media learning then all students were given the final test (posttest) to find out the extent to which virtual media learning increases their conceptual understanding.

RESULTS AND DISCUSSIONS

The results of the data analysis of the research present the data from the normality test and statistical test.

The data processing of the assessment results is described as follows:

1. Descriptive Analysis
   Normality Test

Table 1. The Results of the *Pretest* and *Posttest* Data Normality

	Kolmogorov-Smirnov[a]		
	Statistic	Df	Sig.
Pretest	0,212	27	0,003
Posttest	0,183	27	0,021

Based on the output, it is known that the significance value of the pretest is 0.003 (smaller than 0.05), so it can be concluded that the data are not normally distributed, while the posttest significance is 0.021 (greater than 0.05), so it can be concluded that the data are normally distributed.

2. Statistical Test of Hypothesis 1
   Wilcoxon Signed Ranks Test Post-Test Test Results

Table 2. Descriptive Statistics of Pretest and Posttest Data

	N	Mean	Std Deviation	Minimum	Maximum
Pretest	27	30,63	5,576	20	40
Posttest	27	90,70	5,224	80	100

Table 3. Statistical Test of Wilcoxon Data

	Posttest-Pretest
Z	-4,550[b]
Asymp. Sig. (2-tailed)	0,000

Based on the output above, it is known that the significance value is 0,000 (smaller than 0.05), so it can be concluded that there are significant differences between the pretest and posttest scores.

From the above data, it is known that the data obtained are normally distributed. Then the t-test is carried out and the results can be seen in Table 3. From the table it can be seen that there is an increase in learning outcomes which can be drawn from the average score at pretest = 30.63, then increases to 90.70 (posttest). Therefore, it can be concluded that there is a significant increase in learning outcomes after using virtual learning media (see Table 2).

Based on the results of the research, the students' learning outcomes after learning with virtual learning media on acid base titration material are significantly higher than the learning outcomes before being given the virtual learning media. This is because virtual learning media provide more opportunities for students to be more active in the chemistry

learning process on the subject of acid-base titration. The use of virtual laboratories can also improve student learning outcomes and can have a positive impact on students' affections on chemistry materials. This is also evident from the results of a study conducted by Totiana (2012) that the use of virtual laboratories can improve student learning outcomes on colloid subject.

CONCLUSION

Based on the research data, the results obtained a significant value of 0,000 smaller than 0.05, so it can be concluded that there are significant differences between the scores in the pre-test and post-test. From the data calculation, the data obtained are normally distributed, then the t-test is conducted and it is found out that there is an increase in the learning outcomes. This can be seen from the scores the students get at the pre-test with a mean score = 30.63 then increases to 90.70 at the post-test, thus it can be concluded that there is a significant increase in the learning outcomes after using the virtual learning media.

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