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The Effect of Using Interactive e-Module on The Outcomes and Interest of Learning Students in Class X High School On Redox Reaction Material

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Abstract: The Effect of Using Interactive e-Module on The Outcomes and Interest of Learning Students in Class X High School On Redox Reaction Material. This study aimed to observe learning outcomes, interest in learning and the correlation between interest and learning outcomes conducted at SMA Negeri 2 Kabanjahe. The sample of this study was taken 2 classes randomly and used the project-based learning (PjBL) model. The treatment in the experimental class was assisted by interactive e-module while the control class was assisted by student pack books. Data collection used test instruments and interest questionnaires. Learning outcomes were used to calculate the normalised N-Gain on redox reaction material for the experimental class = 0.77 and the control class = 0.71. The difference in the increase in learning outcomes is 0.06 or 6%. Similar to learning outcomes, the average value of interest in learning for the experimental class was higher than the control class (77.12>72.88). It is also concluded that there is a positive correlation between interest and learning outcomes seen from rcount = 0.627 with a strong category.

Keywords: *Project-Based Learning*, e-Module, Learning Outcomes and Interests, Redox Reactions

Abstrak: Pengaruh Penerapan e-Modul Interaktif Terhadap Hasil Dan Minat Belajar Siswa Kelas X SMA Pada Materi Reaksi Redoks. *Penelitian ini ditujukan untuk mengamati hasil belajar, minat belajar dan korelasi antara minat terhadap hasil belajar yang dilakukan di SMA Negeri 2 Kabanjahe. Sampel penelitian ini diambil 2 kelas secara acak dan digunakan model project-based learning (PjBL). Perlakuan dikelas eksperimen berbantuan e-modul interaktif sedangkan dikelas kontrol berbantuan buku paket siswa. Pengumpulan data digunakan instrumen tes dan angket minat. Hasil belajar digunakan untuk menghitung N-Gain ternormalisasi pada materi reaksi redoks di kelas eksperimen = 0,77 dan kelas kontrol = 0,71. Selisih peningkatan hasil belajar adalah 0,06 atau 6%. Sama halnya dengan hasil belajar, nilai rata-rata minat belajar kelas eksperimen lebih tinggi dari kelas kontrol (77,12 >72,88). Juga disimpulkan terdapat korelasi positif antara minat dan hasil belajar terlihat dari r_{hitung} = 0,627 dengan kategori kuat.*

Kata Kunci : *Project-Based Learning, E-Modul, Hasil dan Minat Belajar, Reaksi Redoks*

• INTRODUCTION

Education is an effort with awareness designed to advance and develop human resources so that the learning atmosphere becomes interactive and conducive. So, education is a process of people beginning that allows them to develop according to their

potential and abilities, while teachers have a vital role in developing the potential and abilities from each student (Sihombing & Sitorus, 2022). The government through the education sector has made efforts from various aspects with the purpose of improving the education system, such as perfecting the curriculum from KTSP to K.13 to Merdeka Belajar curriculum. Curriculum improvement aims to provide improvements in satisfactory learning activities (Febrina, 2018).

Chemistry discusses the subject matter regarding the nature of matter, chemical structure, laws, principles, and theoretical concepts of material change (Rokhim et al., 2020). The complaints of students in studying chemistry are very boring. Because chemistry is complicated, abstract, and difficult to study. Chemistry is considered difficult and not important to everyday life, which is one of the negative perceptions about chemistry. In fact, redox reactions are widely found in reality since their components are closely related to daily life such as photosynthesis reactions, fossil fuel combustion reactions, and metal rusting.(Khaerudin, 2022). Redox reaction is SMA chemicals that contain symbolic, sub-microscopic and macroscopic concepts. The symbolic aspect leads to the use of chemical symbols, the sub-microscopic aspect leads to the process of acceptance and release of invisible electrons. So difficult to understand and explain redox reaction material (Suryati et al., 2022).

In general, teachers deliver material using only textbooks. Where students find it difficult to understand the textbook because the language is standard and less interesting. As a result, students' reading interest is less resulting in low learning outcomes (Dewi & Lestari, 2020). Students' lack of interest in learning affects their learning outcomes (Ningsih et al., 2022). Learning interest is an internal factor that will affect student learning outcomes. A student has an interest in learning as indicated by several indicators of interest, including a sense of like / pleasure, a statement of preference, a sense of interest, an awareness of learning without being told, participating in learning activities, and giving attention (Rozikin et al., 2018). So, improving student learning outcomes and interests requires the ussing of appropriate models and media according to the teaching material. Project-based learning (PjBL) is a model of innovative learning where prioritizes contextual learning based on complex and product-based activities (Hulu & Simorangkir, 2022). PjBL is perceived as an effective and engaging learning method. PjBL provides an effective method to produce students who are critical, analytical, creative, innovative, responsive, and reflective in facing 21st century competencies (Utami& Senam, 2021). A characteristic of PjBL is the requirement for students to design their projects to be completed within a set time limit (Wijayanti ea al., 2021). The syntax of PjBL learning is: 1) giving essential question, 2) project planning, 3) create a schedule of project, 4) monitoring project, 5) assess the outcome, and 6) Evaluating the experience (Purnomo & Ilyas, 2019).

Besides the learning model, the success of a learning is also influenced using learning media. According to Latuheru, learning media are all tools used in the learning process aimed at providing information related to study from teachers to students (Hasan et al., 2021). One of the growing media today is e-module. e-Modules are part of technology development products oriented towards teaching materials that can make up the learning process (Ulum et al., 2021). e-Module is a teaching material developed with software containing text, images and videos that can be read by electronic devices. e-Module is a module made in electronic or digital form containing various variations of interactive media (Asrizal et al., 2022). Interactive e-modules are defined as modules that combine two or more interactive text, images, audio, video to control commands among

users and e-modules. (Dewi & Lestari, 2020). e-Module is a new instructional media for students to improve mastery of lesson and student learning outcomes. e-Modules can also be interpreted as electronic modules that consist of text, graphics, images, videos, and animations that are available anytime and anywhere. In general, there are 5 characteristics of e-module, namely: 1) self-instructional means that students learn on their own without relying on others, 2) self-contained, e-module contain all materials, concepts of the material needed by students, 3) stand alone, e-modules are able to stand alone, 4) adaptive, e-modules are able to follow the latest technological developments, and 5) user friendly, meaning that e-module make readers or students feel happy and familiar (Adawiyah & Susilawati, 2022). Some of the advantages of using e-modules are: 1) increase student motivation, because assignments are adjusted based on instructions so that they can be done, 2) evaluation, help the user to see which parts have been achieved or have not been achieved, 3) learning materials in one semester can be divided, 4) subject matter is arranged according to level 5) the way of presentation is more dynamic and interactive than printed modules, and 6) the element of verbalism in printed modules can be minimised through the creation of visual elements in the form of videos (Laili et al., 2019).

Based on observations and teacher interviews at SMAN 2 Kabanjahe, data was known that Criteria for Minimum Achievement (CMA) for redox reaction is 75, where around 40% of students have not reached KKM. Low student learning outcomes are caused by several factors such as incorrect understanding of concepts, use of models or learning media. There are many complaints from students that chemistry learning is only based on textbooks given by the school. This is the main cause of students feeling tired, so they are not interested in participating in chemistry learning which has an effects on the low outcomes and interest to learning chemistry. Interactive media can be used in learning to deliver information between teachers and students to create real learning conditions and help students absorb material and find solutions to problems. The results of previous research, (Setiawan et al., 2022) stated that the application on interactive media can increase students' interest in learning. Found that the PjBL model accompanied by e-module media was proven to improve student learning outcomes, research (Mulliaman & Mellyzar, 2020) reported that students taught with the PjBL model obtained an average increase in chemistry learning outcomes higher than students taught with conventional models (0.728> 0.627). Likewise, research (Afriani et al., 2022) reported that the application of chemistry e-module provided an increase in student chemistry learning outcomes on the topic of thermochemistry compared to those who did not use e-module.

- **METHOD**

This study was classified as a quasi-experiment to know the effect of a treatment. This research was carried out at SMAN 2 Kabanjahe in February 2023. The population was all students of class X MIPA SMAN 2 Kabanjahe for the 2022/2023 school year totalling 192 people in 6 classes. So, 2 classes were taken as samples (experiment and control) with random sampling. Data collection with test (pretest and posttest) and non-test (interest questionnaire) techniques. This study used project-based learning (PjBL) model. The treatment for the experiment class is to used interactive e-module but the control class used student package books, like Table 1:

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

Research Group	*Pre-test*	Treatment	*Post-test*
Experiment	T_1	X	T_2
Control	T_1	Y	T_2

Information :
T_1 : Pre-test (Initial ability test)
T_2 : Post-test and final interest questionnaire (Final ability test)
X : PjBL model used e-module
Y : PjBL model used student package book

Furthermore, data processing was using Microsoft Excel 2010, which consists of normality, homogeneity, average learning outcomes and interests and the correlation between interest and learning outcomes. Calculate the average grades and interests of students used the formula:

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

Then calculated the N-Gain using formula:

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

- **RESULT AND DISCUSSION**

Based on random sampling, X MIPA 2 class was obtained as the experiment class and X MIPA 4 as the class control. The results of data processing using Microsoft Excel were:

1. Normality Test

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

Table 2 Test Results of The Outcomes And Interest Data Normality

Class	Data	x^2_{count}	x^2_{table}	A	Exp.
Experiment	*Pretest*	10.46	11.07	0.05	Normal
	Posttest	7.80	11.07	0.05	Normal
	Interest	4.88	11.07	0.05	Normal
Control	*Pretest*	10.28	11.07	0.05	Normal
	Posttest	10.96	11.07	0.05	Normal
	Interest	9.02	11.07	0.05	Normal

2. Homogeneity Test

The homogeneity test was carried out to find out whether the data variance was homogeneous or not, therefore the research samples were declared to be in the same condition from the beginning. Homogeneous data were obtained as shown in Table 3 below:

Table 3 Test Results of Homogeneity Test from Outcomes And Interest

Class	Data	F_{count}	F_{table}	Exp.
Eksperiment Control	*Pretest*	1.52	1.79	Homogen
	Posttest	1.32	1.79	Homogen
	Interest	1.33	1.79	Homogen

From the data of Table 3, $F_{count} < F_{table}$ then the three groups of data in this study were declared homogeneous.

3. Student Learning Outcomes Data

Learning outcomes were cognitive scores in the form of numbers obtained by students after completing the concepts of the lesson. The learning outcomes of both classes experienced a fairly high increase, seen from the average value of the pretest to the posttest. The average learning outcomes in this study were shown in Figure 1:

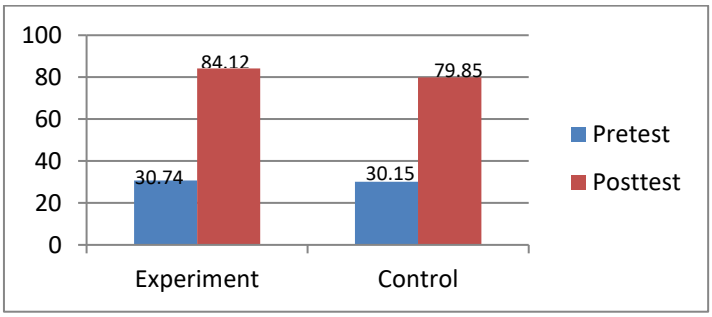

Figure 1 Average graph of Student Learning Outcomes

From Figure 1, the average value of learning outcomes of the control class was lower than the average value of the experimental class (79.85 < 84.12).

4. Student Learning Interest

Interest in learning is an encouragement or pleasure from oneself to do something with full awareness without pressure or coercion from others so that it can bring changes in behavior, knowledge and skills. Student learning interest data was collected through a 30-item learning interest questionnaire in the form of positive statements to be filled in directly by respondents (students). The average student interest in learning as shown in Figure 2:

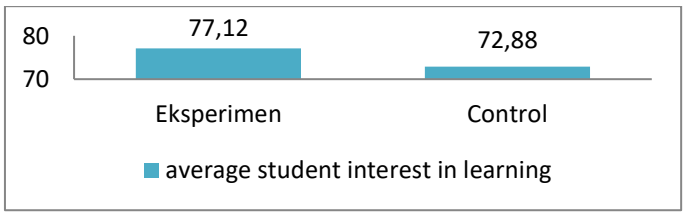

Figure 2 Average Study Interest Graph

From data of Figure 2, the interest in learning the experimental class was higher than the interest in learning the control class (77.12 > 72.88).

5. N-Gain

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

Table 4 Improved Learning Outcomes (N-Gain)

Class	Data	N-Gain	% N-Gain	Criterion	Information
Experiment	Learning Outcomes	0,77	77%	1. g < 0,3 = low 2. 0,3 ≤ g ≥ 0,7= medium 3. g > 0,7= high	High
Control		0,71	71%		High

Based on Table 4, So N-Gain difference between the two classes is 0.06 or 6% with N-Gain higher experimental class upgrade.

6. Test the Hypothesis

Hypothesis testing was carried out after the data was confirmed to be normal and homogeneous. This hypothesis test uses a one-sided t-test (right side) to determine whether a hypothesis was accepted or rejected.

Table 5 Test Hypothesis I Learning Outcomes

Class	$\bar{x}$	Variance	T_{count}	T_{table}	A	Informatioan
Eksperiment	84.12	31.016	3.369	1.668	0.05	Ha is accepted, Ho is rejected
Control	79.85	23.463				

Based on Table 5, $t_{count} = 3.369$ and $t_{table} = 1.668$ 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.

Table 6 Test Hypothesis II Learning Interest

Class	$\bar{x}$	Varians	T_{count}	T_{table}	A	Information
Eksperiment	77.12	63.561	2.341	1.668	0.05	Ha is accepted, Ho is rejected
Control	72.88	47.743				

Based on table 6, $t_{count} = 2.341$ and $t_{table} = 1.668$, where $t_{count} > t_{table}$. Ha was accepted, meaning that there was an effect of using interactive e-module on students' learning interest.

Hypothesis III test or correlation testing was conducted to check the correlation of interest and students' learning outcomes. The calculation used with the product moment formula obtained rcount of 0.627 and rtabel of 0.339, it means there was a significant correlation of interest and learning outcomes.

In this study, both classes used a project-based learning model with different treatment on experimental classroom using interactive e-module and control class using student package books. So that the average value of learning outcomes of the experiment class was higher than the control class (84.12 > 79.85). This was in accordance with the output of hypothesis I test, which means that there was an effect of using interactive e-modules on student learning outcomes on redox reaction material. These results were in accordance with the results of research conducted by (Dewi & Lestari, 2020) which states that the used of the interactive e-module was proven to improve student learning outcomes, shown by the posttest average value in the experimental class of 87.77 while

in the control class it was only 82.29. Likewise, the results of research conducted by (Siregar & Harahap, 2020) which said that the use of PjBL-based e-module increased the learning outcomes of n-gain chemistry which was melted by 0.78 classified as high. This shows that the PjBL learning model that emphasizes activeness and creativity in solving problems and working on projects can improve learning outcomes.

The application of e-module-assisted PjBL also affects students' learning interest. Seen in the average results, students' learning interest in the control class was lower than the average interest, experimental class (72.88 < 77.12). This was in line with hypothesis II test, which means that there was an effect of using interactive e-modules on students' interest in learning. This was because the experimental class that used the PjBL model assisted by interactive e-modules could attract students' attention so that students were happy and excited in participating in learning. These results were in line with previous research by (Ningsih et al., 2022) which stated that e-module media can insert images, graphics, audio, links, and videos in the form of flipbooks that will arouse student interest in learning.

In hypothesis test III or the correlation using the product moment obtained r_{count} of 0.627 and r_{table} of 0.339. Value $r_{count} > r_{table}$ which means there was significant correlation among students' interest and learning outcomes taught with e-modules on redox reaction materials. Where the r value (correlation coefficient) obtained was 0.627 strong category. So it can be said that the higher the student's learning interest, the higher the learning outcomes that will be obtained by students. The contribution of student interest in learning to student learning outcomes was 39.3% while 60.7% was caused by other factors. Other factors in question are internal factors (from within students) and external factors (from outside students) for example, factors of the school environment, home or family environment. So based on research that has been conducted at SMA Negeri 2 Kabanjahe, it is concluded that there is an influence of interactive e-module on students' interests and learning outcomes on redox reaction material.

• CONCLUSION

Based on the results of the discussion, it is possible to conclude that the use of interactive e-module in learning is able to improving students' learning outcomes and interest.Where the average value of student learning outcomes assisted by interactive e-module is higher than the average value of student learning outcomes assisted by package books, which is 84.12 > 79.85. Likewise, the interest in learning using interactive e-module is greater than the package book (77.12 > 72.88). From the calculation, the correlation coefficient (r) = 0.627 is included in the strong category. So there is a significant correlation between interest and learning outcomes. It is mean if higher the interest in learning students so higher too learning outcomes.

• REFERENCES

Adawiyah, R., & Susilawati, S. (2021). Development Of Interactive E-Module On Oxidation-Reduction Concept. *Jtk (Jurnal Tadris Kimiya)*, *6*(2), 202-212. https://doi.org/10.15575/jtk.v6i2.10288

Afriani, N., Haris, M., Savalas, L. R. T., & Sofia, B. F. D. (2022). Pengaruh Modul Elektronik Kimia terhadap Hasil Belajar Siswa Kelas XI MIPA SMAN 1 Jonggat pada Materi Termokimia. *Jurnal Ilmiah Profesi Pendidikan*, *7*(1), 84–88. https://doi.org/10.29303/jipp.v7i1.393

Asrizal, Maharani Zan, A., & Mardian, V. (2022). The Impact of Static Fluid E-Module by Integrating STEM on Learning Outcomes of Students. *Journal of Education Technology*, *6*(1), 110–118. https://dx.doi.org/10.23887/jet.v6i1.4

Dewi, M. S. A., & Lestari, N. A. P. (2020). E-Modul Interaktif Berbasis Proyek terhadap Hasil Belajar Siswa. *Jurnal Imiah Pendidikan Dan Pembelajaran*, *4*(3), 433–441.

Febrina, D. I. (2018). Studi tentang Pelaksanaan Pembelajaran Geografi Berdasarkan Standar Proses di SMA Negeri 7 Padang. *Jurnal Buana*, *2*(1), 338. https://doi.org/10.24036/student.v2i1.81

Hasan, M., Milawati, M. P. I., Darodjat, M. P. I. D., & Khairani, M. A. I. D. T. (2021). *Media Pembelajaran*. Penerbit Tahta Media Group.

Hulu, S. J. R., & Murniaty Simorangkir. (2022). Pengaruh Penggunaan Modul dalam Pembelajaran Kimia Berbasis Proyek terhadap Hasil Belajar Siswa Kelas XI Semester 1 pada Materi Termokimia. *Educenter : Jurnal Ilmiah Pendidikan*, *1*(3), 141–151. https://doi.org/10.55904/educenter.v1i3.62

Khaerudin, R. B. (2022). Identification of The Learning Obstacles in Redox Reaction Concept of The Senior High School Students. *Jurnal Pendidikan dan Pembelajaran Kimia,*11(3), 48–55. https://doi.org/10.23960/jppk.v11.i3.2022.06

Laili, I., Ganefri, & Usmeldi. (2019). Efektivitas pengembangan e-modul project based learning pada mata pelajaran instalasi motor listrik. *Jurnal Imiah Pendidikan Dan Pembelajaran, 3(3),306–315*. https://doi.org/10.23887/jipp.v3i3.21840

Ningsih, R., Rica Wijayanti, R., & Affaf, M. (2022). The Effect of The Use of Project Based Learning Models and Flip Based E-Modules on Statistics Materials on Students' Interest and Learning Outcomes of Class XI TKJ Students at SMK Ifadah. *Jed (Jurnal Etika Demokrasi)*, *7421*(2), 341–349. https://doi.org/10.26618/jed.v

Mulliaman, A dan Mellyzar. (2020). Peningkatan Hasil Belajar Menggunakan Model Project Based Learning Pada Materi Laju Reaksi. *Journal of Chemistry Education 9*(2252), 852–853. https://doi.org/10.1007/978-3-030-58292-0_130436

Purnomo, H., & Ilyas, Y. (2019). *Tutorial Pembelajaran*.

Rokhim, D. A., Widarti, H. R., & Fajaroh, F. (2020). Pengembangan Bahan Belajar Flipbook Pada Materi Redoks Dan Elektrokimia Berbasis Pendekatan Stem-Pjbl Berbatuan Video Pembelajaran. *Kwangsan: Jurnal Teknologi Pendidikan*, *8*(2), 234. https://doi.org/10.31800/jtp.kw.v8n2.p234--250

Rozikin, S., Amir, H., & Rohiat, S. (2018). Hubungan Minat Belajar Siswa Dengan Prestasi Belajar Siswa Pada Mata Pelajaran Kimia Di Sma Negeri 1 Tebat Karai Dan Sma Negeri 1 Kabupaten Kepahiang. *Alotrop*, *2*(1), 78–81. https://doi.org/10.33369/atp.v2i1.4740

Setiawan, F., Febriyana, E., Dianti, E. F., & Sari, M. (2022). Penggunaan Kahoot Sebagai Media Interaktif Terhadap Kemudahan Penggunaan dan Minat Belajar Siswa SMK Jurusan TKJ Se-Kecamatan Natar. *Jurnal pendidikan Teknologi Informasi dan Vokasional,* 4(1), 9-17. http://jurnal.fkip.unila.ac.id/index.php/JPVTI/article/view/23684

Sihombing, I. S., & Marham Sitorus. (2022). Pengembangan E-Modul Kimia Berbasis Proyek pada Materi Larutan Elektrolit dan Non Elektrolit. *Educenter : Jurnal Ilmiah Pendidikan*, *1*(4), 306–315. https://doi.org/10.55904/educenter.v1i4.89

Siregar, A. D., & Harahap, L. K. (2020). Pengembangan e-modul berbasis project based learning terintegrasi media komputasi hyperchem pada materi bentuk molekul. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *10*(1), 1925-

1931. https://doi.org/10.26740/jpps.v10n1.p1925-1931

Suryati, Surningsih, & Mashami, R. A. (2022). Pengembangan E-Modul Interaktif Reaksi Redoks Dan Elektrokimia Berbasis Nature Of Science Untuk Penumbuhan Literasi Sains Siswa Development of Nature Of Science-Based Interactive E-Module for Redox and Electrochemical Reactions for the Growth of Students. *Reflection Journal*, *2*(1), 26–33.

Ulum, M., Sudarmin, S., & Priatmoko, S. (2021). The Validity of Colloid e-Module Based STEAM Integrated with Socio-scientific Issues. *Jurnal Pendidikan dan Pembelajaran Kimia*, *10*(3). DOI: 10.23960/jppk.v10.i3.2021.12

Utami, G. N., & Senam, S. (2021). Implementation of Project Based Learning Model for Enhancing Students' Practical Skill and Scientific Literacy. *Jurnal Pendidikan dan Pembelajaran Kimia*, *10*(2), 103-112. DOI: 10.23960/jppk.v10.i2.2021.08

Wijayanti, S. W., Prodjosantoso, A. K., & Solikhin, F. (2021). The Effect of Using PjBL in Students' Conceptual Understanding and Science Process Skills. *Jurnal Pendidikan dan Pembelajaran Kimia*, *10*(2), 93-102. DOI: 10.23960/jppk.v10.i2.2021.07