

The Effectiveness Periodity of Elements on Guided Discovery Learning For Student's Learning Outcomes

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Abstract—Based on result of interviews and observations conducted at SMAN 5 Padang, it was obtained that 86,3% of the material used in the periodity of elements was not able to direct students to find the own concepts. This study aims to analyze the effectiveness of the element periodity module based on guided discovery learning on student learning outcomes. This research design uses a one-group pretest posttest design with a pre-experimental design type. The population consisted of grade X students of SMAN 5 Padang in the 2021/2022 school year and samples were taken using purposive sampling techniques. The instrument used in research in the form of multiple choice tests that has validity, reliability, differentiation, and index difficulty with good criteria. The effectiveness of module based guided discovery learning were analyzed by the n-gain tests. Based on data analysis the n-gain value is 0,87. The data analysis concluded that the module of periodity elements based guided discovery learning are improving student learning outcomes on high criteria so that these module are effectively used to improve student learning outcomes.

Keywords—Effectiveness, Guided Discovery Learning, Modules, Periodity of Elements, Learning Outcomes.

I. INTRODUCTION

The periodicity of elements is one of the main subjects in chemistry class X MIPA. The periodicity of elements has aspects of factual knowledge and conceptual knowledge that must be mastered by students. This factual knowledge contained in this material is that metal elements are good conductors of electricity both metal elements are hard and can be forged. While the conceptual knowledge contained in this material is the atomic radius definition, ionization energy definition, electronegativity definition and electron affinity definition. This material must be mastered first by students so that they can learn the next material namely ionic bonds, coordination bonds, and metal bonds. Therefore if students have not mastered this material it will be difficult to understand the next material.

The results of observation made at SMAN 5 Padang show that: (a) the teaching materials used in the periodicity properties of the elements have not varied; (b) 86,3% of students feel that the teaching materials used have not been able to direct students to find concepts. Understanding of students concepts is closely related to learning outcomes. If students have difficulty in understanding the concept of a material then learning outcomes will not be achieved optimally. Therefore teaching materials and learning models are needed that can help students find concepts and master concepts so that learning outcomes can increase (Murdiati & Yerimadesi, 2019).

Guided Discovery Learning (GDL) model is a learning model that is in accordance with the 2013 curriculum with a scientific approach (Permendikbud, 2016). GDL is one of the learning models that can improve students understanding, motivation in the

learning process, and students critical thinking skills (Maulidar et al., 2016), ability to solve chemical problems (Sulistiyowati et al., 2012), and is the most effective learning model to be applied in learning (Abdisa & Getinet, 2012).

The module is a printed teaching material that has the most complete components compared to other teaching materials, such as worksheets and handouts (Depdiknas, 2008). The learning module includes a set of activities aimed at making it easier to achieve learning objectives (Wena, 2012). GDL based modules can improve students critical thinking skills and scientific attitudes (Perwitasari & Djukri, 2018). GDL based modules can also motivate and improve student learning outcomes (Yerimadesi et al., 2017), and research on the effectiveness of guided discovery learning based acid-base modules which show that the module can improve critical thinking skills and high school students learning outcomes (Yerimadesi. et al., 2019). This is because the module is structured based on the syntax of the GDL model which makes it easier for students to understand the material, one of which is the periodicity of elements taught in class X SMA.

In this material a GDL based periodicity property module is available. This module has a very high validity category and a high practicality category, but the module effectiveness test has not been carried out on learning outcomes, so a study was conducted to analyze the effectiveness of the GDL based element periodicity module on student learning outcomes at SMAN 5 Padang.

II. METHODS

This research was conducted in November 2021 at SMAN 5 Padang with the research population is class X students of SMAN 5 Padang in the academic year 2021/2022. The sampling technique used purposive sampling technique for the sample class namely class X MIPA 2. The research method uses a pre-experimental design with a one-group pretest-posttest design shown in Table 1.

Table 1. Research Design

Class	Initial Test	treatment	Final Test
Experiment	O ₁	X	O ₂

Based on the research design (Table 1) with Q1 = initial test, X = learning using GDL based modules, Q2 = final test (Sugiyono, 2013). The research instrument used is in the form of multiple choice test questions and has validity, reliability, discriminatory power, and difficulty index on good criteria. The sample class will be given a pretest before starting the lesson and a posttest at the end of the learning process. The data obtained after conducting the research is processed using the n-gain test and hypothesis testing.

III. RESULT AND DISCUSSION

This study aims to analyze the level of effectiveness of the use of the periodicity property module based on GDL on student learning outcomes. The research data were obtained after conducting research at SMAN 5 Padang. Data collection is seen from the learning value of sample class students in the cognitive domain. The results obtained are shown in Figure 1.

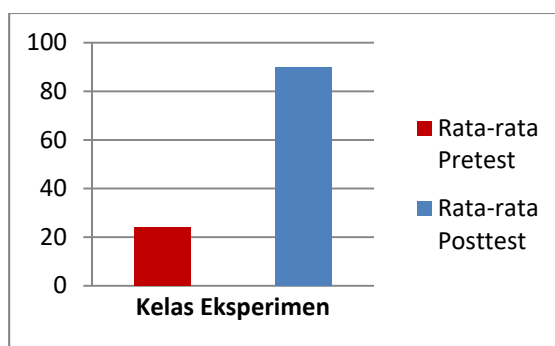


Figure 1. Sample Class Study Results

Learning outcomes are not only the main guide in learning but also pay attention to the learning process (Sudjana, 2005). Based on data analysis, the sample class has a lower initial ability (Figure 1). To analyze the student initial knowledge a pretest was carried out. These results are used to see which material should be taught more deeply in the learning process so that time is used so that time is used more effectively (Gazali & Yusmaita, 2018). At the end lesson the sample class was given a posttest to analyze the ability of students in the cognitive domain. In Figure 1 it can be seen that the posttest value of the sample class has increased. After the pretest and posttest values were obtained, the n-gain data analysis was carried out.

The n-gain test was conducted to determine the level of effectiveness of the GDL based element periodicity module. The results of the n-gain test for the sample class obtained are shown in Table 2.

Table 2. Sample Class n-gain Results

Class	N	n-gain	Category
Experiment	38	0,87	High

The data analysis in Table 2 describes an increase in learning outcomes after learning using GDL based modules. This shown that the periodicity property module based on GDL is effective in improving student learning outcomes. To analyze the learning outcomes of the sample classes that are significantly different, a hypothesis test (statistical test) was conducted. To test the hypothesis, the data obtained must be normally distributed and homogeneous.

The research sample is said to be able to represent the population if the sample is normally distributed. The results of the normally test can be shown in Table 3.

Table 3. Normality Test Results

Class	L_0	L_t	Information
Experiment	0,10	0,14	Normal

Analysis of the normality test data in Table 3 shown that L_0 in the sample class $< L_t$. So it can be concluded that the sample class is normally distributed using the provisions of the level of α 0.05. Furthermore, a homogeneity test is carried out, this is done so that there are no differences or in homogeneities in the sample (Radyuli et al., 2019). Homogeneity test results can be displayed on Table 4.

Table 4. Homogeneity Test Results

Class	F_{count}	F_{table}	Information
Experiment	2,03	1,72	Inhomogeneous

Analysis of the homogeneity test data in Table 4 shows that $F_{\text{count}} > F_{\text{table}}$. This shows that the sample class is not homogeneously distributed with a large degree of α 0.05.

From the data analysis carried out, it was obtained data on the sample class, then the hypothesis was tested using an independent t-test. Hypothesis test results can be displayed in Table 5.

Table 5. Hypothesis Test Results

Class	T_{count}	t_{table}	Information
Experiment	10,012	2,026	H_0 is rejected and H_1 is accepted

The results of the analysis of the hypothesis test data showed that $t_{\text{count}} > t_{\text{table}}$ (Table 5) which indicates that the research hypothesis is accepted in other words, the use of the GDL based element periodicity module to improve student learning outcomes.

Other studies also reveal that the use of GDL based modules is effective on motivation and learning outcomes in the learning process, such as the buffer solution material (Yerimadesi et al., 2019), chemical equilibrium (Said & Yerimadesi, 2020), salt hydrolysis (Rauuf, 2021). Students who learn to use GDL based modules find it easier to follow the lesson, because it is equipped with stages according to the GDL learning model to find and form concepts. In addition, learning can run effectively if students can form and build their own concepts learned in accordance with constructivism learning theory.

GDL based learning has five syntaxes, namely motivation and problem presentation, data collection, data processing, verification, closure (Yerimadesi, 2014).

Based on the above discussion, it can be concluded that the use of GDL based modules is effective on student learning outcomes with a high level of effectiveness category, namely 0.87 and is also one of the factors in increasing students learning outcomes and understanding.

IV. CONCLUSION

Based on the results of research and data analysis it was concluded that the use of the periodicity property module based on GDL was effective in improving the learning outcomes of students of class X MIPA at SMAN 5 Padang as evidenced by the result of the analysis of the level of effectiveness which is high

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