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Effectiveness of the Acid-Base E-Module Based on Guided Discovery Learning on the Students Learning Outcomes of Class XI Students at SMAN 7 Padang

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ABSTRACT

The availability of an acid-base e-module based on *guided discovery learning* that is valid and practical, but its effectiveness has not been tested on student learning outcomes. Thus, a study was conducted to determine the effectiveness of the acid-base e-module based on *guided discovery learning* on the learning outcomes of class XI students at SMAN 7 Padang. This experimental study used a *randomized control group-pretest-posttest design* . The population in this study was class XI students at SMAN 7 Padang in the academic year 2022/2023. The sampling technique was *simple random sampling* and the students selected were class XI MIPA 3 at SMAN 7 Padang. The instrument is multiple choice and the data were analyzed using the N-gain test, normality test, homogeneity test and hypothesis testing. Based on the data analysis, the N-gain value has a moderate category with hypothesis testing obtained a sig value <0.05. It can be said that the accepted hypothesis is that the acid-base e-module based on *guided discovery learning* is effective in improving the learning outcomes of class XI students at SMAN 7 Padang

INTRODUCTION

Chemistry is one of the sciences that has an important role in life. In everyday life the application of chemistry is often found. Almost everything that is used by humans today involves the sciences of chemistry or chemical reactions in it. Chemistry also helps in understanding life, starting from the structure, properties, changes and composition of an object. Chemistry is also studied in schools. One of the materials taught is acid-base material.

Acid-base is one of the materials in chemistry subjects taught in SMA/MA class XI in even semesters. This acid-base is an initial concept that will be a requirement for studying several further materials, such as buffers (buffer solution), hydrolysis and solubility and

solubility product (KSP). Acid-base material is a material that has three levels of representation, namely the microscopic, submicroscopic and symbolic levels of representation.

Based on the observations that have been made, the acid-base material is quite difficult for students to understand. In this material, it is very necessary to understand the concepts contained in the acid-base material. In the results of observations that have been made the understanding of students in understanding acid-base concepts is quite low because students are required to be able to understand the material in the form of knowledge and skills on acid-base material. To make it easier for students to understand acid-base material, a teaching material and learning model are needed that can improve students' understanding and learning outcomes.

Based on the results of observations made at SMAN 7 Padang, the teaching materials used during the learning process are modules, student worksheets (LKPD) and textbooks. Based on research conducted by Suryani (2018), the module prioritizes student activities during learning, so that students can be active in learning and effective in compiling students' knowledge. In a study conducted by Yerimadesi et al (2018), the value of practicality given by the teacher is high and the value of practicality to students is very high so that learning becomes more efficient.

However, in an increasingly advanced era, technology is used in all aspects of daily activities. There have been many uses of technology developed in the world of education. One of the uses of technology in education is the use of electronic modules (e-modules). E-module is a module in digital form, consisting of images, text and animation or a combination of both (text and images) containing digital material accompanied by tests or simulations used in learning (Herawati, 2018). E- module is an electronic module that is easy and can display pictures, animations, videos and quizzes that can help students to be active and creative (Suarsana, 2013) . There are several benefits obtained from the use of e-modules for teachers and students, namely, increasing student motivation in learning, the evaluations available in e-modules can help teachers find out what material has not been mastered by students, learning materials can be broken down. in one semester, the e-module learning materials for students have been arranged according to the academic level so that learning materials do not mix with one another, e-modules are more interactive than print modules so that students can be more active and creative during learning, the availability of videos, images, animations and audio that can attract students' interest to use e-modules so that students can be more active during learning (Laili, 2019). The use of e-modules can improve students' ability to solve problems where there is an increase in the skills of the students' scientific process after using e-modules (Zhafirah, 2021). To support the activities of students in learning, a learning model that is able to improve students' understanding is needed, namely *guided discovery learning*.

Guided discovery learning is suggested to be used by chemistry subject teachers in high school because the *guided discovery learning model* is effectively accompanied by the application of the student center (Udo, 2010). *Guided discovery learning* is a learning model that is able to improve students' understanding and learning outcomes because in this model students will be asked to find concepts independently so that learning will be easily remembered by students (Harianti, 2018). The stages contained in *guided discovery learning* are able to direct students to think critically, observe, record, report and provide explanations for the objects observed and draw conclusions from those observed (Yerimadesi, 2018). In a study conducted by Suryani (2018), students who have high and low level abilities are given the opportunity to form learning concepts by using syntax in learning through the *guided discovery learning model*

. This learning model makes students actively involved and improves students' skills during learning (Astra, 2017).

guided discovery learning -based e-modules that have been arranged in accordance with the learning steps of *guided discovery learning* can assist teachers in delivering learning materials while helping students find and solve problems, especially in acid-base material so that teachers can become facilitators by providing opportunities for students to be active and think creatively during the learning process. With the implementation of *guided discovery learning* - *based e-modules* in schools, it is expected to improve student learning outcomes because the more interactive *guided discovery learning model* can increase students' motivation in learning and make it easier for students to understand the material using the acid-base e-module.

Based on this description, the class XI acid-base e-module based on *guided discovery learning* has been developed with a validity of 0.96 and an average practicality of 92%. However, the effectiveness of this e-module has not been tested, so research is needed to determine its effectiveness in improving student learning outcomes.

METHODOLOGY

This research is a follow-up research from development research using the Plomp model, namely the small group stage and the field test. This study used a Randomized Control Group *Pretest - Posttest* Design. This research was conducted at SMAN 7 Padang in the second semester of the 2022/2023 academic year from January to February. The population is all students of class XI MIPA even semester of the academic year 2022/2023. The sampling technique used is simple random sampling technique. This sampling is considered the best and most representative (Sudaryono, 2018). Before carrying out the research, it is necessary to observe the school to determine its suitability with the objectives of the research carried out. In this study, questionnaires were distributed to students and teachers. The results of the questionnaire can be used as supporting data in this study.

In this study, the population taken were students of class XI MIPA in the even semester of the 2022/2023 academic year at SMAN 7 Padang. Where in this study used 1 sample class from 5 classes XI MIPA. The initial selection of this class is done by testing the normality and homogeneity of the class by using the Final School Examination scores in odd semesters. After finding a normal and homogeneous class, the sample class was determined using a sampling technique, namely *simple random sampling* . Based on these steps, class XI MIPA 3 was obtained as an experimental class using an acid-base e-module based on *guided discovery learning* in the learning process.

The class that was selected as the sample class used an acid-base e-module based on *guided discovery learning* . In the early stages of learning, a *pretest* (initial test) will be given which is useful for knowing the initial abilities of students before learning to use an acid-base e-module based on *guided discovery learning* . After doing the learning, students will also be given a *posttest* (final test) to find out the results student learning after learning to use an acid-base e-module based on *guided discovery learning* . *The pretest* and *posttest* consist of 20 multiple choice questions and have been tested and analyzed for validity, reliability, discriminating power and difficulty index.

The data that has been obtained is first tested for normality because the data must be normally distributed. After the normality test, what is next is the homogeneity test, then the N-gain test is carried out to determine the level of effectiveness.

RESULT AND DISCUSSION

Based on the answers to the *pretest* and *posttest* conducted at SMAN 7 Padang, it can be seen that the students ' *pretest* and *posttest scores are as follows.*

Table 1. *Pretest* and *posttest* values for the sample class

No	Raw score	Mark	Class frequency	
			experiment	
			pretest	*Posttest*
1	1	20	2	-
2	2	25	-	-
3	3	30	1	-
4	4	35	-	-
5	5	40	1	-
6	6	45	6	-
7	7	50	7	-
8	8	55	8	-
9	9	60	6	1
10	10	65	4	3
11	11	70	1	3
12	12	75	-	8
13	13	80	-	6
14	14	85	-	8
15	15	90	-	5
Total students			38	
Average			53.02	79.60

In the sample class, the students' scores when given the *pretest* obtained an average of 53.02 and after doing the learning and being given the *posttest* the average obtained was 79.60. From these data, it can be seen that there was an increase before learning to use an acid-base e-module based on *guided discovery learning* with student learning outcomes after learning to use an acid-base e-module based on *guided discovery learning* . In the table, it can be seen that the students who had the lowest score on the *pretest results* were 20 in the experimental class. In the experimental class, the highest *pretest score* was 70. The *posttest score was* obtained after the learning process was carried out. In the experimental class, the lowest score in the *posttest* was 60, while the highest score for the *posttest* in the experimental class was 90.

After proving that there is an increase in student learning outcomes, the N-gain test can be carried out which is useful for knowing the average student learning outcomes can be seen in the following table.

Table 2. Description of N-gain

Class	Average			Category
	Pretest	*Posttest*	N-gain	
Experiment	53.02	79.60	0.556	Currently

In table 2, it can be seen that the average *pretest score* obtained by students in the experimental class is 53.02 and in the control class is 42.71. In the *posttest score* , students obtained learning outcomes of 79.60 in the experimental class with an average N-gai value of 0.556. This shows that there is an increase in student learning outcomes in the medium category.

The next step is to perform normality test and homogeneity test. This normality test was conducted to determine whether the data used were normally distributed or not. This normality test uses the *Shapiro-Wilk test* with the criteria if the sig value > 0.05 then the data can be said to be normally distributed. The homogeneity test was carried out to find out the data obtained by the variance that was the same or not. This test has a criterion value of sig > 0.05 . If the value of sig > 0.05, then the data on student learning outcomes has a homogeneous variance. The results of the normality and homogeneity test can be seen from the following table.

Table 3. Normality Test Results

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Student learning outcomes	Experiment *Pretest*	0.144	38	0.047	0.963	38	0.234
	Experiment *Posttest*	0.155	38	0.022	0.951	38	0.093

a. Lilliefors Significance Correction

In table 3 there are results of the normality test with a significance level of α= 0.05 and for the experimental class a sig value of 0.093, which means the sig value > 0.05. This value indicates that the learning outcomes of students are normally distributed.

Table 4. Homogeneity Test Results

		Levene Statistics	df1	df2	Sig.
Student learning outcomes	Based on Mean	.007	1	74	0.936
	Based on Median	.011	1	74	0.915
	Based on Median and with adjusted df	.011	1	73.402	0.915
	Based on trimmed mean	.006	1	74	0.939

Table 4 shows that the experimental class obtained a sig value > 0.05 . This shows that in the experimental class the data obtained has a homogeneous variance. From the results of the normality test which is normally distributed and the homogeneity test which has a homogeneous variance, the hypothesis test is carried out using the t test.

Hypothesis testing is done by using t-test or SPSS using paired sample t-test. Rejection at H_0 can be seen from the value of sig > 0.05 and rejection at H_1 can be seen from the value of sig > 0.05. The results of hypothesis testing using t-test with *paired samples test* can be seen in the following table.

Table 5. Hypothesis Test Results

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	*pretest* - *posttest*	-25,921	11,441	1.856	-29,681	-22.161	-13,967	37	0.000

From the tests carried out, the sig value is 0.00 , this means that H0 is rejected because the sig value is <0.05. The acceptance of H_1 was obtained from the *pretest* and *posttest scores* . Based on the results obtained, it can be concluded that H0 is rejected and H1 is accepted . It can be concluded that student learning outcomes have increased after using an acid-base e-module based on *guided discovery learning* .

This study aims to see the improvement of student learning outcomes using an acid-base e-module based on guided discovery learning. Learning outcomes are very important in education in order to know the learning achievement that has been designed (Desrina, 2008).

The learning process carried out in class XI MIPA 3 using an acid-base e-module based on *guided discovery learning* showed an increase in student learning outcomes. This increase can be seen from the *pretest* and *posttest scores* given to students with the data contained in table 1. Giving *pretest* to students aims to determine the initial abilities possessed by students. According to Gazali and Yusmita (2018), to assist teachers in estimating the material being taught more deeply, it is necessary to know the initial abilities possessed by students so that learning time is more effective. After the learning process is carried out, students will be given a *posttest* . This *posttest* aims to determine student learning outcomes after learning.

The use of an acid-base e-module based on *guided discovery learning is* able to increase the activity of students. This *guided discovery learning* model is effective for students because it can help students find concepts independently (Lestari, 2017). In the learning process, the e-module used during learning is considered to be able to reduce student boredom because the learning outcomes of participants have increased. In learning using e-modules, students will be more active in finding concepts independently. The teaching materials used are assisted by a *guided discovery learning model* that directs students to find concepts. This is in line with constructivism learning theory which forms the concept independently.

The success of learning is not only seen from the learning outcomes, but also the learning process. In the e-module there are stages of learning that can help students understand the material. Students answer questions on the activity sheet contained in the e-module according to the meeting. The activity sheets on average increased because students understood enough acid-base concepts according to Arrhenius, Bronsted-Lowry and Lewis then conducted experiments to determine the nature of acids and bases using litmus paper and natural indicators and to determine the strength of acids and bases.

From the acquisition of *pretest* and *posttest scores,* there are differences in average values. The *pretest* score obtained an average of 53.02 and the *posttest* score obtained an average value of 79.60. This shows that there is an increase in student learning outcomes. The use of an acid-

base e-module based on *guided discovery learning* has an influence on student learning outcomes, namely an increase in student learning outcomes.

Based on the results of hypothesis testing contained in table 4, the value of sig (2-tailed) < 0.05 was obtained . These results indicate that there is an increase in student learning outcomes after using an acid-base e-module based on *guided discovery learning* . The availability of an acid-base e-module based on *guided discovery learning* is effective in improving student learning outcomes in class XI of SMAN 7 Padang.

CONCLUSION

Based on the research that has been done, the acid-base e-module based on *guided discovery learning* is effective in improving the learning outcomes of class XI students at SMAN 7 Padang. The learning outcomes of students experienced a significant increase in the *pretest* value from the *posttest value* given before carrying out learning using an acid-base e-module based on *guided discovery learning* .

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