pISSN 2685-0761
eISSN 2685-0850

JURNAL INOVASI PEMBELAJARAN KIMIA
(Journal of Innovation in Chemistry Education)
https://jurnal.unimed.ac.id/2012/index.php/jipk
email: Jinovpkim@unimed.ac.id

Recieved : 18 May 2024
Revised : 6 October 2024
Accepted : 26 October 2024
Publish : 31 October 2024
Page : 203 – 210

The Influence of Problem Based e-Modules on Students' Motivation and Learning Outcomes in Acid-Base Material

Mhd. Fadhilah[1]* and Bajoka Nainggolan[2]

[1,2]*Chemistry Education Study Program, Universitas Negeri Medan, Medan*

**Email: maju.jaya290502@gmail.com*

Abstract **:** *The purpose of this study is to ascertain how problem-based online modules affect students' learning results in acid-base chemistry and to determine the correlation of e-modules with motivation and student learning in acid-base materials at SMA Negeri 11 Medan. This research took a sample consisting of 1 group, namely the experimental group in class XI MIPA 6. Tests for normality, homogeneity, hypothesis, and correlation are used in data gathering procedures. After testing, the prerequisite is that the experimental data is normally distributed, for the homogeneous test the experimental class is homogeneous. To test the hypothesis, test is used One Sample T Test, and to test the correlation test is used Product Moment then the data results are obtained for the value hypothesis* $t_{count} > t_{table}$, *then Ha is accepted and Ho is rejected with the pret-test value in the experimental class, namely X and the post-test value in the experimental class, namely X, correlation test* $r_{count} > r_{table}$, *then Ha is accepted and Ho is rejected. The findings indicated that learning results were different before and after receiving media therapy in the form of problem-based e-modules. Additionally, the relationship between students' motivation and the chemistry learning results in problem-based e-modules.*

Keywords**:** *e-module based on problems; learning outcomes; motivation*

INTRODUCTION

Education is an important part of human life. There are three ways to study in Indonesia: informal, formal, and non-formal (Wicaksono, 2017) . New concepts in education will emerge as a result of changing social dynamics which increasingly emphasize students' creative, emotional, intellectual and spiritual growth (Ardha et al., 2019) .

The world of education must utilize IT to provide more facilities and speed up the learning process. Fourth industrial revolution is characterized by the confluence of physical, biological, and digital space lines. Technological developments in big data, computers, robotics, artificial intelligence, and nanotechnology; improvements to the *Internet of Things* (IoT), are together referred to as industrial revolution 4.0 (Putriani & Hudaidah, 2021).

The degree to which a nation adopts the Industrial Revolution has a detrimental effect on the quality of schooling 4.0, especially for teachers. A teacher needs to be

wise, able to adapt to new technologies, and capable of handling difficulties wherever in the globe (Doringin et al., 2020) .

The outcomes of the SMA Negeri 11 Medan chemistry teachers' interviews, the data obtained shows that schools generally use conventional learning with discussion, question and answer and lecture approaches. The chemistry teacher interviewed also explained that he sometimes used Power Point as a learning medium. However, for certain reasons, this media is rarely used and is only used as a learning tool in class. In Indonesia, there are still teachers who fail to utilize learning technology. Previous research found that 62.15% of teachers rarely use IT and communication in learning, and 34.95% of teachers still lack mastery of IT and communication. (Nurhidayah, 2017; Syukur, 2014, in Syamsuar & Reflianto, 2018) .

Teacher-centered learning will make the class monotonous, make students bored, and make them less motivated to participate. Chemistry is an abstract field of study and requires students to understand it well before they can start. As a result, students quickly get bored when studying it. The PBL learning paradigm with e-module support is the most effective in acid-base theory. With the use of e-modules, the problems that students face during their education are the main emphasis of the problem-based learning paradigm.

When addressing issues, students may hone their critical thinking abilities with the aid of the problem-based learning paradigm. E-module is a technology-based learning resource that accommodates students learning without limited space and time via their smartphone.

LITERATURE REVIEW

According to Steffi Adam and Muhammad Taufik Syastra, educational media is every component of the learning process in both the physical and technological realms and can help teachers convey knowledge to students and achieve a goal (Hafiza et al., 2022). According to Gagne and Briggs, educational media are physical tools used to improve learning. All media are tools that help to achieve the desired goals. (Saragih & Dibyantini, 2024) In general, media includes videos, diagrams, photos, and mechanical and electronic devices used to display, operate, and transmit written or spoken information (Firmadani, 2020) .

According to Wina Sanjaya, the following are the functions of using educational media: 1) Communicative function, 2) Motivational function. 3) Meaningfulness Function, 4) Equalizing Point of View Function, and 5) Individuality Function.

E-modules are electronic adaptations of pre-assembled modules that can be read by a computer and configured with the necessary software (Islahiyah et al., 2021). E-modules are a source of learning material in the form of electronic documents that are specially prepared using computer applications or programs and equipped with multimedia elements to make them more interesting and interactive. (Mufida et al., 2022) .

Problem-based learning (PBL) begins by integrating and introducing new knowledge. In the PBL learning model, teachers and students collaborate to solve problems in small groups. Arends defines problem-based learning as an educational strategy in which students are challenged to solve difficulties in order to increase their understanding, critical and creative thinking abilities, and self-awareness (Setyoningtyas,et al., 2022). The problem-based learning method has three main characteristics, including: 1) Learning activities, 2) Objectives of the learning activities, and 3) Problem solving with a methodological and analytical approach.

The syntax of problem-based learning, according to Ibrahim, Nur, and Ismail, is as follows: 1) introducing students to the problem; 2) planning their education; 3) guiding small-group experiences; 4)

creating and presenting; and 5) assessing and analyzing the problem's solution process.

According to Sudarwan , motivation can be defined as the desire, difficulty, sharpness, willingness, or effort of an individual or group to fulfill certain goals (Suprihatin, 2015). According to Djamarah, the function of motivation is divided into three: 1) Motivation influences students' attitudes, 2) Motivation as an encouragement for action, and 3) Motivation as an encouragement for action.

Motivation is classified into intrinsic and extrinsic motivation based on its characteristics (Arianti, 2018). Extrinsic motivation is the drive to accomplish goals outside of one's own activities, whereas intrinsic motivation, also known as pure motivation, is the drive that originates from within oneself.

According to (Ginting & Purba, 2024), learning outcomes are skills obtained by students after achieving learning objectives . Students receive learning outcomes after the learning process is complete. For teachers, assessing learning outcomes is the conclusion and final step in learning activities. The final product of the learning process is called learning outcomes.

METHODS

The study will be conducted at SMA Negeri 11 Medan, which is situated on Jl. Pertiwi No. 93 in Bantan Village, Medan Tembung District, Medan City, North Sumatra Province, during the February–March even semester of the 2023–2024 academic year. All six classes of SMA Negeri 11 Medan's class XI pupils made up the study's population. In the meantime, MIPA 6 (35 students) was the experimental class, and the sample was obtained by *purposive sampling* from that one class.

Table 1 presents the research design, and the study is classified as quasi-experimental research, beneath this:

Table 1. Research design

Class	Pre-Test	Action	Post-Test
Experiment	O_1	X	O_2

The data analysis used in this investigation consists of:

N-Gain Test

$$g = \frac{Skor Posttest - Pretest}{Skor Maksimum - Pretest}$$

Normality test

Researchers use the *Liliefors test* using criteria that state that data is normally distributed if $L_{count} < L_{table}$

Homogeneity Test

$S^2 = \frac{\sum(X_i - X)^2}{n-1}$ and $S = \sqrt{\frac{\sum(X_i - X)^2}{n-1}}$

Hypothesis testing

$$t_{count} = \frac{\bar{X} - \mu_o}{\frac{S}{\sqrt{n}}}$$

Correlation Test

$$r = \frac{N \Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{\{N \Sigma X^2 - (\Sigma X^2)\} - \sqrt{\{N \Sigma Y^2 - (\Sigma Y^2)\}}}}$$

RESULT AND DISCUSSION

Result

Description Of Research Data Student Learning Outcomes

Based on the research thet has been carried out, data pre-test and post-test result can be seen in table 2.

Table 2. Learning outcome data

Class	Pre-test			Post-test		
	X	S	S^2	X	S	S^2
Exp	30.73	11.22	125.95	82.35	9.94	98.84

Based on the research that has been carried out, pre-test and post-test data in experimental class can be seem below in table 2. Pre-test and post-test data obtained will be described in Figure 1.

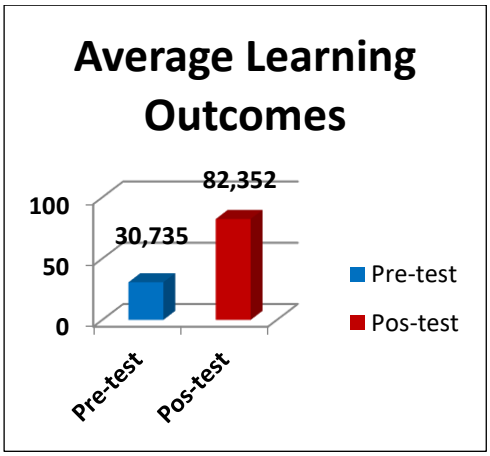

Figure 1. Graph of average learning outcomes student

Student's Motivation to Study

Based on the research that has been carried out, the data on student motivation obtained has described in Figure 2.

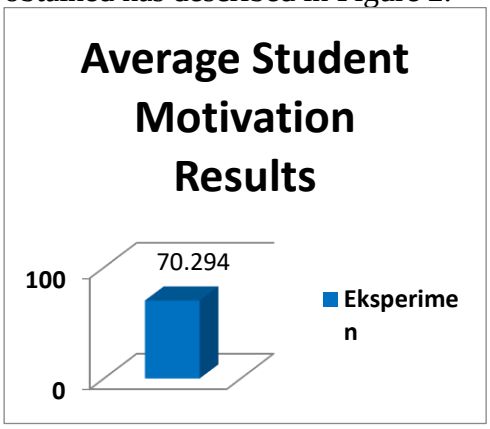

Figure 2. Average graph of motivation results student

Learning Outcome Data Analysis

Normality test

Based on the results of the normality test, it can be seen that data has be normal cause value is larger than 0.05 and the *Liliefors* test is used to evaluated the normality of data at a significance level of 0.05. The result can be seen in table 3.

Table 3. Normality test of learning result data

Class	Data	Sig (2 tailed)	Sig	Info
Exp	Pre-test	0.147	0.05	Normal Data
	Post-test	0.214	0.05	Normal Data

Homogeneity Test

The homogeneity test determines whether the variance in the data sample is homogeneous or not, which is done by calculating the sample variance and standard deviation. The smaller the standard deviation value, the more homogeneous the data. Table 4 presents the findings of the homogeneity test.

Table 4. Homogeneity test of result data study

Class	Data	Varians Data (S^2)	Standard Deviation (S)	Info
Exp	Post-test	98.834	9.941	Homogen

Gain Test (Increase in Learning Outcomes)

Based on the research that has been carried out, the data on N-Gain Student Learning Outcomes in the expriment class can be seen in figure 3..

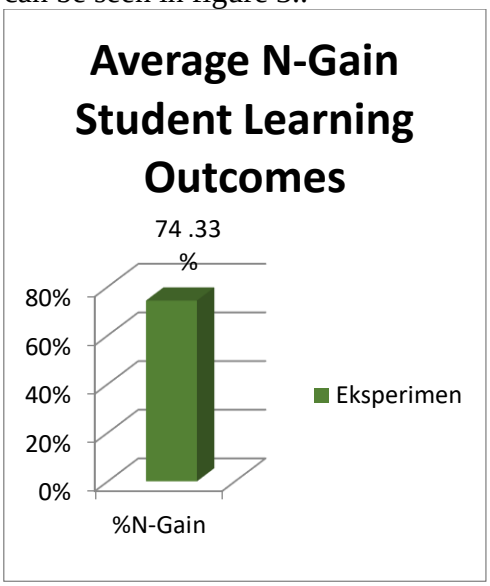

Figure 3. Average n-gain results graph student learning

The calculation results show that problem-based e-module learning in the experimental class increases learning outcomes by 0.7433, or 74.33%.

Hypothesis Testing

Hypothesis Test I

To test hypothesis I, utilize the t-test (One Sample T Test). According to the test requirements, if $t > t_{table}$, then Ha is approved and Ho is refused. In hypothesis I, the alternative hypothesis (Ha), is that the

school's KKM score is lower than the student learning outcomes taught through e-modules which focus on acid-base material.

Table 5. Hypothesis test learning results

Class	t_{hit}	t_{tabel}	Conclusion
Experiment	4.281	1.692	Ho rejected and Ha Accepted

Based on the hypothesis test, the researcher found a t_{hit} of 4.281 and a t_{table} with a significance level of a = 0.05 of 1.692, where the t_{hit} was greater than the t_{table}. Thus, we might say that Ho is rejected while Ha is accepted. In conclusion, problem-based e-modules yield superior learning results for students than traditional classroom KKM tests on acid-base content.

Hypothesis Test II

To determine whether there was a relationship between motivation and the learning results provided by problem-based e-module media, Hypothesis II testing was conducted. If $r_{hits} > r_{Table}$ (a= 0.05), then there is a relationship between learning objectives and motivation. The computations for the Hypothesis II tests are presented in Table 6.

Table 6. Hypothesis test learning results

Class	r_{hit}	r_{tabel}	$\propto$	Conclusion
Exp	0.783	0.339	0.05	Ho rejected and Ha accepted

The Coefficient of Determination (CD) is used to determine how much learning motivation affects student learning results, which is as follows:

$CD = r^2$

$CD = (0.783)^2$

$CD = 0.6131 = 61.31\%$

According to calculations, the $r_{calculated}$ is 0.783, and the r_{table} at the significance level a= 0.05 and N = 34 is 0.339. Therefore, $r_{hit} > r_{table}$ shows that There is a positive correlation between students' motivation and their learning outcomes when they use problem-based e-modules to teach acid-based content. As so, Ha is approved whereas Ho is rejected. Learning outcomes are influenced by 61.31 % by learning motivation, while other components contribute 38.69%.

Discussion

Based on statistical calculations, the experimental class's pre-test average was 30.73, while its post-test average was 82.35. These findings showed that students' learning outcomes in acid-base courses were better when they were taught using problem-based e-modules. Research by (Dewita & Andromeda, 2023) served as the foundation for this study, resulting in an average score of 35.3 for the pre-test and 81.6 for the post-test. Another study found an average pre-test score of 26.08 and an average post-test score of 81.08 (Yerimadesi & Rahmi, 2022). According to a research by (Damanik et al., 2024) the average pre-test score was 36.34, whereas the average post-test score was 85.83. The experimental group had a considerable rise in average pre-test and post-test scores, reaching 51.6. Treatment, specifically problem-based e-modules that affect the acid-base content in the experimental class, is the cause of this. Furthermore, there is a fair amount of concordance between the test results and the learning goals of the experimental class, which is homogeneous and normally distributed. This is demonstrated by the data's volatility and standard deviation.

Apart from learning outcomes, researchers also obtained data about students' learning motivation. With an average motivation score of 70.29, researchers found that the treatment, namely problem-based e-modules, had an impact on the acid-base material in the experimental class. In line with research such as (Soejana et al., 2020), It was found that the average learning desire of the students in the experimental class was 76, and research such as (Marpaung & Sitorus, 2024), found that the average student's learning motivation was 109.5 .

The correlation test between learning motivation and student learning results, often known as hypothesis testing II, the *product moment formula* with a= 0.05 is used. Based

on the calculation results, $_{\text{the calculated}}$ r is 0.783 and $_{\text{the table r}}$ is 0.339. The $_{\text{calculated}}$ r value > r $_{\text{Table}}$ means that it can be concluded that Ha is accepted and Ho is rejected, meaning that students' motivation and learning outcomes when taught using problem-based e-module media on acid-based content are positively correlated. Students' learning motivation has a significant influence on their learning outcomes, namely 61.31%, while other factors are 38.69%. The next aspect that needs to be considered is the internal elements that come from within the student and influence their learning drive, on the other hand, outside variables might also affect a student's motivation to study. Examples of external factors include the surrounding community, school environment, and family environment.

The use of e-modules as a learning tool increases student response. This is supported by research (Pratama et al., 2018), which analyzed student responses to the application of problem-based e-modules showing positive results. This positive response will build a good learning environment.

Problem-based e-modules have the potential to make students more engaged during learning activities. This motivates students to become more motivated in continuous learning, thus having an impact on their learning outcomes. Students can improve their ability to solve problems and participate in group discussions by using e-modules that incorporate problem-based learning. Research carried out at SMA Negeri 11 Medan explained that their motivation and learning outcomes regarding acid-base material were influenced by problem-based e-modules in learning.

CONCLUSION

Drawing on the findings of the conducted research, it can be said that:

Students who were taught through problem-based e-modules in experimental class learning had better learning outcomes (82.3) compared to the KKM score at school on acid-base material (75).

The learning results offered by problem-based e-modules when studying acid-based content are significantly correlated with student motivation, with a 61.31% correlation.

REFERENCE

Ardha, M. A., Gordisona, S., Ulfatin, N., & Supriyanto, A. (2019). Analisis Komparasi Sistem Pendidikan Indonesia dan Finlandia. TADBIR: *Jurnal Studi Manajemen Pendidikan,* 3 (2), 145-160. https://doi.org/10.29240/jsmp.v3i2.1102

Arianti, A. (2018). Peranan Guru Dalam Meningkatkan Motivasi Belajar Siswa. *Didaktika: Jurnal Kependidikan*, 12 (2), 117-134. http://dx.doi.org/10.30863/didaktika.v12i2.181

Damanik, N. U. B., Riris, I. D., Sitorus, M., Sihombing, J. L., & Syafriani, D. (2024). The Effect of E-Module on Activity and Learning Outcomes on Electrolyte and Nonelectrolyte Solutions. *Jurnal Inovasi Pembelajaran Kimia* (*Journal Of Innovation in Chemistry Education), 5*(2), 174–184. https://doi.org/10.24114/jipk.v5i2.54922

Dewita, R., & Andromeda, A. (2023). Efektivitas Penggunaan E-Modul Titrasi Asam Basa Berbasis Inkuiri Terbimbing Terintegrasi Video Percobaan Terhadap Hasil Belajar Peserta didik. *Jurnal Pendidikan MIPA*, 13 (1), 211-217. https://doi.org/10.37630/jpm.v13i1.861

Doringin, F., Tarigan, N. M., & Prihanto, J. N. (2020). Eksistensi Pendidikan Di

Era Revolusi Industri 4.0. *Jurnal Teknologi Industri dan Rekayasa*, 1 (1), 43-48. https://doi.org/10.53091/jtir.v1i1.17

Ginting, P., & Purba, J. (2024). The Influence of the Problem Based Learning Model on Student Interest and Learning Outcomes. *Jurnal Inovasi Pembelajaran Kimia* (*Journal Of Innovation in Chemistry Education)*, *6*(1), 46–52. https://doi.org/10.24114/jipk.v6i1.57279

Firmadani, F. (2020). Media Pembelajaran Berbasis Teknologi Sebagai Inovasi Pembelajaran Era Revolusi Industri 4.0. *Prosiding Konferensi Pendidikan Nasional*, 93-97.

Hafiza, M., Marlina, L., & Astuti, R. T. (2022). Pengembangan Media Pembelajaran Whiteboard Animation pada Materi Hidrokarbon sebagai Media Alternatif Pembelajaran Daring. *Jurnal Inovasi Pembelajaran Kimia* (*Journal of Innovation in Chemistry Education)*, *4*(1), 82. https://doi.org/10.24114/jipk.v4i1.33661

Islahiyah, I., Pujiastuti, H., & Mutaqin, A. (2021). Pengembangan E-Modul Dengan Model Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10 (4), 2107-2118. http://dx.doi.org/10.24127/ajpm.v10i4.3908

Marpaung, E. M., & Sitorus, M. (2024). The Influence of Problem Based Learning Weblog on Students Motivation and Learning Outcomes on Thermochemical. *Jurnal Inovasi Pembelajaran Kimia* (*Journal Of Innovation in Chemistry Education)*, *6*(1), 130–138. https://doi.org/10.24114/jipk.v6i1.57248

Mufida, L., Subandowo, M., & Gunawan, W. (2022). Pengembangan E-Modul Kimia Pada Materi Struktur Atom Untuk Meningkatkan Hasil Belajar. *JIPI: Jurnal Ilmiah Penelitian dan Pembelajaran Informatika*, 7 (1), 138-146. https://doi.org/10.29100/jipi.v7i1.2498

Pratama, G., Divayana, D.G.H., Sugihartini, N. (2018). Pengaruh E-Modul Berbasis Metode Pembelajaran Problem Based Learning Pada Mata Pelajaran Basis Data Terhadap Hasil Belajar Dan Motivasi Siswa (Studi Kasus: Kelas XII Rekayasa Perangkat Lunak Di SMK Negeri 1 Negara). *Jurnal Nasional Pendidikan Teknik Informatika*, 7 (2), 121-131. https://doi.org/10.23887/janapati.v7i2.12369

Putriani, J. D., & Hudaidah, H. (2021). Penerapan Pendidikan Indonesia Di Era Revolusi Industri 4.0. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(3), 830–838. https://doi.org/10.31004/edukatif.v3i3.407

Saragih, W. L., & Dibyantini, R. E. (2024). Implementation of an Integrated Problem Based Learning Model in Generic Science Skills in Acid-Base Material. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education*,

6(1), 8–19. https://doi.org/10.24114/jipk.v6i1.56437

Soejana, Y., Anwar, M., & Sudding, S. (2020). Pengaruh Media E-Modul Berbasis Flipbook pada Model Problem Based Learning (PBL) Terhadap Motivasi dan Hasil Belajar Peserta Didik Kelas XII SMA Negeri 1 Wajo (Studi Pada Materi Pokok Sifat Koligatif Larutan). *Chemica: Jurnal Ilmiah Kimia Dan Pendidikan Kimia*, *21*(2), 163. https://doi.org/10.35580/chemica.v21i2.17986

Setyoningtyas, N, M., Astriani, D., & Qosyim, A. (2022). Efektivitas E-Modul Berbasis Pendekatan Deduktif Pada Materi Sistem Ekskresi Manusia Terhadap Peningkatan Hasil Belajar Siswa. *Jurnal Pendidikan Sains*, 10 (1), 135-141.

Suprihatin, S. (2015). Upaya Guru Dalam Meningkatkan Motivasi Belajar Siswa. *Jurnal Pendidikan Ekonomi*, 3 (1), 73-82. http://dx.doi.org/10.24127/ja.v3i1.144

Syamsuar, S., & Reflianto, R. (2018). Pendidikan Dan Tantangan Pembelajaran Berbasis Teknologi Informasi Di Era Revolusi Industri 4.0. *Jurnal Ilmiah Teknologi*, 6 (2), 1-13. https://dx.doi.org/10.24036/et.v2i2.101343

Wicaksono, A. G. (2017). Fenomena Full Day School Dalam Sistem Pendidikan Indonesia. *Jurnal Komunikasi Pendidikan*, 1 (1), 10-18. https://doi.org/10.32585/jkp.v1i1.12

Rahmi, S., & Yerimadesi. (2022). Efektivitas E-Modul Titrasi Asam Basa Berbasis Guided Discovery Learning Terhadap Hasil Belajar Siswa XI di SMAN 7 Padang. *Jurnal Pendidikan MIPA*, 12 (3), 431-436. https://doi.org/10.37630/jpm.v12i3.633