Vol 12(3), 2023, 40-49 DOI: 10.23960/jppk.v12.i3.23.04
Jurnal Pendidikan dan Pembelajaran Kimia
e-ISSN: 2714-9595| p-ISSN 2302-1772
http://jurnal.fkip.unila.ac.id/index.php/JPK/index

The Effect of Using Interactive E-Module on Student Motivation and Learning Outcomes on Acid-Base SolutionMaterial

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Received: July 25th, 2023 Accepted: October 10th, 2023 Online Published: December 28th 2023

Abstract:The Effect of Using Interactive E-module on Student Motivation and Learning Outcomes on Acid-Base Solution Material . The problem in this study is the low motivation and learning outcomes of chemistry students on acid-base solution material. This study aims to determine the effect of project-based learning (PjBL) model assisted by interactive e-module media on student motivation and learning outcomes at SMAN 7 Medan. The research sample was taken 2 classes with random sampling technique and taught with PjBL model. The treatment in the experimental class was assisted by interactive e-module while the control class was assisted by student packet books. Data collection used test instruments and questionnaires. It was found that students in the experimental class demonstrated notably better learning outcomes compared to their counterparts in the control class. The average learning outcomes for the experimental class were 84.43 and the control class were 78.71. There is a significant correlation with a medium category between motivation and student learning outcomes of 19.36%. The hyphoteses of this study were accepted, namely there is an effect of the PjBL model assisted by interactive e-module media on student chemistry learning outcomes, student chemistrylearning motivation, and there is a correlation between learning motivation and student learning outcomes.

Keywords: E-module, Project Based Learning (Pjbl),Learning Outcomes ,Student Motivation, Acid-Base Solution.

Abstrak:Pengaruh Penerapan E-modul Interaktif Terhadap Motivasi dan Hasil Belajar SsiwaPada Materi Larutan Asam Basa. *Masalah dalam penelitian ini adalah masih rendahnya motivasi dan hasil belajar kimia siswa pada materi larutan asam basa. Penelitian ini bertujuanuntuk mengetahui pengaruh model project based learning (PjBL) berbantuan media e-modul interaktif terhadap motivasi dan hasil belajar siswa di SMAN 7 Medan. Sampel penelitian diambil 2 kelas dengan teknik random sampling dan diajarkan dengan model PjBL. Perlakuan dikelas eksperimen berbantuan e-modul interaktif sedangkan dikelas kontrol berbantuan buku paket siswa. Pengumpulan data digunakan instrumen tes dan angket. Hasil penelitian menunjukkan rata-rata hasil belajar siswa kelas eksperimen sebesar 84,43 dengan gain 68,64%dan kelas kontrol sebesar 78,71 dengan gain 53,68%. Motivasi belajar siswa di kelas eksperimensebesar 81,71 sedangkan di kelas kontrol 75,29. Terdapat korelasi yang signifikan dengan*

kategori sedang antara motivasi dan hasil belajar siswa sebesar 19,36% . Hipotesa dalam penelitian ini diterima, yaitu terdapat pengaruh model PjBL berbantuan media e-modul interaktif terhadap hasil belajar kimia siswa , motivasi belajar kimia siswa, dan ada korelasi antara motivasi belajar terhadap hasil belajar siswa.

Kata kunci: *E-modul, PjBL, Hasil Belajar, Motivasi Belajar, Larutan Asam dan Basa*

- **INTRODUCTION**

Chemistry is a branch of natural science that studies the composition and properties of substances or matter from the atomic to the molecular scale, so that the physical properties of most forms of substances and chemicals cannot be observed directly with the eye (Zammilumi, 2018). Therefore, in the chemistry learning process, intermediary media such as images, videos, and animations are needed to visualize the material in a way that is easy for students to understand. One of the chemistry materials in class XI SMA / MA is Acid-Base Solution which studies acidic or basic substances that are closely related to the environment and daily life. (Amalia and Susilaningsih, 2014; Herawati, 2018). The existence of abstract chemical concepts in acid-base material makes students less able to build an understanding of chemical concepts fundamentally. Therefore, according to the characteristics of the acid-base solution material, the Project Based Learning (PjBL) learning model is appropriate in building students' activeness and understanding, where in the PjBL model the learning process focuses on students (student centered) and learning is processed based on project tasks (Siburian, 2021).

According to interviews conducted by researchers with a number of chemistry teachers at SMA Negeri 7 Medan, the Direct Instruction (DI) learning model with the help of media in the form of chemistry textbooks and power point (PPT) has often been used in recent years. Then teachers at SMA Negeri 7 Medan also reported that in learning acid-base material, students have difficulty because it is abstract and complex, among others, when learning the concept material of calculating pH in strong acids and strong bases. By applying appropriate learning methods for the subjects taught with the help of interesting media and in accordance with the requirements of the K-13 curriculum is one way to overcome this problem. The PjBL model with media in the form of interactive e-modules is a learning model that can be utilized in the teaching and learning process in improving student learning outcomes.

The PjBL model is able to increase student motivation, creativity and activeness in solving acid-base material problems, increasing collaboration among students in working on projects during practicum, exploring and citing information from trusted reference books/literature, thus providing learning experiences for students through practicum activities (Siburian, 2021).

Electronic modules (e-modules) are referred to as digital learning media that display animation, text, images, audio, graphics, and video in learning (Winatha, 2018). To improve student learning outcomes, the use of e-modules can be combined with innovative learning models (Winatha, 2018). The statement is supported by Elnovery's research report which says that learning accompanied by the application of the developed module can improve students' chemistry learning outcomes in teaching the subject of hydrolysis in RSBI schools or Rintisan Sekolah Bertaraf Internasional (Sihombing, 2022).

Based on the results of research conducted (Dewi, et al, 2020) with the title of interactive E-modules on student learning outcomes, it is concluded that students obtain higher learning outcomes compared to students taught using conventional learning models. Likewise, the results of research (Sihombing and Sitorus 2022) entitled Development of project-based chemistry e-modules on electrolyte and non-electrolyte solution materials

obtained an average value of student learning outcomes higher than the KKM value of 78.81.

Based on the background description, in increasing student motivation and learning outcomes, it is necessary to innovate in the learning process through the application of the PjBL learning model assisted by interactive e-module media on acid-base solution material, with the hope that student chemistry learning outcomes can increase.

▪ METHOD

This research design used a pretest-posttest control group design. This design uses two groups that are randomly selected. This research was conducted at SMAN 7 Medan during February 2023. The population in this study were all students of class XI MIPA SMAN 7 Medan in the school year 2022/2023 which amounted to 216 students divided into 6 classes. The data analysis technique was carried out by conducting tests (pretest and posttest) and testing motivation with a questionnaire sheet.. This research used project-based learning (PjBL) model. The treatment for the experimental class was to use an interactive e-module, while the control class used a textbook, as in Table 1:

Table 1 Research Design Of Pre-test Post-test Group

Research Group	***Pretest***	**Treatment**	***Posttest***
Experiment	**T1**	**X**	**T2**
Control	**T1**	**Y**	**T2**

Description:
T1 : Pre-test in experimental and control classes before treatment
T2 : Post-test and questionnaire of learning motivation in experimental and control classesX : PjBL learning model with interactive e-module media
Y : PjBL learning model with chemistry textbook

Furthermore, data processing uses Microsoft Excel 2010, which consists of normality tests, homogeneity of the average learning outcomes and student learning motivation as well as the correlation between motivation and learning outcomes. Calculating the average scoreand motivation of students using the formula:

$$\text{average} = \frac{\text{Total score of all students}}{\text{total of students}}$$

Then calculated the N-Gain using formula:

$$N - Gain = \frac{Score\ Post\ test - score\ pretest}{score\ maks - score\ pretest}$$

- **RESULT AND DISCUSSION**

Based on random sampling, XI MIPA 5 class was obtained as the experimental class and XI MIPA 6 as the control class. The results of data processing using Microsoft Excelare:

1. Normality Test

Test data normality using Chi Square Test where a significant level α = 0.05 accordingto the provisions if $x^2_{count} < x^2_{table}$ then it is declared normal distributed data. Normality test showed at Table 2 :

Table 2. Research Design Of Pre-test Post-test Group

Class	*Data*	X^2_{count}	X^2_{table}	*α*	Description
Experiment	*Posttest*	7.90	11.07	0.05	Normal
	Motivation	8.55	11.07	0.05	Normal
Control	*Posttest*	10.35	11.07	0.05	Normal
	Motivation	7.67	11.07	0.05	Normal

2. Homogeneity Test

The homogeneity test was carried out to see whether the data variance was homogeneous or not so that the research sample from the beginning was stated to be in the same state. Testing the homogeneity of the data variance of the two sample groups was carried out using the F test. Based on the homogeneity test of learning outcomes and interest in learning, homogeneous data were obtained as shown in Table 3 :

Table 3. Test Results of The Outcomes And Motivation Data Normality

Class	*Data*	F_{count}	F_{table}	Description
Experiment Control	*Pretest*	1.20	1.75	Homogeneous
	Posttest	1.21	1.75	Homogeneous
	Motivation	1.36	1.75	Homogeneous

From the data of Table 3, Fcount < Ftable then the three groups of data in this study are declared homogeneous.

3. Student Learning Outcomes Data

After receiving learning, students get a cognitive assessment in the form of numbers as the final result. The learning outcomes of both classes improved as indicated by the average pretest and posttest scores. The average student learning outcomes are shown inFigure 1:

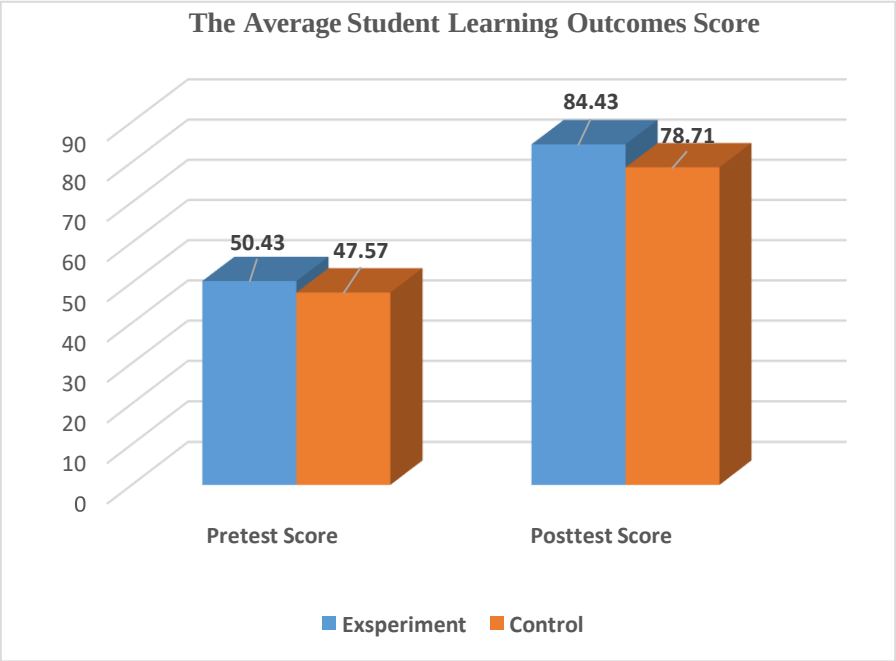

Figure 1 Average graph of Student Learning Outcomes

From Figure 1, the average value of learning outcomes of the control class is lower than the average value of the experimental class (78.71< 84.43.)

4. Student Learning Motivation

Learning motivation is a series of drives or driving forces that come from within oneself and from outside to carry out learning activities so as to cause change. Learning Motivation in this study is in the form of assessing student attitudes after following the learning process taught with the PjBL model assisted by interactive e-modules and without the help of interactive e-modules. Student learning motivation data is netted through a learning motivation questionnaire of 15 questions in the form of positive statements that will be filled directly by respondents (students). The average student learning motivation as shown in figure 2:

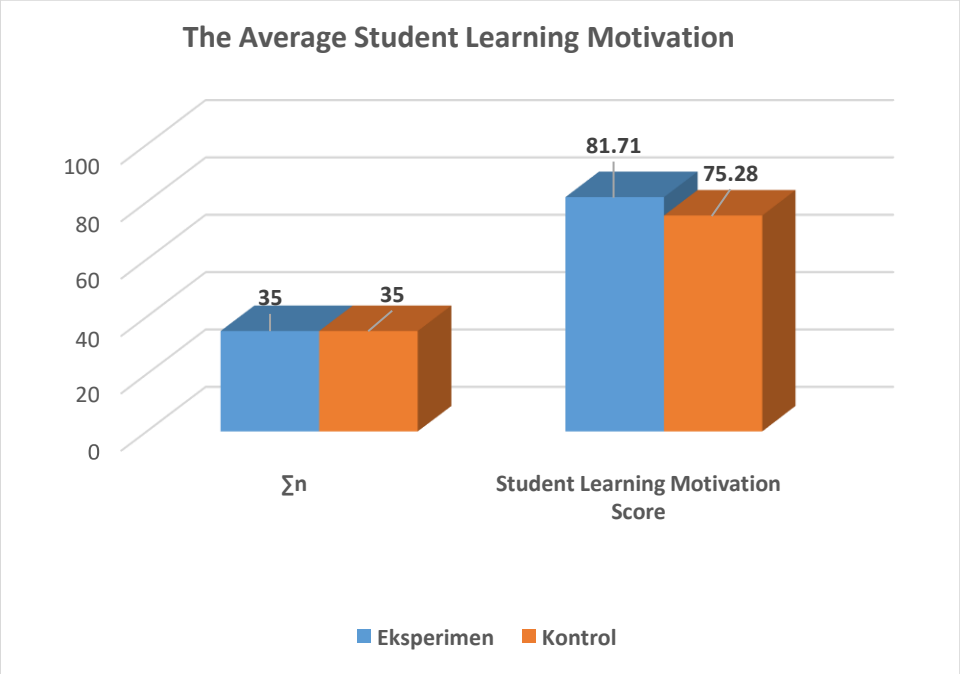

Figure 2 Average Study Motivation Graph

From data of Figure 2, the motivation in learning the experimental class is higher than the motivation in learning the control class (81.71 > 75.28).

5. N-Gain

The N-gain test was conducted to see the difference in Pretest and Posttest scores, thenit can be seen in Table 4:

Table 4. Improved Learning Outcomes (N-Gain)

Class	Data	*N-Gain*	% N-Gain	Criteria	Description
Experiment	**Learning Outcomes**	0,68	68%	1. g < 0,3 = low 2. 0,3 ≤ g ≥ 0,7 = medium 3. g > 0,7= high	medium
Control		*0,53*	53%		medium

Based on Table 4, the N-Gain difference between the two classes is 0.15 or 15% witha higher experimental class N-Gain increase.

6. Hypothesis Tet

After the data is confirmed to be normal and homogeneous, hypothesis testing is carried out. This hypothesis test uses a one-party t-test (right side) to determine whether a hypothesis is accepted or rejected.

Tabel 5. Hypothesis Test I Learning Outcomes

Class	$\bar{x}$	Variance	T_{count}	T_{table}	α	Description
Eksperiment	84.43	37.89	3.71	1.66	0.05	Ha is accepted, Ho is rejected
Control	78.71	46.09				

Based on Table 5, t_{count} = 3.71 and t_{table} = 1.66 were obtained, where $t_{count} > t_{table}$so Ha was accepted that means, there is an effect of using Interactive e-module on student learning outcomes.

Tabel 6. Hypothesis Test II Learning Motivation

Class	$\bar{x}$	Varians	T_{count}	T_{table}	α	Description
Eksperiment	81.71	101.06	2.88	1.66	0.05	Ha is accepted, Ho is rejected
Control	75.29	73.85				

Based on table 6, t_{count} = 2.88 and t_{table} = 1.66, where $t_{count} > t_{table}$. Ha is accepted, meaning that there is an effect of using interactive e-module on students' learning motivation.

Hypothesis III test or correlation test used to see the relationship between motivation and outcomes learning of student. The calculation is used with the product moment formula. Obtained a calculation of 0.440 and r_{table} of 0.334, this means that there is a significant correlation between motivation and learning outcomes in the medium category.

The sample in this study was taken randomly (random sampling) so that two classes were given different treatments. The experimental class (XI MIPA 5) was given teaching with the Project Based Learning (PjBL) model using interactive e-module media and the control class was given teaching with the PjBL model using student packet books. Based on posttest data, the average learning outcomes of experimental class students were higher than the control class (84.43 > 78.71).

This is in accordance with the results of hypothesis I testing, which means that there is an effect of using interactive e-modules on student learning outcomes on the material of acid and base solutions. This is in line with research previously conductedby Sihombing and Sitorus (2022) where student learning outcomes are higher than theKKM value of 78.81. Another study conducted by Samosir and Nainggolan (2022), obtained an increase in the chemistry learning outcomes of students taught by the application of chemistry e-modules based on Cooperative Learning type NHT higher,namely with an average N-gain value of 0.725 or 72.54% (high category).

In addition to learning outcomes, this study also analyzed student motivation at the end of learning. The average acquisition of student motivation scores in the experimental class was 81.71 while the average acquisition of student motivation scores in the control class was 75.29. Based on the results obtained, it can be seen thatthe learning motivation of students taught with the PjBL model assisted by interactive e-modules in

the experimental class is higher than the learning motivation of studentstaught with the PjBL model assisted by student packet books in the control class on Acid-Base material. This is in line with research conducted by Oksa and Soenarto (2020), that project-based e-modules effectively increase student learning motivation with an average score of 85.03 (high category) higher than the average score. The same research was conducted by Imansari, et al (2022) on the effectiveness of project-based e-modules on increasing student learning motivation which stated that the e-module data proved to be better. Classes that use project-based e-modules have higher learningmotivation scores.

Hypothesis III test or correlation test between motivation and student learning outcomes was conducted to find out how big the relationship between the two variablesis. Correlation can help in understanding whether there is a positive or negative relationship between learning motivation and student learning outcomes. Several studies have been conducted to test the relationship between learning motivation and student learning outcomes, such as research conducted by Arini, et al (2020) which states that there is a positive and significant correlation together between curiosity andlearning motivation with science learning outcomes which $r_{x1.x2} = 0.817$ and the coefficient of determination is 66.8%. Another study conducted by Aprily Ulya (2020)obtained the results of data analysis research significance value between learning motivation and student learning outcomes of 0.44. With Pearson correlation 0.044

<0.05, it can be said that there is a relationship between learning motivation and student learning outcomes. In this study, to test the correlation between motivation and student chemistry learning outcomes, the product moment formula was used with α =

0.05. Based on the calculation results obtained r_{count} of 0.440 and r_{Table} of 0.334. The value of $r_{count} > r_{Table}$ so it can be concluded that Ha is accepted or Ho is rejected, meaning that there is a significant correlation with a medium category between motivation and learning outcomes of students taught with interactive e-module media based on Project Based Learning on acid-base material. The contribution of student learning motivation to learning outcomes is 19.36%. So that, based on research that has been conducted at SMA Negeri 7 Medan, it is concluded that there is an influenceof interactive e-modules on students' motivation and learning outcomes on Acid-Base Solution material.

▪ CONCLUSION

Based on the results of the study, it can be concluded that learning by using interactive e-modules based on the Project Based Learning (PjBL) model can improve student learning outcomes and motivation. This is evidenced by the average value of student learning outcomes assisted by interactive e-modules is higher than the average value of student learning outcomes assisted by package books, namely 84.43> 78.71. Likewise, with learning motivation, learning using interactive e-modules is greater than that of textbooks (81.71 > 75.28). Based on the calculation results, the correlation coefficient (r) = 0.440 is included in the medium category. So, it can be concluded that there is a correlation between motivation and learning outcomes. That is, the higher the student's learning motivation, the higher the learning outcomes .

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