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The Effects of E-Module with Guided Discovery Model on Students Learning Outcomes in Electrolyte and Nonelectrolyte Solution

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Abstract: This study aims to analyze the effect of using an e-module electrolyte and nonelectrolyte solution based on guided discovery learning on student learning outcomes. This quasi-experimental study used a randomized control-group pretest-posttest design. The population consisted of grade X student of SMA Negeri 1 Padangpanjang in the 2021/2022 school year and samples were taken using simple random sampling technique. The research instrument was a multiple-choice test and the data were analyzed by n-gain test and hypothesis testing by t-test. Based on data analysis, n-gain experimental class is higher than the control class with a medium category and the hyphothesis is the use of an e-module electrolyte and nonelectrolyte solution based on guided discovery learning is effect in improving student learning outcomes at SMA Negeri 1 Padangpanjang.

Keywords: e-module, guided discovery model, learning outcomes.

Abstrak: *Penelitian ini bertujuan menganalisis pengaruh penggunaan e-modul larutan elektrolit dan nonelektrolit berbasis guided discovery learning terhadap hasil belajar siswa. Penelitian eksperimen semu ini menggunakan desain penelitian randomized control-group pretest-posttest design. Populasi terdiri dari siswa kelas X SMA Negeri 1 Padangpanjang tahun ajaran 2021/2022 dan pemilihan sampel menggunakan teknik simple random sampling. Instrumen penelitian berupa tes dalam bentuk pilihan ganda serta data dianalisis menggunakan uji n-gain dan uji hipotesis menggunakan uji t. Berdasarkan analisa data, diperoleh n-gain kelas eksperimen lebih tinggi dibandingkan kelas kontrol dengan kategori sedang dan uji hipotesis yag diperoleh sig(2-tailed) < 0,05. Dapat disimpulkan bahwa hipotesis diterima yaitu penggunaan e-modul larutan elektrolit dan nonelektrolit berbasis guided discovery learning berpengaruh terhadap peningkatan hasil belajar siswa di SMA Negeri 1 Padangpanjang.*

Kata kunci: *modul elektronik, model inkuiri terbimbing, hasil belajar.*

▪ INTRODUCTION

The demands of the 2013 curriculum on students are to be active in the learning process, develop their potential to become creative, productive, and affective human beings through integrated knowledge of attitudes, skills, and knowledge. One way to realize these challenges is to use a scientific approach. The scientific approach is an approach that uses scientific methods in overcoming problems so that it can improve thinking skills, curiosity and students can be motivated in observing phenomena that occur in the surrounding environment (Permendikbud, 2016). One type of learning model with a scientific approach is guided discovery learning.

Guided dscovery learning is a learning model where students can appreciate themselves freely in finding a concept for understanding the material and the teacher gives examples to students related to specific material and guides student in finding and understanding concepts (Smitha, 2012). The application of guided discovery learning can improve basic science skills and higher order thinking skills (Suryanti et al., 2020)

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and increase student interest in learning and learning outcomes (Yuliana et al., 2017). The guided discovery learning model is supported by appropriate teaching materials, such as modules. With the emergence of technology that has developed rapidly, providing changes in the field of education, namely e-modules.

E-modules are independent teaching materials used for the learning process which are presented in an electronic format and arranged systematically (Kemendikbud, 2017). E-modules has advantages such as interactive learning, students can learn independently, user friendly, practical to read, can be accessed easily using the cloud, and not require paper (Yusuf, 2020). In research on chemistry learning e-modules, there are various chemistry learning e-modules based on guided discovery lerning that are valid and practical, such as research on the development of elemental chemistry e-modules (Z. A. Wahyuni & Yerimadesi, 2021), atomic structures (Putri et al. al., 2021), chemical equilibrium (Febrila & Yerimadesi, 2021), salt hydrolysis (Lisa Rosanna et al., 2021), acid-base (Afrilianti & Yerimadesi, 2021), and electrolyte and nonelectrolyte solutions (Wildayati & Yerimadesi, 2021).

The using of e-modules can has an influence on the learning process. The effect of using e-modules on learning is that it can improve student learning outcomes (Asda, Viola &Andromeda, 2021), increase students conceptual understanding of learning (Hariani & Nuswowati, 2020), improve students independent learning processes (Linda et al., 2020), more effective than printed books (Astalini et al., 2019), improve student problem solving and critical thinking skills (Suryaningtyas et al., 2020) because they are considered to have attractive and effective designs for learning activities,and can stimulate critical thinking skills for slow leaners students (Sugiyarta &Suparman, 2019).

In the class X chemistry learning process, there is an abstarct material of electrolyte and nonelectrolyte solution. This material consist of the dimensions of factual, conceptual, and procedural knowledge. Concepts in this material can be more easily understood by students if they are equipped with supporting illustrations such as pictures and experimental video so that student learning outcomes can improve.

Based on the results of a questionnaire from two chemistry teachers and 89 students at SMA Negeri 1 Padangpanjang, information was obtained that: (1) 59,6% of students at SMA Negeri 1 Padangpanjang have difficulty understanding chemistry learning, especially electrolyte and nonelectrolyte solution, (2) teachers are interested using e-modules in learning electrolyte and nonelectrolyte solutions but teaching materials are not yet avaiable, (3) 82% of students at SMA Negeri 1 Padangpanjang are interested in using e-modules as teaching materials in learning electrolyte and nonelectrolyte solutions.

In this material, an e-modules of electrolyte and nonelectrolyte solution based on guided discovery learning is available that is valid, practical (Wildayati & Yerimadesi, 2021), and effective (Kristalia & Yerimadesi, 2021). However, this e-module has not been tested for its effect on student learning outcomes. The use of e-modules on electrolyte and nonelectrolyte solution can improve student learning outcomes (Asda & Andromeda, 2021). Based on the explanation that has been presented, this research is directed to analyze the effect of using e-module electrolyte and nonelectrolyte solution based on guided discovery learning on student learning outcomes at SMA Negeri 1 Padangpanjang.

▪ METHOD

This research is quasi-experimental research using a randomized control-group pretest-posttest design. The structure of the research design is shown in Table 1. The research was conducted at SMA Negeri 1 Padangpanjang from March to April 2022 in three stages, namely preparing, implementation, and finishing. The subjects used in the study were students of class X MIPA 1 and X MIPA 6 SMA Negeri 1 Padangpanjang in the 2021/2022 academic year. The object of research used is the e-module electrolyte and nonelectrolyte solution based on guided discovery learning.

Table 1. Research design structure

Class	Pretest	Treatment	Posttest
Experimental	O_1	X	O_2
Control	O_3		O_4

Description:
X : Treatment
O1 : test before treatment for experimental class
O2 : test after treatment for experimental class
O3 : test before treatment for control class
O4 : test after treatment for control class

In the preparation stage, the researcher prepares related to the implementation of the research. These activities include determining the time and place of research, population, research samples, experimental class and control class. In addition, observations were made to schools to collect initial information and the reasons for the need for this research to be carried out. After that, the researchers prepared learning tools in the form of lesson plans, e-module electrolyte and nonelectrolyte solution based on guided discovery learning, compiled and analyzed test questions to measure student learning outcomes. Before using the test questions, must be tested for validity, reliability, discriminating power of questions, and the index of difficulty of the question (Latisma, 2011).

Next is the research implementation stage. At this stage, students are given a pretest before being given treatment. Then, different treatments were given to the two sample classes. The experimental class using an e-module electrolyte and nonelectrolyte solution based on guided discovery learning and the control class using a book from the school. The last stage is the completion stage. At this stage, students are given a posttest after being given treatment. The pretest and posttest values were processed and then analyzed. Then based on the results of data analysis, a conclusion is drawn. Data was collected using multiple choice test questions to measure learning outcomes in the cognitive domain. Analysis of the learning outcomes test used the n-gain test (R. Hake, 1999), the normality test and the homogeneity of variance test (Santoso, 2012). Based on the results of data analysis, the data is normally distributed and has a homogeneous variance. Therefore, to hypothesis test using the indpendent sample t (Santoso, 2012).

▪ RESULT AND DISSCUSSION

The results obtained from the pretest and posttest scores as learning outcomes in the cognitive domain. Figure 1 shows student learning outcomes before being given treatment (pretest) and after being given treatment (posttest). From Figure 1 it can be

seen that the score in the experimental class is higher than the control class. To analyze the learning outcomes of the sample class, it is necessary to perform statistical test (hypothesis test). The mean value of the pretest in the experimental class is 29.3 and in the control class is 29.6. The pretest was conducted to determine the initial ability level of the students regarding the electrolyte and nonelectrolyte solution material.

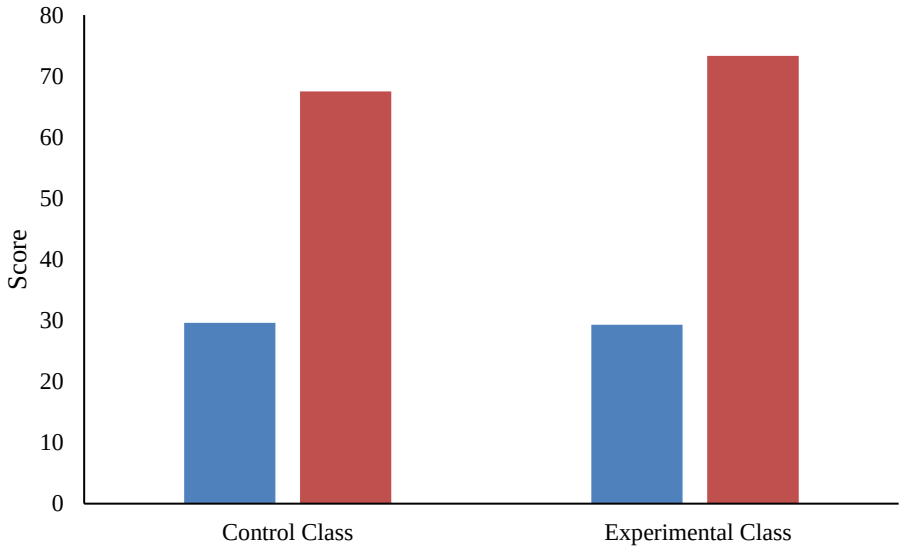

Figure 1. Pretest and posttest results

Sample classes was given a posttest to see student learning outcomes in the cognitive domain. Based on Figure 1, the posttest mean in the experimental class is 73.3 and in the control class is 67.5. It can be concluded that, there is an increase in learning outcomes from previous learning outcomes. After getting the results of the pretest and posttest, the N-gain test was carried out. Based on the n-gain analysis (Table 2), the experimental class n-gain value is higher than the control class. This shows that there is an increase in good learning outcomes in the experimental class compared to the control class. The data obtained was tested for the n-gain value to determine the increase in learning outcomes that occured. The n-gain data obtained can be seen in Table 2.

Table 2. N-gain learning results

Class	N-Gain	Category
Experimental	0.61	Medium
Control	0.53	Medium

Table 2 shows that the n-gain value for the control class is lower than the experimental class. Hypothesis tests proved that the learning outcomes of the sample classes were significantly different. To select the hypothesis test to be used, the data were analyzed through normality and homogeneity tests.

The normality test was conducted to determine the distribution of the data generated by the normal sample class or not by using the Shapiro-Wilk test. Based on the results of the normality test, the value (sig) in the experimental class is (0.286) and the value (sig) in the control class is (0.899) and is greater than (0.05). It can be

concluded that the learning outcomes data in the two sample classes are normally distributed.

The homogeneity test was conducted to determine whether the data generated by the sample class had a homogeneous variance or not. Based on the results of the homogeneity test, it was found that the experimental class and the sample class had a value (sig) of 0.926 > (0.05). It can be concluded that the sample class learning outcomes data have a homogeneous variance. In the normality test and homogeneity test, it was found that the sample data were normally distributed and had homogeneous variance. Therefore, the hypothesis test used is the independent t-test. Based on the results of hypothesis testing, the sig (2-tailed) obtained is 0.042. That is, H0 is rejected because the value of sig <0.05 and H1 is accepted, the n-gain value of the experimental class is higher than the control class. The experimental class N-gain value is 0.61 and the control class N-gain value is only 0.53. It can be concluded that the increase in learning outcomes of the experimental class is higher than that of the control class.

Other research relevant to this research is the use of e-modules based on guided discovery learning that is effective in improving student learning outcomes (Kristalia & Yerimadesi, 2021) and improving students' critical thinking skills (Aufa et al., 2021). In the learning process, students in the experimental class are easier to follow because they are guided by e-modules that have guided discovery learning syntax so that students can find and form new concepts being studied. Based on this description, it can be concluded that the use of an e-module electrolyte and nonelectrolyte solution based on guided discovery learning has an effect on improving the learning outcomes of class X students at SMA Negeri 1 Padangpanjang. This is relevant to the research conducted by (Muntari et al., 2019), namely the application of the guided discovery learning model has a positive effect on the chemistry learning outcomes of class X students.

▪ CONCLUSION

Based on the research that has been done, it can be concluded that the using of e-module electrolyte and nonelectrolyte solution based on guided discovery learning has an effect on the learning outcomes of grade X students of SMA Negeri 1 Padangpanjang. The effect is an increase in student learning outcomes in the experimental class using e-module electrolyte and nonelectrolyte solution based on guided discovery learning which is significantly higher than the control class.

The weakness in this study is that students do not understand the guided discovery learning model so that it must be explained first before starting learning, students must have a android or laptop to access e-modules and the time allocation used during learning is not as usual during the Covid19 pandemic. Therefore, the existence of an e-module based on guided discovery learning has a positive impact in the field of education, namely it can help students understand and find concepts independently.

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