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The Influence of the Discovery Learning Model Assisted by E-Modules on Improving High School Students' Chemistry Learning Outcomes on Buffer Solution Material

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Abstract: The Effect of Discovery Learning Model Assisted by E-Modules on Improving Chemistry Learning Outcomes of High School Students on Buffer Solution Material. This study aims to determine the effect of the *Discovery Learning learning model* assisted by *E-Modules* on improving the chemistry learning outcomes of high school students on the material of buffer solutions. This study used two classes, in the experimental class given treatment using the *Discovery Learning learning model with Ispring* media , and for the control class using a conventional learning model. From the results of the study, the average value after being given a pretest in the experimental class was 29.6, and the average value of the control class was 32. After being given treatment, then given a posttest, the average value of student learning outcomes in the experimental class was 77.8 and the average value of the control class was 76.6, both classes experienced an increase in learning outcomes, in the experimental class an increase of 0.68 or 68% and in the control class an increase of 0.65 or 65% after being given treatment. It can be concluded that the *Discovery Learning learning model* assisted by *E-Modules* can improve students' chemistry learning outcomes, especially in the material of buffer solutions.

Keywords: Discovery Learning , E-Module , Learning Outcomes, Buffer Solution

Abstrak: Pengaruh Model Discovery Learning Berbantuan E-Modul terhadap Peningkatan Hasil Belajar Kimia Siswa SMA pada Materi Larutan Penyangga. *Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran Discovery Learning berbantuan E-Modul terhadap peningkatan hasil belajar kimia siswa SMA pada materi larutan penyangga. Penelitian ini menggunakan dua kelas, pada kelas eksperimen diberikan perlakuan menggunakan model pembelajaran Discovery Learning dengan media Ispring, dan untuk kelas kontrol menggunakan model pembelajaran konvensional. Dari hasil penelitian diperoleh nilai rata-rata setelah diberikan pretest pada kelas eksperimen sebesar 29,6, dan nilai rata-rata kelas kontrol sebesar 32. Setelah diberikan perlakuan, kemudian diberikan posttest diperoleh nilai rata-rata hasil belajar siswa pada kelas eksperimen sebesar 77,8 dan nilai rata-rata kelas kontrol sebesar 76,6, kedua kelas tersebut mengalami peningkatan hasil belajar, pada kelas eksperimen mengalami peningkatan sebesar 0,68 atau 68% dan pada kelas kontrol mengalami peningkatan sebesar 0,65 atau 65% setelah diberikan perlakuan. Dapat disimpulkan*

bahwa model pembelajaran Discovery Learning berbantuan E-Modules dapat meningkatkan hasil belajar kimia siswa khususnya pada materi larutan penyangga.

Kata Kunci: *Discovery Learning, E-Module, Hasil Belajar, Larutan Penyangga*

• INTRODUCTION

Chemistry is one of the subjects that is considered difficult for students. According to Ashadi (2009), the causes of difficulty in learning chemistry include many abstract chemical concepts and the lack of teacher competence in using interesting learning media. One of the chemical materials that is considered abstract is buffer solution.

Buffer solutions are materials that require students to have good mastery of concepts and mathematical abilities, this is because the material on buffer solutions is included in the concept of solutions so that an initial understanding of the concept of equilibrium, the concept of acids and bases and stoichiometry is needed in order to understand the concept of buffer solutions properly. (Stephanie, et al., 2019).

In addition, Retno Dwi Suyanti (2010) said that the delivery of material delivered by teachers only verbally can cause communication failure between teachers and students. If learning runs effectively, learning objectives will certainly be achieved with maximum results (Istiqomah, 2019). Other problems in learning are the low absorption of students to the material to be taught and the lack of understanding of the learning concept, this will cause students to experience pseudo learning, namely learning that has no meaning (Purwanto, 2016). With this problem, it will produce low student learning outcomes. This learning outcome is a learning process that is still conventional here teachers tend to provide learning in one direction so that students become passive.

In order to attract students to chemistry, a teacher can make an effort that can attract students' interest in learning chemistry. One effort that can be done or used is by changing the learning model. (Winarti and Sunarti, 2017). A more effective learning model can increase interest, enthusiasm, the ability to work with friends in finding a problem, and the joy of students and is expected to improve student learning outcomes.

Discovery Learning learning model is one of the more active learning activities, because it contains a number of mental processes carried out by students (Rutonga, 2017). *Discovery Learning* indirectly makes students more creative and critical in thinking. Not to mention, this model is also able to make students more independent in finding a conclusion or learning material (Sunarto and Amalia, 2022). The use of the discovery learning learning model is expected to improve students' understanding of mathematical concepts. In discovery learning, students play an active role in discovering a concept (Rahayu,et all., 2018). The application of *discovery learning* in chemistry subjects is a good choice because this model has several advantages such as increasing students' experience in learning, giving students the opportunity to get closer to sources of knowledge other than books, exploring students' creativity, being able to increase students' self-confidence, and increasing cooperation between students (Syawal., et al., 2022).

Based on research conducted by Bella (2022), there was an increase in student learning outcomes with the *Discovery Learning model* where there was an increase in the learning outcomes of students in the experimental class by 75% while the increase in the learning outcomes of students in the control class was 66.25%. This means that it is possible to use the *discovery learning model* to produce an increase in learning.

In addition to the need to replace the learning model, teaching materials are also as important as the learning model. Teaching materials that are suitable for *discovery learning* are e-modules. Where this *E-Module* can guide students to learn actively and independently. Good learning is also very important in the running of education in the classroom properly. E-modules with *discovery learning* are good to apply to buffer solution material because the images, tables, and videos presented in the e-module are considered able to help students understand the learning material (Permatasari., et al., 2022). The e-modules that are made certainly have several criteria, namely: (a) E-modules that can limit teacher dominance in learning so that students play an active role in learning and (b) can improve students' cognitive abilities while still paying attention to affective and psychomotor abilities (Harahap, Et. All., 2022). Therefore, E-Modules are suitable for Discovery Learning.

- **METHOD**

This type of research or research design uses quasi-experiments to see the differences in learning outcomes in the experimental class and the control class by providing a pretest-posttest. This study also uses a quantitative approach where the Quantitative Approach is a study that takes a large amount of data and aims to test hypotheses using existing theories. This study is divided into two classes, namely for the control class in the form of conventional learning using textbooks while for the experimental class it is carried out using discovery learning assisted by E-Modules.

This research was conducted at Berastagi Private High School, JL. Berastagi District, Karo Regency, North Sumatra Province, Academic Year 2023/2024, June to August 2024.

The population in this study were all students of class XI IPA of SMA Swasta Bersama Berastagi consisting of 3 classes with a total of around 74 students. Where the sampling used the purposive sampling technique, namely the technique of determining samples with certain considerations. From 3 classes of XI IPA at SMA Swasta Bersama Berastagi, 2 classes will be obtained. Where the first class will be used as an experimental class and the second class as a control class. The experimental class will be taught using the *Discovery Learning model* assisted by e- *modules* and the second class will be taught using the conventional model using textbooks.

The data collection tool used is an objective instrument in the form of multiple choice consisting of five choices (a, b, c, d, e) and there is only one correct answer. This test is given to students before being given treatment (Pre-Test) and also at the end of learning after treatment (Post-test) which aims to determine student learning outcomes. Before the questions are tested on (sample), the questions are first tested on students outside the research sample. The instrument trial is carried out on samples that have the same characteristics as the research sample that has been obtained. The instrument trial is attempted to be the same as the actual research conditions. This aims to determine the validity, reliability, discriminatory power and level of difficulty of the questions so that questions are obtained that meet the quality required in the preparation of the test device that will be tested on the treatment group in the actual research.

In this study, data analysis was carried out after the post-test process was completed in each class, the data on student learning outcomes in each treatment combination group were tabulated, then the data was processed according to the stages of research data processing. Data analysis used was by using normality test, homogeneity test and

hypothesis test. In the normality test, the Chi Square (X2) test was used to determine whether the data was normally distributed or not. The homogeneity test was carried out to determine the level of data homogeneity. While the hypothesis test was carried out using paired sample T-test analysis and finally the n-gain test to see the improvement in the learning outcomes carried out.

- **RESULT AND DISCUSSION**

In this study, the improvement of learning outcomes was measured by the treatment that had been carried out in both classes (control and experiment) in the form of pretest and posttest. So to measure the learning outcomes, multiple choice questions were given to each student at the end of the learning. Based on the data analysis that has been carried out, the following research data were obtained:

1. Normality Test
   To find out whether the data obtained is normally distributed or not, a chi square test is carried out at a significance level of $\alpha = 0.05$ with the criteria where the calculated Chi Square < Chi Square table, then the data is normally distributed as in the following table:

Table Normality Test

Class	Data	X^2 Count	X^2 Table	Information
Experimental Class	Pretest	8.94	11.07	Normally Distributed
	Posts	10.99	11.07	Normally Distributed
Control Class	Pretest	8.14	11.07	Normally Distributed
	Posttest	9.08	11.07	Normally Distributed

2. Homogeneity Test
   The homogeneity test is carried out to determine whether the data obtained has the same characteristics or is called homogeneous or not. This test is carried out by calculating the standard deviation and sample variance. Decision making is a homogeneity test, namely if F count <F table then the data is homogeneous and vice versa, if F count> F table then the data is not homogeneous, as can be seen in the following table:

Table Homogenety Test

Data	Class	F Count	F table	Information
Pretest	Experimental Class	1.00	1.75	Homogeneous Data
	Control class			
Posttest	Experimental class	1.25	1.75	Homogeneous Data
	Control Class			

3. Hypothesis Testing
   The hypothesis in this study is to determine whether there is an influence of the *Discovery Learning learning model* with the module. towards improving student learning outcomes. This hypothesis test is conducted to determine whether the hypothesis is accepted or rejected. The testing criteria if $t_{count} > t_{table}$, then the alternative hypothesis ($Ha_{)}$ is accepted and the null hypothesis ($H0_{)}$ is rejected and vice versa if $t_{count} > t_{table}$, then $H0_{is}$ accepted and the alternative hypothesis is rejected with degrees of freedom (db) = n-1 and $\alpha = 0.05$, can be seen in the following table:

Table Hypothesis test

Data	T_{count}	T_{table}	Information
Pretest-Posttest	8.35	2.03	H_0 is rejected, Ha is accepted

Based on the calculation data above, the $_{calculated\ t\ value}$ is greater than the t_{table}, which is 8.35, with this Ho is rejected and Ha is accepted so that it can be concluded that the hypothesis is accepted. This means that there is an increase in student learning outcomes that are taught using the *Discovery Learning learning model with ispring* media towards increasing student learning outcomes in the buffer solution material.

4. N-Gain Test
   The results of the calculation of the increase in learning outcomes can be directly sought from the average gain value of all students for each class in the experimental class and control class, an increase in learning outcomes in the experimental class of 0.68 or 68% (moderate) and the control class an increase of 0.65 or 65% (moderate). So the results can be seen in the following table:

Table N-gain Test

Class	Gain Score	% Gain	Information
Experiment	0.68	68	Currently
Control	0.65	65	Currently

From the results obtained above, it can be concluded that there is an influence of the application of the Discovery Learning learning model assisted by e-modules on student learning outcomes in the buffer solution material. as Bella said (2020 that there was an increase in student learning outcomes where in the experimental class it was 75% while the increase in student learning outcomes in the control class was 66.25%. This means that it is in line with research that has been conducted previously by Harahap et al. (2022) that discovery learning can encourage students to think systematically in order to find concepts and principles of learning through mental and learning stages given by the teacher. as previously conducted by Pertiwi et al. (2020) the average increase in critical thinking skills of experimental class students was higher, namely with an average increase of 62.80 compared to the control class which was only 27.49. In addition to the use of learning models based on research by Safitri et al. (2022) that the important role of media in learning along with the development of current technology in the form of e-modules as a form of independent teaching materials that are arranged systematically and are more practical, efficient and can support all learning components. The Discovery Learning learning model is one of the more active learning activities, because in it there are a number of mental processes carried out by students (Rutonga, 2017). Discovery Learning indirectly makes students more creative and critical in thinking. Not to mention, this model is also able to make students more independent in finding a conclusion or learning material (Sunarto and Amalia, 2022).

Overall, *Discovery Learning* and *e-modules* that have been used during the research can provide a fairly good influence on student learning outcomes, namely in the form of increased learning outcomes. Based on the research results and data that have been obtained and explained above, it can be concluded that the *Discovery Learning learning model* assisted by e-modules can be one of the learning alternatives that can be used in the learning process in schools in order to obtain better student learning outcomes.

- **CONCLUSION**

Based on the research that has been done and the results of hypothesis testing, it can be concluded that there is an increase in students' chemistry learning outcomes in buffer solutions using the *Discovery Learning learning model* assisted by e-modules in class XI students of SMA Swasta Bersama Berastagi. The average increase in students' chemistry learning outcomes in the experimental class was 68.1% while in the control class it increased by 65.8%. And based on the results of the t-test calculation, it was obtained that there was a significant effect of using the *Discovery Learning model* assisted by e-modules on improving students' learning outcomes in buffer solution material at a significant level of $\alpha = 0.05$ and db = 35 with $t_{count} > t_{table,}$ namely 8.35> 2.03. Where the t count value is greater than the t table value (t count> t table) or the t count value is in the critical area, meaning that for testing the hypothesis H0 is rejected and Ha is accepted or it can be concluded that there is an influence of the application of the Discovery

Learning learning model assisted by e-modules on student learning outcomes in the buffer solution material.

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