JPPIPA 8(2) (2022)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Implementation of Guided Discovery Learning Model with SETS Approach Assisted by E-Modul Chemistry on Scientific Literacy of Students

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DOI: 10.29303/jppipa.v8i2.1264

Article Info
Received: December 13, 2021
Revised: April 7, 2022
Accepted: April 9, 2022
Published: April 30, 2022

Abstract: Chemical concepts are not only taught abstractly by the teacher, but students also need to do it independently to better understand, of course, with the help of the teacher. So it is necessary to intervene in learning such as the right way in learning the right way. The purpose of this study was to demonstrate the effect of implementing a guided discovery learning model with the SETS approach with the help of a chemistry module on the scientific skills of SMA Negeri 1 Padang class XI students. The method of this study uses a quasi-experimental type of study, and the study design used is a randomized control group test-only design. The subject of this study is all students in class XI SMA Negeri 1 Padang, who are actively enrolled in 2021/202, which consists of seven classes. Groups of research populations are grouped using random sampling techniques. Multiple-choice test equipment/2-step literacy is based on up to 20 items. Technical analysis of data in this study is quantitative data analysis by testing hypotheses using the average analysis of the similarity test of 2 groups of unpaired samples (independent). The results of the hypothesis test, namely $t_{count} > t_{table}$, determined that the research hypothesis was accepted. This means that the implementation of a guided discovery learning model with the SETS approach supported by the Chemistry E module will have a significant impact on the scientific abilities of Class XI students in SMA Negeri 1 Padang.

Keywords: Model Guided Discovery Learning; SETS Approach; E-Module Chemistry; Science Literacy

Citation: Warlinda, Y. A., Yerimadesi, Y., Hardeli, H., & Andromeda, A. (2022). Implementation of Guided Discovery Learning Model with SETS Approach Assisted by E-Modul Chemistry on Scientific Literacy of Students. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 507–514. https://doi.org/10.29303/jppipa.v8i2.1264

Introduction

The main goals of the Indonesian curriculum for learning chemistry are scientific skills known as scientific abilities and higher thinking skills. But in reality, students are still struggling to study science, including chemistry, to come up with concepts of specific chemical problems such as solubility, electrolysis, redox reactions, chemical equilibrium, and volumetric analysis. (Tunde et al., 2010; Alabi & Nureni, 2016).

Chemical concepts are not only taught abstractly, but students also need to do independently in groups and exchange ideas in small groups on each given concept so that students understand better (Alabi & Nureni, 2016). This leads to breakthroughs in the learning process, such as teacher guidance and the choice of the appropriate strategy, which is a guided discovery learning model, or GDL model for short.

The GDL model is a learning model that helps stimulate students' ability to answer open and specific questions from teachers (Eggen & Kauchak., 2012). This learning model has positive implications, namely in the

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learning process the GDL model affects students' learning motivation, seeks to improve creative, critical thinking skills and has an effect on students' scientific literacy. (Wulandari, 2018; Ibad et al., 2019; Lestari, 2019).

21st century learning is currently an era of learning based on science and technology, specifically communication technology is developing very rapidly and its impact is seen in the fierce global competition in everything that includes human life. Moreover, the Covid-2019 condition which became a pandemic in various countries including Indonesia in early 2020. This condition innovated educational institutions to make updates in digital-based learning processes. The form of innovation carried out is online learning or termed online (in the network). Online/online learning will certainly be less meaningful without digital-based teaching materials to support the learning process. One of the digital teaching materials available online is the emodule. E-module chemistry is relatively practical and valid, so it can be used for online and offline learning (Febrila, 2021; Wildayati, 2021).

According to a 2018 report released by the Organization for Economic Co-operation and Development (OECD), Indonesia is still ranked 72nd out of 77 countries. Recent results from the Program for International Student Assessment (PISA) show student development in countries with very few literacy goals. Indonesia has participated in PISA seven times and has been at the bottom six times. The results of Indonesian scientific literacy skills are shown in Table 1.

Table 1. Table of Indonesian Scientific Literacy Test Results by OECD 2018

Years	Rating	Number of Participants (Country)
2003	38	40
2006	50	57
2009	60	65
2012	64	65
2015	62	70
2018	72	77

This condition is very worrying because the ability and reading skills which are the basis for obtaining knowledge in problem-solving, decision-making skills and attitude formation are still very minimal. Overcoming these problems learning science including chemistry requires a learning approach that can find conceptual facts and solve problems in the surrounding environment in order to change passive learning into active learning. One of the applicable learning approaches is the *SETS (Science, Environment, Technology, Society)* approach. The focus of the SETS approach is to enable students to discover interrelated knowledge of science, environment, technology and society (Nikmah & Binadja, 2013). Consistent with the purpose of the guided discovery model. This, when implemented, means a discovery or discovery under the guidance of the teacher that the student found while the teacher was guiding the student. Therefore, SETS approaches learning as a goal in learning the 21st creative thinking (Nuray & Morgil, 2010; Wiasti, 2018; Akmalia, 2019; Kamirasari, Northwest, 2020). Based on the above explanation, this study provides instructions for implementing a guided discovery learning model supported by the chemistry e-module in the SETS approach to student scientific competence at SMA Negeri 1 Padang.

Method

The method used is quasi-experimental and uses a study design that is a post-test design of a randomized control group. The subject of this study is all students in class XI SMA Negeri 1 Padang, who are actively enrolled in 2021/2022, which consists of seven classes. One group of the study population was divided into two sample classes, an experimental class and a control class, using a random sampling technique. The procedure for this design is that the experimental class is processed using a GDL model with a SETS learning approach supported by E-module chemistry. Although the control class was treated according to the traditional model. The design procedure is summarized in Table 2.

Table 2. Research Design Randomize Posttest Only Design

Class	Treatment	*Posttest*
Experiment	X	T
Control	Y	T

Description:

T = posttest result

X = GDL model with SETS approach assisted by e-chemistry module

Y = conventional learning.

The research instrument uses a test that serves to reveal the scientific literacy of students. The test instrument in the form of multiple choice reasoned / two tiers literacy-based as many as 20 items that have been measured and analyzed in terms of validity, index of difficulty, reliability and discriminating power of questions. Technical analysis of data in research is quantitative data analysis by testing hypotheses. Hypothesis testing using the average similarity test analysis technique from 2 groups of unpaired samples (independent). The conditions for testing the hypothesis must be homogeneity and normality. The normality test uses the *Liliefors* formula. Followed by homogeneity testing using the Fisher's exact test formula (F test) to have a homogeneous variance or not. The analysis of the resulting data is well distributed and has homogeneous variations, so it can continue to test the hypothesis (t-test) on two groups originating from different samples (unpaired) using equation 1.

$$t_{hitung} = \frac{X_A - X_B}{S\sqrt{\frac{1}{n_A} + \frac{1}{n_B}}} \qquad \text{.........................} \ (1)$$

Parameters for hypothesis testing can be seen from the ttable price which is based on a certain significance level and has degrees of freedom (dk) = nA + nB – 2, if $t_{count} > t_{table}$, then H0 is rejected and vice versa if $t_{count} < t_{table}$, then H0 is accepted (Supardi, 2013).

Result and Discussion

In this study, the learning process in the experimental class applied guided discovery learning model, students carried out 5 stages of the learning model with guidance from the teacher and assisted by e-modules based on guided discovery learning models with the SETS approach on chemical equilibrium material in the process. learning carried out online through the Zoom meeting platform.

In the first stage, namely motivation and problem presentation, students conduct observation activities through reading, listening, viewing pictures presented in the chemical equilibrium e-module and students listening to questions posed by the teacher as a stimulus. to provide motivation. Stimulus or stimulation given by the teacher can also raise questions from students so that from these questions students can identify with teacher guidance in the form of questions among these problems to formulate temporary answers or hypotheses. This first stage can be seen in Figure 1.

Figure 1. Stages of motivation and problem presentation

The next stages of the guided discovery learning model are data collection (data collection) and data processing (data processing). At this stage students are given the opportunity by the teacher to answer the questions contained in the module by collecting information by observing objects, reading material descriptions. During the data collection stage, the data processing stage also takes place, where students process and interpret the data, which is guided by the teacher through study group discussions. This second stage can be seen in Figure 2.

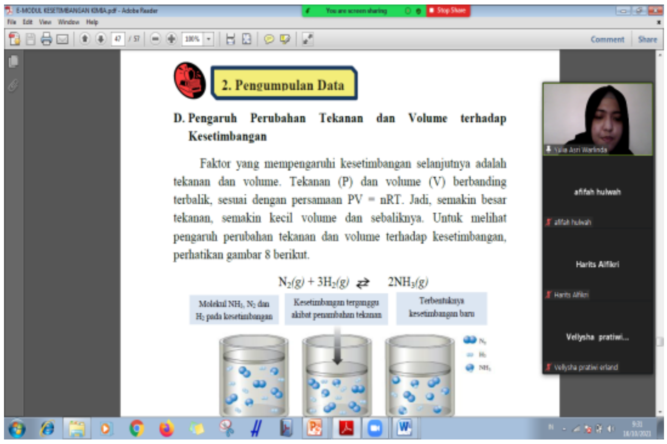

Figure 2. Stages of data collection and data processing

The next stage of the guided discovery learning model is verification and closure. At this stage, students with teacher guidance conclude what has been learned based on facts or observations in accordance with learning objectives. The stages of this activity can be seen in Figure 3.

Figure 3. Verification and closure stages

During the learning process, students carry out each stage by applying the guided discovery learning model quite well. This causes students to understand so that scientific literacy increases which is supported by statistical processed data from the following research results.

Research result

The results of the study are derived from the average score of test questions based on multiple-choice justification / scientific ability in the form of two layers, demonstrating that the experimental class achieved excellent scores. The results of the average assessment are summarized in Figure 4.

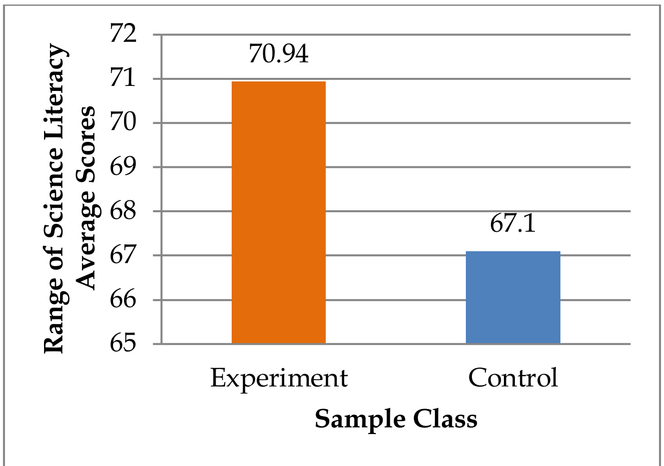

Figure 4. Average Results of Scientific Literacy-Based Tests

The next step, from the results of the average test scores based on scientific literacy, then carried out hypothesis testing with the initial stage of testing the normality of the data using the Liliefors technique. The results of the sample class normality test are shown in Table 3.

Table 3. Sample Class Normality Test Results

Class	L_0	L_t	Description
Experiment	0.14	0.11	Normal
Control	0.14	0.12	Normal

The results obtained in Table 3 show that the two sample classes are normally distributed, so the Fisher/F-test technique can be used to test the uniformity of the data and continue in the second stage. The results of the sample class homogeneity test are shown in Table 4.

Table 4. Sample Class Homogeneity Test Results

Class	Fcount	Ftable	Description
Experiment Control	1.59	1.69	Homogeneous

The data in Table 4 shows that the two sample classes have homogeneous variance. This is because the two sample classes do not have a high or heterogeneous level of variation in test scores. Then it can be continued with the final stage of testing, namely the t-test which is summarized in Table 5.

Table 5. Sample Class Hypothesis Test Results

Class	S	S^2	t_{count}	t_{table}
Experiment	18.7	350.4	2.2	1.66
Control	14.9	223.8		

The results of the above hypothesis test explain that the research hypothesis was accepted. This means that the implementation of a guided discovery learning model using the SETS approach supported by the chemistry e-module will have a significant impact on the scientific skills of class XI students in SMA 1 negeri Padang.

Discussion

The results of data processing and analysis that have been carried out, obtained differences in the significance of the data on the literacy abilities of students from the 2 sample classes. The data obtained in Figure 1 show that the experimental class achieved higher mean values than the control class. The average for the experimental class was 70.94, while the average for the control class was 67.1. Then the difference in the average value was analyzed statistically, namely normality and homogeneity tests. The test results obtained data that were normally distributed with homogeneous variance contained in Tables 3 and 4 so that the data was continued with hypothesis testing (t-test).

Table 5 shows the results of data processing to test the hypothesis obtained with $t_{count} > t_{table}$. From this result, we can conclude that the research hypothesis was accepted. In other words, the implementation of the GDL model has a significant impact on the scientific capabilities of the population sample. The significant difference was caused by different processing classes assigned to the two sample classes. In the experimental class, the GDL model was used in the SETS approach and supported by the E-Chemistry module, while in the control class a conventional model or learning model was used/agreed upon by the teachers of SMA Negeri 1 Padang to teach. This has resulted in an increase in the differentiation of the scientific literacy abilities of class XI students at SMAN 1 Padang.

Mastery of students' scientific literacy skills is influenced by several factors, namely the approach or science learning method used by teachers in building learning concepts (Wulandari, 2016). Therefore, improving students' scientific abilities can be traced back to the implementation of guided discovery learning models. This is consistent with studies that conclude that the GDL model is a model (Yerimadesi et al., 2018; Bayharti et al., 2019; Yerimadesi et al., 2019a; 2019b). Level validity, practicality, and high effectiveness.

This GDL model can increase students' interest in science and technology, planned in advance and then guided by the teacher so that students are trained and apply scientific knowledge obtained from discoveries to any situation (Akinbobola, 2010). This is consistent with the research done by (Nbina, 2013; Khasanah et al., 2016) If the average score of the question is based on science education, the GDL model or guided discovery model can improve the student's literacy or metacognitive skills found in experimental classes that apply the GDL model. In addition, the GDL model can adjust the position of the teacher as a facilitator and encourage students to think for themselves. Students are given the opportunity to build knowledge based on teaching materials and data created by teachers. As a result, under the guidance of this teacher, it provokes a better understanding of students of physical concepts (Arafah, 2020).

The science learning model has implications, namely as a process in science learning, scientific reasoning and communication (Acher et al., 2007; Ardianto & Rubini, 2016). Therefore, the learning model is present as an effective pedagogic tool to guide students to develop scientific literacy skills (Halloun, 2007). Indirectly, the achievement of students' scientific literacy wins is supported and accommodated by each GDL model syntax during the learning process. Actively following during student learning through discovery, including reflection, thinking, experimenting, and exploring activities. These activities lead students to connect examples in everyday life, so that later they can propose and test hypotheses and provide space for students to interact and understand the expected performance (Balim, 2009). This is in line with research that has been carried out (Afrrannisah et al., 2021) that the GDL model can increase students' interest in understanding concepts assisted by audio-visual media because the stages of learning begin by providing a stimulus or stimulation to students first. So that students are able to solve early learning problems independently. After students are able to stimulate the learning process, students begin to identify the problem as a hypothesis. Students can also collect data from the results of previous identification, then process data, prove and generalize or conclude findings. So that it can improve process skills student science (Dewi et al., 2017).

The increase in students' scientific literacy skills in classes given treatment is also influenced by digital teaching materials used in online learning to support the learning process (Reynolds & Chiu, 2013). This is in line with the objectives of the 21st century learning demands in the 4.0 revolution era which is learning based on the development of science and the use of technology. Utilizing information technology in the chemistry learning process can motivate and encourage more independent learning so that students have the impression of learning that is recorded long in memory. Not only applying the GDL learning model so that students are trained independently but also assisted with teaching materials such as e-modules based on the GDL model as an innovation in teaching materials to create optimum and efficient communication between teachers and students in the learning process (Handayani et al., 2021; Maison, 2021; Nenchi et al., 2021).

A significant increase in scientific capacity in the experimental class was also caused by the teaching of material concepts by teachers supported by the use of chemical modules based on the GDL model. The COVID-19 pandemic has led to online learning so teachers need teaching materials and practical media to use without face-to-face learning (Sudarsana et.al., 2021). Having a chemistry module based on the GDL model helps students find and understand concepts easily. This is supported by previous studies in which appropriate and effective e-modules of chemistry are used in the learning process to improve students' learning outcomes and scientific abilities (Raharjo et al., 2017; Puspitasari et al., 2018; Andriani & Masykuri, 2021; Asda & Andromeda, 2021).

The difference between the experimental class and the control class is also influenced by the application of the SETS approach in the learning process of the experimental class. The SETS approach stands for Science, Environment, Technology and Society and is a learning approach that combines environment, society and technology into learning to make learning more meaningful. The focus of the SETS approach is for students to discover knowledge that is interrelated between science, environment, technology, and society (Nikmah & Binadja, 2013). In line with the purpose of the guided discovery learning model, its implementation is discovery or discovery under the guidance and guidance of a teacher. By applying the SETS approach in learning, it can be used to develop students' academic abilities so as to improve learning outcomes (Akmalia, 2019; Fatimahwati et al., 2021). This causes a difference in the average of the two sample classes.

Conclusion

The results of the research that have been described and explained above provide the conclusion that by implementing the guided discovery learning model with the SETS approach assisted by the chemical e-module, it has a significantly higher effect on the average test score on the scientific literacy ability of class XI students at SMA 1 Negeri Padang.

Acknowledgements

The author has provided the expertise and time to review previous hardships, supervisors, participating instructors, SMA Negeri 1 Padang School, and manuscripts and evaluate articles submitted as publications. Thanks to the article reviewers. Approved or rejected during the journal publishing process. All of these are very important to ensure the quality and scientific impact of this article.

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