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EFFECTIVENESS OF E-MODULE BASED ON GUIDED DISCOVERY LEARNING ON LEARNING OUTCOMES OF HIGH SCHOOL STUDENTS

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Abstract: This study aims to analyze the effectiveness of e-module colligative properties of solutions based on guided discovery learning in improving high school student learning outcomes. The research was conducted on class XII students in a public high school space (MAN 1 Padang) with 36 students. The type of research used is quasi-experimental. The research design was a randomized control-group pretest-posttest design, and data analysis used a t-test. The sample was taken by a simple random sampling technique. The level of effectiveness of the e-module is analyzed from the results of the n-gain value. It obtained an n-gain value of 0.71 in the high category. In conclusion, guided discovery learning based on the chemistry e-module effectively improves student learning outcomes with high criteria. Keywords: Effectiveness, E-Module, Guided Discovery Learning, Learning Outcomes.

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INTRODUCTION

Implementing the 2013 curriculum in learning using the scientific approach method requires students to be actively and independently involved in the learning process [1]. The scientific approach implemented in learning requires a learning model. Teachers are a very important motivator in increasing students' potential, as well as can use learning models. Teachers can use the appropriate approach in the curriculum, namely scientific, such as Guided Discovery Learning (DGL).

Guided Discovery Learning is a learning model that can Motivate students to be more active by emphasizing participant involvement students in the learning process through teacher guidance [2]. In GDL, the teacher designs a series of questions that guide participants' students to find concepts[3]. The application of guided model discovery learning in learning can generate motivation and student activity [4].

In the guided discovery learning model, understanding A material concept requires application in everyday life to carry out the learning process. Frequent learning used in the implementation of the GDL model is a module. The module is designed to assist students in mastering learning objectives and as a means of self-study according to ability. Several studies report that using guided discovery-based modules in learning chemistry can improve students' learning outcomes and critical thinking skills, including the elemental chemistry e-module [5], acid-base module [6], and the redox module and electrochemical cells [7].

However, the demands of 21st-century learning expect a combination of learning models and the use of technology, Information, and Communication (ICT) in learning to improve the creativity and innovation of students. So it takes teaching materials that can support the use of digital technology for easy access to information in the learning process. One way to improve quality education in the 21st century is by developing modules that utilize technological sophistication, namely e-modules (electronic modules).

E-module is a form of presentation of self-paced teaching materials systematically into certain learning units, which are presented in electronic format. E-modules have several advantages over print books and modules; e-modules are equipped with videos, images, animations, and audio to enrich the learning experience and make the learning process more interesting [8].

E-module is one of the appropriate teaching materials to support the implementation of the learning model. E-modules are interactive teaching materials that make it easier for students to navigate easily, equipped with graphics, audio, video, images, and formative practice questions that automatically allow for automatic feedback [9]. Learning models can improve students' understanding of concepts. In line with that, [10] stated that Students who use e-modules find it easier to find material concepts than those who use e-modules do not use e-modules. It is because e-modules are equipped with materials, and practice questions contain key questions to help students find a concept independently so that learning outcomes also increase. Based on the research that has been done, the use of e-modules on electrolyte and nonelectrolyte solutions can be applied to improve learning outcomes for students. Using e-modules in learning can help students in the independent learning process [11], increase knowledge competence, and increase students' learning motivation [12]. Reports that the application of e-

modules in learning has the potential to improve learning outcomes [13].

Based on the results of the questionnaire given to 2 chemistry teachers and 62 students in MAN 1, Padang obtained information that: (a) 69.4% of students have difficulty in learning chemistry, especially the colligative properties of solutions; (b) 100% of students interested in using e-module colligative properties of solutions; (c) the teacher is interested using the e-module colligative properties of solutions. The colligative properties of a solution belong to the subject matter of high school chemistry, which includes factual, conceptual, and procedural. This material is classified as an abstract concept with concrete examples of everyday chemical phenomena. The colligative property of a solution has characteristics of the material that need to be mastered and are found difficult by students.

This research is a follow-up study carried out by [14]: development of the E-module Colligative Properties of Solutions based on guided discovery learning for class XII SMA/MA. Based on the study results, the results obtained that the material has a high category of validity and practicality. The e-module has been developed for the assessment phase, where validity and practicality tests have been carried out. The effectiveness test is carried out to determine whether the e-module is feasible or not. E-modules that have yet to be tested for effectiveness cannot be disseminated. Therefore, the author wants to test the effectiveness of the e-module as seen from the student learning outcomes. With the research title "Effectiveness of Colligative Properties E-Module" Solutions Based on Guided Discovery Learning on the learning outcomes of Class Students XII MIPA at MAN 1 Padang".

RESEARCH METHOD

The research used in this study was a quasi-experimental study with a randomized control-group pretest-posttest design. This research was conducted at MAN 1 Padang in the academic year 2022/2023. The samples used in this study were students of class XII MIPA 2, with 36 students as the experimental class, and class XII MIPA 3, with 37 students as the control class. A simple random sample is used to determine the sample class [13]. The research instrument used is a pretest and posttest in the form of objective questions, totaling 20 questions with five answer choices that have been tested for validity, reliability, discriminating power, and difficulty index.

Class	Pretest	Treatment	Posttest
Eksperimen	O_1	X	O_2
Kontrol	O_3	-	O_4

Based on research design with X = learning using GDL- e-modules; O_1 = Pretest; O_2 = Posttest. The experimental class learns using the GDL module, while the control class is taught like a teacher usually teaches using the teacher's lesson plans in the pilot school. Second, the sample class was given a pretest and posttest in the form of an objective test. The test questions already have discriminatory, valid, reliable, and difficulty index questions, which have met the criteria for good questions [15]. The study results were processed using the n-gain test and hypothesis testing.

Normality Test

This test aims to see whether the sample class used is normally distributed. The normality test uses the SPSS application with the Shapiro-Wilk test.

Homogeneity Test

Test This test aims to determine whether the class sample already has a homogeneous variance by using the test of homogeneity variance. A homogeneity test was carried out using SPSS. If the level of sig. > 0.05, then the data can be said to be homogeneous.

Hypothesis Test

Hypothesis testing was carried out with a t-test calculated using the SPSS application with a paired simple test. The results of the hypothesis are said to influence learning outcomes if the results of data analysis obtained on the initial and final variables are at the sig level. < 0.05. However, if the level of sig. > 0.05 means that the initial and final variables do not show a significant change.

RESULTS AND DISCUSSION

The results obtained from the pretest and posttest as learning outcomes in the cognitive realm. The results obtained are displayed in Figure 1. From Figure 1, it can be seen that the experimental class produces more scores tall. Samples are significantly different. We have to do test statistics (hypothesis testing) to analyze class learning outcomes.

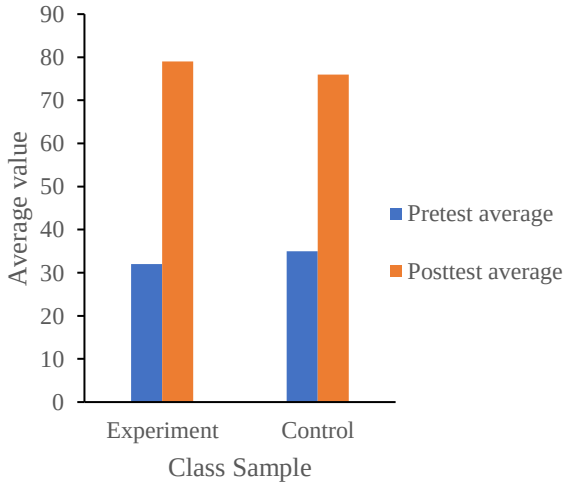

Figure 1. Sample class learning outcomes

Based on data analysis, the sample class has almost the same initial ability (Figure 1). It is necessary to do a pretest To analyze the initial knowledge possessed by students. The results of this pretest are very useful for teachers to see which material should be taught more deeply in the learning process so that the time achieved in the learning process is more effective [15].

N-gain Test

The n-gain test was carried out to express the effectiveness of the chemical equilibrium module GDL based. The results of the n-gain test of the two sample classes obtained are shown in Table 2.

Tabel 2. N-gain

Class	N	Average gain	Interpretation
Eksperimen	36	0.71	Tinggi
Kontrol	37	0.66	Medium

The data in Table 2 shows the class control results in higher n-gain values lower than the experimental class. Hypothesis testing proves the learning outcomes of different sample classes significantly. Requirements for testing the hypothesis must perform a homogeneity test and normality [16].

Normality Test

Normality test results are shown in Table 3. Table 3 shows that the two sample classes are normally distributed with the large terms of level 0.05.

Tabel 3. Normality Test

Class	A	(sig)	Interpretation
Eksperimen	0.05	0.19	Terdistribusi
Kontrol		0.23	normal

Homogeneity Test

Table 4 displays the test results' homogeneity. From Table 4, it can be seen that the result data study class homogeneously distributed sample.

Table 4. Homogeneity Test

Class	A	(sig)	Interpretation
Eksperimen Kontrol	0.05	0.307	Terdistribusi Homogeneity

Hypothesis Test

Table 5 shows the results of hypothesis testing. Table 5 shows that the hypothesis research is accepted. In other words, the sample class has differences in improving learning outcomes significantly.

Table 5. Hypothesis Test

Class	Sig(2-tailed)	Interpretation
Eksperimen Kontrol	0.000	H_0 rejected H_1 accepted

The initial stage in this research is giving a pretest to each sample class. The description of the pretest and posttest data for the sample class in Tables 10 & 11 shows students' learning outcomes before being given treatment. The average value of the pretest in the experimental class is 33.05, and the average value in the control class is 33.61. The mean value of the pretest in the two sample classes shows that the sample class has different initial abilities. The pretest was conducted to determine the extent of the student's initial knowledge regarding the solution's colligative properties. The importance of the initial knowledge that students already have can help teachers predict which parts of the material should be taught more deeply so that the time used during learning will be more effective [17]. After each sample class was given a pretest, the next step was the learning process for the two sample classes.

In the learning process, the experimental class XII MIPA 2 learns using guided discovery learning models. Control class XII MIPA 3 is taught like a teacher by using the textbook provided by the school and the teacher's lesson plans. Applying the GDL model can increase students' learning motivation and critical thinking skills. The GDL model is effective in chemical problem-solving abilities. The application of e-modules in learning has a positive effect on improving student learning outcomes [18].

After the two sample classes finished studying the colligative properties of the solution, students in the two sample classes were given a posttest to assess learning outcomes in the cognitive domain of students. The final test (posttest) aims to assess student learning outcomes after the learning process. Based on Table 2. Description of the results of the pretest and posttest for the sample class, the average posttest value in the experimental class was 78.33, and the posttest average value in the control class was 76.62. In both sample classes, it can be seen that there is an increase in learning outcomes from previous learning outcomes. After the pretest and posttest scores were obtained, the researcher analyzed the N-gain data.

Based on Table 12 Description of the sample class's N-gain, the experimental class's average is 0.71 in the high category, while the N-Gain for the control class is 0.66 in the medium category. It shows an increase in student learning outcomes that are better in the experimental class using the e-module colligative properties of solutions based on guided discovery learning compared to the control class. It is relevant to previous research, which states that the e-module

electrolyte and nonelectrolyte solution based on guided discovery learning effectively improves student learning outcomes [19]. It indicates an increase in student learning outcomes in the learning process that uses the chemical equilibrium module GDL based [20].

After obtaining the N-gain value, proceed with testing the normality and homogeneity of the two sample classes. Based on Table 13. From the data processing, the results of the normality test for the sample class obtained a significant value for the experimental class, which is 0.19, and the control class is 0.23. It indicates that the two samples are normally distributed with the terms large from the 0.05 level. The sample class's homogeneity test results show that the two sample classes have a homogeneous variance with a significant value of 0.307 with a large provision of the 0.05 level. Because both samples were found to be normal and homogeneous, the hypothesis was tested by independent t-test.

Based on the hypothesis test results in Table 15, the value of sig (2-tailed) for the experimental and control classes is 0.000, and the value obtained is <0.05. It indicates that H0 is rejected and H1 is accepted. It means that the learning outcomes and understanding of the experimental class material are higher than the control class. It is because learning in the experimental class is carried out using the e-module of colligative properties of GDL-based solutions, and the control class does not use the e-module. The learning process using e-modules is easier to understand because of the application of guided discovery learning syntax that can motivate students' learning and learning outcomes [6]. Based on the hypothesis test results in Table 15, the value of sig (2-tailed) for the experimental and control classes is 0.000, and the value obtained is <0.05. It indicates that H0 is rejected and H1 is accepted. It means that the learning outcomes and understanding of the experimental class material are higher than the control class. It is because learning in the experimental class is carried out using the e-module of colligative properties of GDL-based solutions, and the control class does not use the e-module. The learning process using e-modules is easier to understand because of the application of guided discovery learning syntax that can motivate students' learning and learning outcomes [6]. The factor that causes the increase in experimental class learning outcomes is the use of the syntaxes found in the colligative properties e-module based on GDL solutions because the syntax contained in the e-module can make it easier for students to find concepts independently.

There are differences in the increase in student learning outcomes between the experimental and control classes. The experimental class has higher learning outcomes than the control class. However, when viewed from the sample class's learning outcomes, many students still need to achieve the Minimum Completeness Criteria. It happened due to time constraints, lack of accuracy of students in reading and understanding pretest and posttest questions, and lack of motivation to teach students to repeat learning at home. And this is also an obstacle in this research. Therefore, students are expected to repeat the lessons learned at school to obtain maximum learning outcomes. From the explanation above, it can be concluded that there is an increase in student learning outcomes using the e-module colligative properties of solutions based on guided discovery learning in the learning process.

CONCLUSION

Based on the study results, the e-module colligative properties of solutions based on guided discovery learning effectively increased the learning outcomes of students of class XII MIPA MAN 1 Padang. The increase in learning outcomes of experimental class students using the e-module colligative properties of solutions based on guided discovery learning was significantly higher than the control class without using the e-module.

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