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The Effectiveness Of Ion Equilibrium And Ph Of Salt Solution E-Modules Based On Guided Inquiry Learning For Student's Learning Outcomes

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***Abstract*—This study aims to test the effectiveness of an integrated virtual laboratory-based guided inquiry e-module on ion balance material and the pH of a salt solution whose validity and practicality are known. The research method used is a quasi-experimental in the form of a nonequivalent control group design. The research site is at SMA Negeri 5 Padang with a population of class XI students at SMA Negeri 5 Padang for the academic year 2020/2021 and sampling using purposive sampling technique. The research instrument used multiple choice questions with 5 answer choices with good question criteria. The effectiveness of e-modules was analyzed from improving student learning outcomes through N-Gain testing with the result of g = 0.59 which stated that e-modules were effectively used to improve student learning outcomes with moderate criteria. Improved student learning outcomes using guided inquiry-based e-modules compared to student learning outcomes that did not use guided inquiry-based e-modules in learning through hypothesis testing. Data processing from the sample class showed an increase in student learning outcomes that were normally distributed with homogeneous variance.**

Keywords*—*Effectiveness, Guided Inquiry, E-module, Ionic Equilibrium and pH of Salt Solutions, Learning Outcomes

I. INTRODUCTION

Materials on ionic balance and pH of salt solutions were studied by students of class XI MIPA SMA/MA. The material on ion balance and pH of salt solution has a scope of factual, conceptual, and procedural knowledge and is theoretical in nature that must be mastered by students. The factual knowledge contained in this material, for example, the symptoms of changing the color of litmus paper when it is put into an acid/alkaline solution. The conceptual knowledge contained in this material is one of the definitions of salt hydrolysis and the types of salt hydrolysis. Procedural knowledge on this material is in the form of determining the pH of a salt solution. Based on these characteristics, it is concluded that the material of ionic equilibrium and the pH of the salt solution is an abstract chemical concept. Therefore, teaching materials are needed that can help students understand abstract concepts in this material independently.

Interviews were conducted with 3 chemistry teachers and a questionnaire given to 106 students of class XII MIPA at SMAN 5 Padang obtained information that: (a) teachers have used learning media on ion balance and pH of salt solution, three media that are often used are power points, modules and worksheets; (b) 56.6% of students have difficulty in understanding the concept of ion balance material and the pH of a salt solution. Understanding students' concepts is closely related to learning outcomes. If students have difficulty in understanding the concept of a material, learning outcomes will also not be achieved optimally. Therefore, it is very important to find efforts that can help students understand the concept so that student learning outcomes can increase.

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Therefore, teaching materials and learning models are needed that increase students' interest in independent learning in finding material concepts so that learning outcomes can increase (Aulia & Andromeda, 2019).

The inquiry model in Indonesia is in accordance with the 2013 Curriculum by applying a scientific approach (Permendikbud, 2016). One level of the inquiry model is guided inquiry learning (GIL). GIL has a positive influence on critical thinking skills (Ningsyih et al., 2016), and maximizes students' ability to interpret data and analyze information (Ramadhan et al., 2018). Research conducted by Rambe et al, (2020) found that the GIL learning model can improve student learning outcomes. In the GIL model, students are required to be active in developing critical, logical and systematic thinking skills so that students are able to find concepts independently through the questions asked while the teacher facilitates students to learn. Therefore, GIL is an effective learning model to be applied in learning and a solution to improve learning outcomes.

E-modules are teaching materials used by students, equipped with animations and interactive simulations so that students are easy to solve problems and increase the level of interaction in learning (Gigih et al., 2015). Research conducted by Hariani et al., (2020) resulted in the use of e-modules on salt hydrolysis material with the GIL learning model to improve students' conceptual understanding. In line with that, Agung et al., (2020) stated that students who use e-modules are easier to find material concepts compared to those who do not use e-modules, this is because e-modules are equipped with materials, practice questions which contains key questions to assist students in finding a concept independently so that learning outcomes also increase. Based on the research that has been done, the use of e-modules on ion balance material and the pH of salt solutions can be applied to improve student learning outcomes.

Research conducted by Asda & Andromeda (2021) on the use of GIL-based e-modules in virlabs integrated electrolyte and nonelectrolyte solutions can improve student learning outcomes. Virlabs can be used to understand a subject matter and be an alternative for practicum activities that cannot be carried out in the laboratory due to time constraints or laboratory equipment (Gunawan et al., 2018) concluded that the learning carried out was effective on student learning outcomes. In addition, the use of ICT makes practical videos of interest to students. Retaining knowledge through practical videos has proven to be effective compared to traditional lessons in terms of knowledge (Herga & Dinevski, 2012).

Subsequent research conducted by Yohana & Andromeda (2019) produced a GIL-based e-module on ion balance material and the pH of a salt solution equipped with virlabs. According to (Tatli & Ayas, 2010) virlabs can be used as a support tool in a real laboratory or as an alternative laboratory when a real laboratory is not available or real laboratory conditions are insufficient. In addition, the use of virtlabs in e-modules is considered very efficient because learning between practicum and theory can be done in one room.

II. METHODS

This research was conducted from February to March 2021 at SMA N 5 Padang. The research population is class XI students of SMA Negeri 5 Padang in the academic year 2020/2021. The sampling technique is purposive sampling. The two sample classes used are class XI MIPA 3 and XI MIPA 4. The research method using a quasi-experimental method in the form of a nonequivalent control group design is shown in Table 1.

Table 1. Methods

Class	Pretest	Treatment	Posttest
R_1	Q_1	X	Q_2
R_2	Q_1		Q_2

Based on the research design with R1 = experimental class R2 = control class X = learning using guided inquiry-based e-modules Q1 = initial test Q2 = final test (Sugiyono, 2013). The experimental class conducted learning using an e-module based on guided discovery learning integrated virlabs, while the control class studied using teaching materials provided by the school. The research instrument used was in the form of multiple choice and had validity, reliability, discriminatory power and difficulty index on good sole criteria. The research instrument used in the form of multiple choice and already has validity, reliability, discriminatory power

and difficulty index on the criteria for good questions. Both sample classes were given a pre-test before starting the lesson and a final test at the end of the lesson. The data obtained after conducting the research were processed using the n-gain test and hypotheses.

III. RESULTS AND DISCUSSION

This study aims to determine the effectiveness of the use of e-module based on guided discovery learning integrated video practicum on the material of ion balance and pH of salt solution on student learning outcomes. The research data were obtained after conducting research and data collection at SMA N 5 Padang. Data collection was carried out directly from the data on the

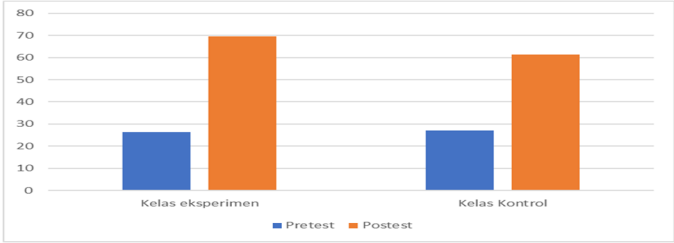

Figure 1. Pretest and Postest Eksperimental C*lass*

learning scores of the sample class students in the cognitive realm. The results obtained are shown in Figure 1

Based on data analysis, the sample class has almost the same initial ability. To analyze the initial knowledge possessed by students, it is necessary to do a preliminary test. The results of this initial test are very useful for teachers to see which material should be taught more deeply in the learning process so that the time achieved in the learning process is more effective (Gazali & Yusmaita, 2018). In both classes the sample was given an initial test after the learning process ended to analyze students' abilities in the cognitive domain. Based on the results of the initial test for the sample classes, it can be seen that the value of the two sample classes has increased. However, the experimental class has a higher learning outcome value. After the initial and final test scores were obtained, n-gain analysis was performed.

The level of effectiveness of the guided inquiry-based e-module can be seen with the n-gain test. The test results of the two sample classes obtained are shown in Table 2.

Table 2. Experimental Class N-Gain Criteria

Kelas	N	n-gain	Kategori
R_1	36	0.59	Sedang
R_2	36	0.47	

The n-gain analysis describes an increase in the results of the two sample classes after learning. The average n-gain for the experimental class is 0.59 while the control class is 0.47. The average of the two sample classes is in the medium category, but the difference in value between the two is 0.12 with the experimental class being higher. This shows that guided inquiry-based e-modules are more effective in increasing the value of student learning outcomes. To prove the value of the sample class has a significant difference, a hypothesis test is carried out. To test the hypothesis, it is necessary to know in advance whether the data obtained are normally distributed and homogeneous or not.

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

Table 3. Normality of Data

Class	α	N	(sig)	Information
Eksperiment	0,05	36	0,077	Normal Distribution
Control			0,326	

The table above shows the results of the normality test with a significance level of 0.05 and the value (sig) in the experimental class 0.077 and the control class 0.326. The homogeneity test is carried out so that there are no differences or sample inhomogeneities when comparing two or more groups (Radyuli et al., 2019). The homogeneity test results are described in Table 4.

Table 4. Data Homogeneity

Class	α	(sig)	Information
Eksperiment	0,05	0,328	Homogeneous Variance
Control			

The table above shows a value (sig) of 0.328 > 0.05 which means that the learning outcomes of the sample class have a homogeneous variance. The results of the normality and homogeneity test showed that the data were normally distributed and homogeneous, so the hypothesis test was carried out by independent t-test (Table 5).

Table 5. Hyphothesis Test

Class	Sig. (2-tailed)	Information
Eksperiment	0,026	H0 is rejected and H1 is accepted
Control		

The results of the hypothesis test showed that Sig. (2-tailed) < 0.05 which indicates that the research hypothesis is accepted because the sample class has a significant difference in improving learning outcomes. In other words, the use of GIL-based e-modules integrated with virlabs on ion balance material and salt solution pH is effective on student learning outcomes.

Other studies also reveal that the use of guided inquiry learning models is effective on students' conceptual understanding (Mahesti et al., 2019) and the use of guided inquiry-based e-modules is also effective on student learning outcomes (Asda & Andromeda, 2021). Students who learn using guided inquiry-based e-modules find it easier to follow the lesson because it has been equipped with steps according to the guided inquiry learning model. In addition, students can re-learn material that has not been understood repeatedly with or without guidance from the teacher using guided inquiry-based e-modules.

GIL-based learning has five steps, namely orientation, exploration, concept formation, application and closing (Hanson 2005). The existence of a GIL-based e-module makes the learning process more focused because it has been equipped with a step-by-step learning model. Each learning step in the e-module is equipped with key questions so that students can study independently. The key questions contained in the e-module require students to be able to think to solve a problem critically and analytically. Therefore, GIL-based learning can develop students' scientific attitudes and realize active learning that can increase student independence in the learning process (Sanjaya, 2006).

The use of virlabs can be a solution to practical activities that cannot be implemented in real terms. In addition, virlabs make a positive contribution in achieving the goals of a learning process (Tuyuz, 2010). Virlabs helps make a positive contribution in achieving the objectives of a material to students which basically requires practicum activities so that student learning outcomes can be improved (Anisah, 2013). The data obtained from the control class is used to provide reinforcement (external validity) for

the conclusions drawn in the study (Nazir, 2009). The limitation of this research is that the e-module cannot be accessed using mobile phones so that schools that do not have a computer laboratory cannot do learning using this e-module.

Based on this description, it can be concluded that the use of the GIL-based e-module integrated with virlabs on the ion balance material and the pH of the salt solution is effective on student learning outcomes with the category of moderate effectiveness level. Thus, this e-module can be used in a wider scope as one of the alternative technology-based teaching materials that can improve student learning outcomes.

IV. CONCLUSION

Based on the analysis of research data, it can be concluded that the use of an integrated GIL-based e-module virlabs on the ion balance material and the pH of the salt solution is effective on the learning outcomes of students of class XI MIPA at SMAN 5 Padang as evidenced by the results of the analysis of the level of effectiveness, which is moderate

REFERENCES

[1] Agung, F. P., Suyanto, S., & Aminantu, T. (2020) E-Modul Gerak Refleks Bebrbasis Pendekatan Kontekstual ubtuk Meningkatkan Pemahaman Konsep Siswa SMA. Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan, %(3), 279-289

[2] Asda, V.D., & Andromeda. (2021). EDUKATIF : JURNAL ILMU PENDIDIKAN Efektivitas E-modul Berbasis Guided Inquiry Learning Terintegrasi Virlabs dan Multirepresentasi pada Materi Larutan Elektrolit dan Non Elektrolit terhadap Hasil Belajar Siswa. 3(3), 710-716

[3] Anisah, E., Mantini RS, S., & Subroto, T. (2013). Kefektifan Virtual Laboratory Terhadap Hasil Belajar Siswa Materi Larutan Penyangga dan Hidrolisis, Chemistry in Education, 2(1), 1-6

[4] Aulia, A., & Andromeda, A. (2019). Pengembangan E-Modul Berbasis Inkuiri Terbimbing Terintegrasi Multirepresentasi dan Virtual Laboratory pada Materi Larutan Elektrolit dan Non Elketrolit untuk Kelas X SMA/MA. Edukimia, 1(1), 94-102

[5] Gazali, F., & Yusmaita, e. (2018). Analisis Prior Knowledge Konsep Asam Basa Siswa Kelas XI SMA untuk Merancang Modul Kimia Berbasis RACT. Jurnal Eksakta Pendidikan (Jep), 2(2), 202

[6] Gigih, D. D., Saptorini, & Soeprodjo. (2015). Penerapan Metode Inkuiri Berbantuan E-Modul. Jurnal Inovasi Pendidikan Kimia, 7(2), 1201-1209.

[7] Gunawan, G., Nisrina, N., Suranti, N. M. Y., Heryanti, L., & Rahmatiah, R. (2018). Virtual Laboratory to Improve Students, Conceptual Understanding in Physics Learning. Jurnal of Physics: Conference Series, 1108(1)

[8] Hanson, D. M. (2005). Designing Process-Oriented Guided-Inquiry Activities. Faculty Guidebook – A Comprehensive Tool for Improfing Faculty Performance, 1 – 6

[9] Hariani, N. R., Nuswowati, M., & Winarno. (2020). Pengaruh Penerapan Model Inkuiri Terbimbing Berbantuan E-Modul Terhadap Pemahaman Konsep Hidrolisis Garam. Jurnal Inovasi Pendidikan Kimia, 14(1), 2561-2571

[10] Herga N. H., & Dinevski, D. (2012). Virtual Laboratory in Chemistry – Experimental Study of Understanding, Reproduction and Application of Acquired Knowledge of Subject's Chemical Content, Organizacija, 45 (3)

[11] Mahesti, K., Harjono, A., Sahidu, G., & Gunawan. (2019). Pengaruh Model Pembelajaran Inkuiri Terbimbing Berbantuan Vidio Kontekstual Terhadap Penguasaan Konsep Fisika Peserta Didik. Jurnal Pendidikan Fisika dan Teknologi, 5(2), 341

[12] Nazir. (2009). Metode Penelitian. Ghalia Pustaka

[13] Ningsyih, S., Junaidi, E., & Al Idrus, S. W. (2016). Pengaruh Pembelajaran Praktikum Berbasis Inkuiri Terbimbing Terhadap Kemampuan Berpikir Kritis dan Hasil Belajar Kimia Siswa. Jurnal Pijar Mipa, 11(1), 55-59

[14] Permendikbud. (2016). Permendikbud Th. 2016 No. 021 Ttg. Standar Isi Pend. Dasar_Menengah

[15] Radyuli, P., Sefriani, R., & Qomariah, N. (2019) Pembelajaran Inquiri Menggunakan Google Form Terhadap Hasil Belajar Simulasi dan Komunikasi Digital (Case Study of Class X of SMK Negeri 9 Padang). Jurnal Ilmu Pendidikan, 1(3), @94-302

[16] Ramadhan, M. E. P., Andayani, Y., & Hadisaputra, S. (2018). An Analysis of Thinking Skills Among Students Studying Chemistry Using Guided Inquiry Models. AIP Conference Proceedings, 2021(October 2018), 1-5

[17] Rambe, Y. A., Silalahi, A., & Sudrajat, A. (2020). The Effect of Guided Inquiry Learning Model and Critical Thinking Skills on Learning Outcomes. 488(Aisteel), 151-155

[18] Sanjaya, W. (2006). Strategi Pembelajaran Berorientasi Standar Proses Pendidikan. Kencana Prenada Media Group

[19] Sugiyono. 2013. Metode Penelitian Kombinasi. Bandung : Alfabeta

[20] Tatli, Z., & Ayas, A. (2010). Virtual Laboratory Application in Chemistry Education. Procedia – Social and Behavioral Sciences, 9, 938 – 942

[21] Tuyuz, C. (2010). The Effect of the Virtual Laboratory on Students' Achievement and Attitude in Chemisrty. International Online Journal of Aducational Sciences, 2(1), 37-53

[22] Yohana, Elvi (2019). Pengembangan E-Modul berbasis Inkuiri Terbimbing Terintegrasi Virtual Laboratory Pada Materi Kesetimbangan Ion dan pH Larutan Garam Untuk Kelas XI SMA/MA. UNP