# The Effect of Virtual Lab Assisted PBL Model on Student Motivation and Learning Outcomes

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**Abstract:The Effect of Virtual Lab Assisted PBL Learning Model on Student Motivation and Abstract:The Effect of Virtual Lab Assisted PBL Learning Model on Student Motivation and Learning Outcomes.**  The aim of this study(1)  to determine the impact that the use of the Virtual Lab-assisted problem-based learning paradigm has on students' learning in acid-base material,(2)discovering out the application on the paradigm for problem-based learning assisted by the Virtual Lab has an effect on student motivation in acid-base material,(3)to identify the important and positive relationship between learning outcomes and motivation to learn. The research method used is a quantitative method with the Posttest Only Control Group Design.  The sample consists of 2 class, that is class XI-MIA 5 as experimental class and class XI-MIA 6 as a control class.To evaluate learning outcomes, test instruments are put to use, while non-test instruments are used to evaluate learning motivation.Hypothesis testing and correlation are the analytical techniques utilized. The outcomes of the average value on the posttest data are 81,57 and 72,57.And the average value of learning motivation is 81,60 and 74,51. The average posttest score shows that the learning outcomes of the experimental class are higher than the learning outcomes of the control class. This indicates that the application of the Virtual Lab-assisted Problem Based Learning model is good.

**Keywords:** Virtual Lab,Problem Based Learning Model,Learning Motivation,Learning Outcomes, and Acid-Base

**_Abstrak:Pengaruh Model Pembelajaran Problem Based Learning (PBL) dengan Berbantuan Virtual Lab terhadap Motivasi dan Hasil belajar Siswa pada Materi Asam Basa._** _Tujuan penelitian ini (1) melihat pengaruh pengakplikasian model PBL  dengan bantuan laboratorium virtual terhadap hasl belajar siswa pada materi asam basa , (2)mengetahui pengaruh penerapan model pembelajaran berbasis masalah dengan dukungan Laboratorium Virtual terhadap motivasi belajar siswa pada materi asam basa,(3)menjelaskan hubungan positif dan relevan antara motivasi belajar dengan hasil belajar yang dimediasi menggunakan PBL yang didukung dengan laboratorium asam basa virtual. Sampel terdiri dari 2 kelas yaitu kelas eksperimen dan kelas kontrol.  Instrumen yg digunakan ialah instrumen test untuk mengukur pembelajaran hasil belajar  serta instrumen nontest untuk mengukur motivasi belajar.Metode penelitian yang digunakan adalah metode kuantitatif dengan desain Posttest Only Control Group Design. Hasil yang diperoleh nilai rata-rata pada data posttest adalah 81,57 dan 72,57.Rata-rata motivasi belajar adalah 81,60 dan 74,51. Rata-rata nilai posttest menunjukkan bahwa hasil belajar kelas eksperimen lebih tinggi daripada hasil belajar kelas kontrol.Ini menandakan bahwa penerapan model Problem Based Laearning berbantuan Virtual Lab sudah baik._

▪ **INTRODUCTION**

The goal of education is to support students in realizing their inner potential via interaction between teachers and students. (Rizkia *et al*., 2021)In education, learning and learning outcomes go side by side. According to (Setiawati, 2018), learning is not just reading, listening, writing, doing homework and tests, but there are changes in behavior as a product of the educational process, understanding learning concepts, and applying them. But a lot of high schoolers have trouble grasping the idea of learning, particularly in chemistry. This lowers student motivation to learn and affects the results of learning,so that chemistry learning outcomes become less good (Jayadiningrat, *et al*., 2017).

According to the outcomes of observations and interviews in SMA Negeri 17 Medan, it is known that in teaching and learning systems, teachers still often use methods *teacher centered*, meaning that learning is still focused on the teacher. Apart from that, learning media such as laboratories are still very minimal in facilities. This is one of the reasons why student learning results and motivation have declined. Therefore, it is very important to use an effective teaching and learning model. One of the fun and effective teaching methods is by employing a problem-based learning model (Azmy *et al.,* 2018). Advantages model of problem-based learning is discovering new knowledge by making learning fun and easy to understand. Problem Based Learning Model (PBL) will increase student understanding and help children develop critical thinking skills. This has been demonstrated through studies carried by (Efendi, 2021) describing the PBL model can increase students' understanding of stoichiometry topics by solving problems effectively. This research is also strengthened by (Liska *et al.,* 2021) shows that the PBL model can increase students' proficiency in electrolyte and non-electrolyte material.

Learning outcomes related to increased student motivation.According to Naipospos (2016) there are a number of factors that influence the process and student learning outcomes, namely external factors consisting of the environment and from themselves.

One of the methods used to convey information to students in order to increase creativity is learning media. The use of media facilitates teaching and learning more engaging and beneficial, which enhances interactions between teachers and students (Linda *et al.,* 2021). Furthermore, the media could help students learn in the classroom. The teaching and learning process does not vary without media, and student interest decreases. So one of the objectives of the media for education is to increase the effectiveness and student learning outcomes (Tafonao, 2018)

The limitations of real experiments in schools can be overcome by other types of experiments that can be operated by each student, in the form of virtual experiments. If students have difficulty doing practicum, one way to support their learning is to use a virtual laboratory. To describe chemical reactions that cannot be observed in real terms, computer-based chemistry practicum activities can be simulated in a virtual laboratory (Hikmah *et al*., 2017). Apart from being used in class, the use of virtual labs can be used anywhere making easy for students to access them.

This study has differences with previous studies where researchers used different treatments for the two samples. The use of the Problem Based Learning learning model assisted by Virtual Lab will only be carried out in the experimental class, then the direct

| Class | N | Average Student Motivation | Varians | Deviation Standard |
|---|---|---|---|---|
| Experimental Class | 35 | 81,57 | 55,55 | 7,45 |
| Control Class | 35 | 67,28 | 53,44 | 7,31 |

instructions will be carried out in the control class. From the description above, the use of animated video media is expected to improve student learning outcomes. Therefore, a study was carried out with the title "The Effect of Virtual Lab Assisted PBL Learning Model on Student Motivation and Learning Outcomes"

▪ **METHODS**

The research was performed at SMA Negeri 17 Medan on 7 January 2023.This research was conducted in the even semester of the 2022/2023 school year.

**Population and Sample**
Research Population
The population in study were students of class XI SMA Negeri 17 Medan

Research Sample
Sample selection in this research use purposive sampling. Purposive sampling technique is a technique taking and taking samples determined by researchers with consideration certain (Sugiyono,2015)

Based on the sampling technique, 2 classes were obtained, namely class XI MIA 5 and XI MIA 6. Class XI MIA 5 as an experimental class and class XI MIA 6 as the control class.

Research Design
The part of this design that is used is the *Posttest Only Control Group Design* which involved 2 classes, namely the experimental and control classes and the two classes received different treatment. The two groups received different treatment, where the experimental group used a problem based learning assisted by Virtual Lab while the control class used a Direct Instruction.

• **RESULT AND DISCUSSION**
**Student Learning Outcomes**
The average student learning outcomes are presented in table 1

**Normality Test**

The results of the normality test as a prerequisite for the t test are presented in table 2

| Analysis | $X^2$ count | $X^2_{table}$ | $\alpha$ |
|---|---|---|---|
| Experimental Class | 9,81 | 11,07 | 0,05 |
| Control Class | 6,23 | 11,07 | 0,05 |

According to table 2, $X^2_{count} < X^2_{table}$ shows the learning outcomes data is normally distributed

**Homogeneity Test**

In order to perform the t test, the normality test results are supplied in table 3

| Analysis | Varians | $F_{count}$ | $F_{table}$ |
|---|---|---|---|
| Experimental Class | 55,55 | 1,03 | 1,78 |
| Control Class | 53,44 | | |

According to table 3, $F_{count} < F_{table}$ shows the learning outcomes data is homogeneous

**Hypothesist Test**

The hypothesist test result are supplied in table 4

| Class | X | $S^2$ | $t_{count}$ | $t_{table}$ |
|---|---|---|---|---|
| Experimental Class | 81,57 | 55,55 | 8,11 | 1,69 |
| Control Class | 67,28 | 53,44 | | |

From table 4 it is known that Ha is accepted and Ho is rejected

**Learning Motivation of Student**

The average learning motivation of student are presented in table 5

| Class | N | Average Student Motivation | Varians | Deviation Standard |
|---|---|---|---|---|
| Experimental Class | 35 | 81,60 | 28,66 | 5,35 |
| Control Class | 35 | 74,51 | 24,02 | 4,90 |

## Normality Test

The results of the normality test as a prerequisite for the t test are presented in table 6

| Analysis | $X^2_{count}$ | $X^2_{table}$ | $\alpha$ |
|---|---|---|---|
| Experimental Class | 7,83 | 11,07 | 0,05 |
| Control Class | 6,73 | 11,07 | 0,05 |

According to table 6, $X^2_{count} < X^2_{table}$ shows the learning outcomes data is normally distributed

## Homogenity Test

The results of the normality test as a prerequisite for the t test are presented in table 7

| Analysis | Varians | Ftable | $F_{count}$ |
|---|---|---|---|
| Experimental Class | 28,66 | 1,78 | 1,19 |
| Control Class | 24,02 | | |

According to table 7, $F_{count} < F_{table}$ shows the learning outcomes data is homogeneous.

## Hypothesis Test

The hypothesist test result are supplied in table 8

| Class | X | $S^2$ | $t_{count}$ | $t_{table}$ |
|---|---|---|---|---|
| Experimental | 81,60 | 28,66 | 5,81 | 1,69 |
| Control | 74,51 | 24,02 | | |

According to table 8 obtained $t_{count} > t_{table}$ so Ha is accepted and Ho is rejected

## Correlation Test

The correlation test result are supplied in table 9

| Analysis | rcount | rtable |
|---|---|---|
| Experimental Class | 0,45 | 0,33 |

According to table 9, obtained $r_{count} = 0,45$ and $_{table} = 0,33$ where $r_{count} > r_{table}$ so that Ha is accepted and Ho is rejected. The researcher gave for three meetings, each class

received a distinct approach. Resulting from the post-test data, it was found that student's scores in the XI MIA 5 were 81,57 and XI MIA 6 with score of 67,28. Apart from being able to see from the standard deviation of the worth of student learning outcomes,models of PBL have an impact on student's motivation. Based on data on student motivation, the average in the XI MIA 5 was 81,60 and the average in the XI MIA 6 was 74,51. These results indicate that the effect of PBL model affects student motivation. In (Adawiyah *et al*., 2021) the use of online laboratories shows good results in the science learning process in junior high schools. This research is also reinforced by (Panggabean *et a*l., 2019) there is a difference in increasing student achievement of learning style assessments, (gain scores) using virtual lab resources with the Problem Based Learning approach.

Following data collection, a normality test is carried out on the outcomes of learning. The data in the XI MIA 5 is normally distributed from the calculations obtained $X^2_{count}$ (9.81) < $X^2_{table}$ (11.07) and control class data $X^2_{count}$ (6.23) < $X^2_{table}$ (11.07). Based on the data above,the distribution of the XI MIA 5 and XI MIA 6 is normal. The data was then put through a homogeneity test to determine its homogeneity. From the calculation of the data obtained $F_{count}$ (1.03) < $F_{table}$ (1,78). Based on the data above, student learning outcomes are homogeneous. After the homogeneity test, a hypothesis test was carried out. The data obtained after calculation $t_{count}$ (8,11) > $t_{table}$ (1,69). According to the data obtained $t_{count}$ > $t_{table}$ namely Ha is admitted whereas Ho is refused because the problem-based learning approach, backed up by Virtual Lab, has an impact on learning motivation.

After analyzing the data on learning outcomes, then analyzing data on student motivation. After the data is obtained, the outcomes of learning motivation are put through a normalcy test. In the XI MIA 5 class the data are typically distributed. from the calculations obtained $X^2_{count}$ (7,83) < $X^2_{table}$ (11.07) and control class data $X^2_{count}$ (6.73) < $X^2_{table}$ (11.07). The experimental and control classes are generally distributed due to the aforementioned data. The data was then put through a homogeneity test to determine its homogeneity. From the calculation of the data obtained $F_{count}$ (1.19) < $F_{table}$ (1,77). Based on the data above, student learning outcomes are homogeneous. After the homogeneity test, a hypothesis test was performed. From the calculation of the data obtained $t_{count}$ (5,81) > $t_{table}$ (1,69). According to the data obtained $t_{count}$ > $t_{table}$ namely the application of the PBL model assisted by Virtual Lab has an effect on learning motivation.

After the results of the hypothesis test are obtained, then a correlation test is carried out. According to data analysis, obtained $r_{count}$ = 0,45 and $_{table}$ = 0,33 where $r_{count}$ > $r_{table}$. There is substantial and positive relationship between learning motivation and student learning outcomes when using virtual lab learning media with acid-base material. This research was also reinforced by (Raini, 2020) who said that there was an effect on learning outcomes and an increase in students' chemistry practicum skills after being given virtual laboratory media (PhET) in class XI IPA 2 at SMK Taruna Terpadu Bogor

▪ **CONCLUSIONS AND RECOMMENDATIONS**

The effectiveness of a virtual lab and the problem-based learning paradigm in the classroom have an impact on students' learning outcomes. This is indicated by the value $t_{count}$ > $t_{table}$ (8,11 > 1,69). Students taught in a problem-based learning model are more motivated than undergraduates who are taught using the Direct Instruction approach.This is indicated by the value $t_{count}$ > $t_{table}$ (5,81 >1,69). When students are taught utilizing the problem-based learning paradigm with acid-base material, there is a substantial association between their motivation and the learning results they achieve. This is

indicated by the value $r_{count} > r_{table}$ (0,45 > 0,33). based on the results obtained, the use of the virtual lab-assisted problem base learning model has an effect on increasing learning outcomes and student motivation in class XI MIA 5.

Based on the results and conclusions of the study, the researcher has several suggestions, namely : By using the problem based learning model can improve the ability to solve problems in students independently. Media virtual lab can be an alternative media and can increase interest in learning and student motivation

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