

## EFFECTIVITY OF GUIDED DISCOVERY LEARNING SUPPORTED WITH ELEMENTAL CHEMISTRY E-MODULE ON STUDENTS LEARNING OUTCOMES

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**Abstract:** This study aims to analyze the effectiveness of the elemental chemistry e-module based on guided discovery learning in improving student learning outcomes. The research was conducted in class XII at a public high school (SMAN 13 Padang) with 36 students. The type of research used is quasi-experimental. Research design is a one-group pretest-posttest design and data analysis using a t-test. Sampling using a simple random sampling technique. The level of effectiveness of the e-module was analyzed from the results of the n-gain value. The obtained n-gain value is 0.49 in the medium category. In conclusion, the guided discovery learning-based e-chemistry module effectively improves student learning outcomes with high criteria.

**Keywords:** *Effectiveness, E-Module, Guided Discovery Learning, Learning Outcomes*

### INTRODUCTION

Industrial revolution 4.0 has led to digitalization in various aspects of life, and the educational environment is also affected by this 4.0 era. So it is an opportunity to develop better and up-to-date teaching materials [1]. Learning in the 4.0 industrial revolution era is closely related to digital technology [2]. The purpose of the 2013 curriculum is to improve students thinking skills and curiosity, and the 2013 curriculum demands the active role of students during the learning process [3].

The 2013 curriculum emphasizes the scientific learning approach. This scientific approach emphasizes student activity during the learning process, and the teacher is only guiding and providing stimulus to students [4]. One learning model to support a scientific approach is the guided discovery learning model. During the learning process using the guided discovery learning model, students are required to play an active role and be able to find their concepts with the help of the stimulus provided by the teacher. So the teacher's role is only as a facilitator during the learning process [5]. Applying the guided discovery learning model needs a learning material to help students find their concepts. Teaching materials that can help students find their concepts are modules. The module is considered effectively guides students to play an active role [6]. The module is deemed effective as a means for students to learn independently. The module can provide instructions that can be followed by students [7].

At this time, the learning process is applied online or online learning. In practice, online education has many obstacles [8]. The implementation of online learning, especially in chemistry subjects, makes it difficult for students to understand the lesson [9]. This is due to the lack of student interest in online learning, which results in low learning outcomes. An update or innovation is needed to minimize the problems found to increase

students' enthusiasm and interest in learning [10]. There is a need for updates on education, such as updates on teaching materials that can help students during learning. Varied learning media can reduce student boredom during the learning process [11].

The purpose of the 2013 curriculum is to improve students' thinking skills and curiosity, and also, the 2013 curriculum demands the active role of students during the learning process [3]. Teaching materials to be better and updated. Teaching materials consist of handouts, books, student worksheets, and modules [12]. In general, the module is widely used in the print module. Along with technological developments, currently, teaching materials can be presented in digital or electronic form, one of which is e-modules [13]. E-modules are interactive learning media that contain images, animations, audio, and videos to increase students' learning motivation [6]. Electronic modules are considered adequate as a solution to face online learning [14]. When compared to conventional learning, e-modules are considered more effective because they can increase student motivation and are practically used to support independent learning [15]. E-module is very suitable for the needs of today's students because it contains verbal and nonverbal knowledge so that it is effective in improving student learning outcomes [16]. The use of e-modules is also related to the demands of 21st-century education, where students are required to be able to use technology, information, and communication.

Elemental chemistry is carried out in even semesters and is one of the chemistry subjects for class XII in high school. Students still consider elementary chemistry difficult because of the lack of media use during the learning process [17]. Elemental chemistry is abstract. Elemental chemistry is abstract because the human senses cannot directly see it only through logic during the learning process. In studying chemistry, three components must be available to make it easier to understand

chemistry, namely macroscopic (can be seen directly by the human senses), submicroscopic (atoms, molecules, ions, and elements), and symbolic (formulas, symbols, formulas) molarity, equations, and graphs) [18]. Learning media is needed that can provide these three components. The e-module contains graphics, audio, video, pictures, and practice questions [19] which can facilitate students in understanding the elemental chemistry material considered abstract.

Research that has been done before there is an increase in student learning outcomes when learning using e-modules. It can be seen that the use of e-modules effectively improves student learning outcomes [20], research conducted by Yerimadesi [21] showed that the use of the GDL module was able to increase the interest and curiosity of students. In line with that, the results of other studies revealed an increase in student learning outcomes, and it was also easier for students and helped to find their concepts than when not using e-modules [22]. This study aims to determine the effectiveness of the elemental chemistry e-module based on guided discovery learning. The researchers conducted a study entitled the effectiveness of the elemental chemistry e-module based on guided discovery learning on improving student learning outcomes in class XII.

**RESEARCH METHODS**

The research used in this study was a quasi-experimental research with a one-group pretest-posttest design. This research was conducted at SMA Negeri 13 Padang in the academic year 2021/2022. The sample used in this study was students of class XII MIPA 2 with 36 students. The technique used to determine the sample class is simple random sampling. 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, discriminatory power, and difficulty index.



Description:

O<sub>1</sub>= test before being treated (pretest)

X = treatment using the model

O<sub>2</sub>= test after being treated (posttest)

The pretest was given to the sample class before learning using an e-module of elemental chemistry based on guided discovery learning. In contrast, the posttest was given after learning by using the e-module. The analysis of the effectiveness of the e-module uses a hypothesis test, namely the t-test. Before that, it is necessary to test for normality and homogeneity.

**Normality Test**

This test aims to see whether the sample class used usually is distributed or not no. Normality test using the Liliefors test using the formula:

$$[F(z_i) - S(z_i)]$$

**Homogeneity Test**

This test aims to determine whether the sample class used already has a homogeneous variance. The F test is carried out with the formula:

$$F = \frac{S_1^2}{S_2^2}$$

Description :

F : Variant of data group

S<sub>1</sub><sup>2</sup> : The biggest learning outcome variance

S<sub>2</sub><sup>2</sup> : The smallest learning outcome variance

A homogeneity test was carried out with the help of 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 of this study obtained data on student learning outcomes. The test was carried out in 2 stages, namely pretest and posttest. The pretest was carried out in the sample class before the learning was carried out using an e-module of elemental chemistry based on guided discovery learning. At the same time, the posttest was given after the learning was carried out. Guided discovery learning has a convenient learning syntax, namely hypotheses, data processing, verification, and closure. The assessment on the activity sheet contained in the e-module is adjusted to the indicators and assessment rubrics. The results of the e-module analysis can be seen in table 1.

Table 1. Syntax Guided Discovery Learning Results

Syntax Guided Discovery Learning			
Hypothesis	Data Processing	Verification	Closure
73	76	80	83
75	81	84	86
76	81	86	88
77	85	87	90
75	81	84	87

The analysis of the e-module activity sheet shows that the students' abilities are guided discovery of learning syntax. Each syntax in the GDL has a different value, and each syntax is increased.

The test results were analyzed using the n-gain test, which aims to determine the level of

effectiveness of the e-module. The results of the n-gain test obtained are shown in Table 2.

Table 2. N-gain Test Results

N	Pretest	Posttest	Average gain	Interpretation
36	37.36	66.11	0.49	Medium

Based on table 2. The comparison between the average pretest and posttest shows a significant increase, so it is known that the use of e-modules impacts improving student learning outcomes. The average value of n-gain obtained is 0.49 in the medium category. Hypothesis testing is carried out to prove the e-module is effective, consisting of a normality test, a homogeneity test, and a t-test. The data from the normality test can be seen in Table 3.

Table 3. Normality Test Results

A	Lo	Ltabel	Interpretation
0.05	0.15	0.17	Normal

Based on Table 3. The obtained L0 value < Lt. It is known that the data is normally distributed at the level of 0.05. In the next test, the homogeneity test was carried out with the help of the SPSS application. The homogeneity of the data can be seen in Table 4.

Table 4. Homogeneity Test Results

df	F	Sig.
38	3.986	0.53

The test results are said to be homogeneous if the significant level value obtained is > 0.05. Based on the results presented in Table 4. It can be seen that the significant level value of the sample is 0.53. Because 0.53 > 0.05, it can be concluded that the sample is homogeneously distributed. After the normality and homogeneity tests were carried out, the data were normally distributed and homogeneous. Therefore, the hypothesis test was analyzed using a t-test carried out with a paired sample test with the help of SPSS. The results of the hypothesis are said to have a significant difference if the results of data analysis obtained on the initial and final variables are at a significant level of <0.05. However, if the significant level > 0.05 means that the initial and final variables do not show a significant change, the obtained results of hypothesis testing can be seen in Table 5.

Table 5. Hypothesis Test Results

Std	df	Sig. (2-tailed)
9.738	35	0.000

The results of the t-test on the paired sample test obtained a significant level value of 0.00, so it is known that there is an effect on the treatment given to the sample class, which can be seen from the results of the initial and final variables after being given treatment. In other words, this e-module is effective in increasing student learning outcomes.

This study begins with testing the items consisting of validity, reliability, discriminating power of questions, and the level of difficulty of the questions. Questions that have passed the item test are then used as pretest and posttest test questions. The pretest was conducted to test the students' initial abilities. The pretest results determine which sub-material has a high difficulty level. It needs to be explained more deeply to students to make the learning process more effective and efficient. Based on the results of observations that have been made by giving a questionnaire to the chemistry teacher of class XI and 20 students of class XII MIPA at SMAN 13 Padang, information was obtained that: (a) 80% of students had difficulties in elemental chemistry (b) 62.3% of students have never used guided discovery learning-based modules in chemistry learning (c) all teachers are interested in guided discovery learning-based elemental chemistry modules tested effectiveness against students. The research that has been done previously states that the module based on guided discovery learning is effective in improving student learning outcomes of class XI MIPA at SMAN 13 Padang with a score of 0.83 in the high category [23]. Based on the results of hypothesis testing, it can be concluded that e-modules are effectively used as learning media. It is evidenced by the increase in student learning outcomes, which significantly increased between the pretest and post-test results. It is under the results of research conducted by Kristalia and Yerimadesi [24], which stated that using GDL-based e-modules effectively improved student learning outcomes and helped students find their concepts. The GDL learning model can help students be actively involved in learning [25]. In addition, the use of e-modules based on guided discovery learning is also effective in increasing students' understanding of concepts [26]. Learning is said to be effective if students can find their concepts from the material that has been studied.

This e-module is one solution that can be used to improve student learning outcomes. Previous research also revealed that learning using GDL-based e-modules increased students' enthusiasm and curiosity. Learning using GDL-based modules could increase students' enthusiasm and desire and improve student learning outcomes [21]. Learning using guided discovery learning-based modules can make the learning process not dull so that students' interest and motivation also increase. It is reinforced by the statement of Suarsana and Mahayukti [19]. They state that e-modules are one of the most interactive teaching materials because they contain videos,

pictures, audio, and test questions, motivating students. The guided discovery learning model is very effective in improving student learning outcomes at SMAN 13 Padang, especially in elemental chemistry [4]. Because in abstract elemental chemistry, students will find it easier to understand the material if they can play an active role and find their concepts. The guided discovery learning model is very suitable for elemental chemistry material applied at SMAN 13 Padang. The use of e-modules can also increase the learning independence of students. The e-module can improve student learning outcomes and be used as a suitable learning medium to increase student interest so that learning can run more effectively. The implications of this research can be used directly during the learning process and serve as a reference and reference for similar research to conduct exciting research and innovation.

### CONCLUSION

Based on the results of hypothesis testing that has been done, we obtained a significant level of 0.00. This shows that the use of e-modules can improve student learning outcomes. The elemental chemistry e-module based on guided discovery learning is effectively used as a learning medium

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