Jurnal Penelitian Pendidikan IPA (JPPIPA)

P-ISSN : 2460-2582 | E-ISSN : 2407-795X
Sekretariat : Lt. 3 Gedung Pascasarjana Universitas Mataram
Telp./Fax : (0370) 634918
Email : jppipa@unram.ac.id
Website : http://jppipa.unram.ac.id/index.php/jppipa/index

THE EFFECT OF PROCESS ORIENTED GUIDED INQUIRY LEARNING MODEL BASED ON VIRTUAL LABORAORY TOWARD PROBLEM SOLVING ABILITIES OF PHYSICS STUDENT

PUTU WIRA SANGGARA[1*], ARIS DOYAN[1], NI NYOMAN SRI PUTU VERAWATI[1]

[1]Physics Education Program, Mataram University, Indonesia.Eemail: sputuwira@gmail.com

Accepted: September 9st, 2018. Approved: November 18st, 2018. Published: December 24st, 2018
DOI: 10.29303/jppipa.v5i1.154

Keywords
POGIL, Lab Virtual, Problem Solving Ability.

Abstract

This study aims to determine the effect of Process Oriented Guided Inquiry Learning model of Virtual Lab to the ability of solving physics problem of high school students of class X. This research type is quasi experiment with pretest-postest control group design research design. The population of this research is all students of class X MIPA SMAN 1 Kuripan with sampling technique using purposive sampling. There are two samples taken are the sample as experimental class given treatment in the form of learning using learning model POGIL assisted Virtual Lab. and control class treated using conventional learning model. Data collection of problem-solving abilities is done by a blueprint test technique. The research hypothesis was tested by using the t-test polled variance with 5% significance. It was concluded that the use of Process Oriented Guided Inquiry Learning model (POGIL) with Virtual Lab has an effect on students problem solving ability with $t_{table} = 2{,}00 < t_{count} = 3{,}11$.

INTRODUCTION

Physics is the study of nature and the natural phenomena that occur, the study focuses on matter, energy, and the relationship of them. Some abstract concepts contained in physics learning, cause difficulties in understanding a material taught, both by students and teachers who are teaching. For this reason, an ideal learning model is needed to support the achievement of the objectives of physics subjects. The ideal learning model in question is a varied model and the learning process is student centered which can lead to an active role in the learning process. Increasing the ability of students in mastering concepts can result in an increase in physical problem solving abilities (Fabian, 2016, Monika, 2014, Mubarrak, 2009).

Today, students' physical problem-solving abilities are still lacking. This can be seen from the results of initial observations made by researchers about the level of problem solving abilities. Based on the observations of researchers through interviews with physics subject teachers and students at SMA Negeri 1 Kuripan, showed that the physical learning process that took place was still dominated by learning that did not involve the active role of students. The learning used is still teacher-centered and limited to information transfer, especially in the form of theoretical and mathematical equations. Learning that only transfers information can result in students becoming passive and lacking in understanding the concept so that it affects the low ability of physics problem solving (Naaman, et al, 2012, Nugraheni, et al, 2014, Sholikhah, et al, 2014)

Based on these problems, a learning model is needed that is able to actively involve students so that learning becomes more meaningful. Learning physics by using a more varied learning model and student-centered learning process can make students play an active role in the learning process. This problem can be solved by using a learning model that is appropriate to the ability of students. Through guided discovery of concepts students will be able to understand concepts that are studied more deeply. One learning model that can be applied is Process Oriented Guided Inquiry Learning (POGIL) assisted by Virtual Lab (Jaya, 2012, Li, 2015).

POGIL is part of the research training teaching model (inquiry training). This learning model applies by bringing students together with a slightly confusing problem, raising questions, experimenting, constructing and testing ideas (Widyaningsih, 2012, Misbah, 2017). Process Oriented Guided Inquiry Learning (POGIL) learning models can further enhance students' problem solving abilities. This is also reinforced by Rosidah's research (2014) which states that students 'problem solving abilities are subject to learning by applying Process Oriented Guided-Inquiry Learning (POGIL) learning models assisted by the Student Activity Sheet (LKPD) higher than students' problem solving abilities subject to conventional learning models in the subject matter of Class XI Opportunities. Nugraheni's (2014) study also stated that the application of the POGIL learning model assisted with effective teaching aids to the problem-solving abilities of grade VIII students of Kuwarasan 1 Public Middle School, Kebumen District in the academic year 2012/2013 on the circumference and area of the circle. Research that strengthens the opinion of researchers is also the research of Pratiwi (2016) which states that the mathematical problem solving ability of students who are taught by using the POGIL model is more effective than students who are taught using Direct Learning.

In addition to applying Process Oriented Guided-Inquiry Learning (POGIL) learning models, students are expected to be easier to solve problems when given the help of a Virtual Lab. Virtual Lab is defined as a computer-based media in the form of simulation of laboratory activities as well as experimental activities in the actual laboratory. Virtual laboratory media are media that can carry out experimental activities without the need for real laboratory tools. The advantages of multimedia use in learning will improve efficiency, motivation, and facilitate experimental active learning, consistent with student-centered learning and help to learn better (Sugiarti, 2015, Sujarwanto, et al., 2014).

Researchers suspect that using the Process Oriented Guided Inquiry Learning (POGIL) learning model assisted by the Virtual Lab is expected to improve students' problem solving abilities. In addition, there is no use of Process Oriented Guided Inquiry Learning (POGIL) learning models combined with Virtual Labs, and from several related studies still in language, chemistry, biology and mathematics subjects so researchers feel interested to conduct research on the field of physics studies. Based on the above considerations, the use of the Learning-Oriented Guided Inquiry Learning (POGIL) model combined with the Virtual Lab is allegedly appropriate for use in Kuripan Senior High School in improving the problem solving skills of learners on physics learning (Kathene, et al 2016, Mason, et al 2016).

METHODS

This quasi-experimental study uses a non-equivalent control group design. A study has several research variables so that it reads out the flow of an experiment. In this study involves the independent variables of learning model POGIL assisted virtual laboratory, the dependent variable problem solving ability, and time control variable, teaching materials.

In this study, the instrument used is a problem solving test in the form of description of eight questions that have been tested for validity, reliability, differentiation, and difficulty level. Then test the hypothesis using the polled t-test variant (Sugiono, 2012).

RESULTS AND DISCUSSION

This research was conducted with the aim to know the effect of learning model of POGIL with Virtual Lab to the ability of solving physics problem of high school students of class X. The research was done by giving treatment in experimental class (X MIA 3) using learning model of POGIL with Virtual Lab, X MIA 2) treated with conventional learning models. Both classes were treated for three meetings with an allocation of 135 minutes each time.

The problem-solving capability measured in this study has four indicators that identify problems, plan strategies, implement strategies, and evaluate solutions. Data on the ability of physics problem solving before and after treatment is obtained through pre-test and final test (Post-test). The test of students' physical problem solving skills before being given treatment can be seen from the initial test scores presented in Table 1.

Table 1. Initial Problem Solving Ability Test Results

Class	Student Number	Higest Score	Lowest Score	Ave-rage
Experiment	20	61.00	28.00	46.15
Control	22	32.00	10.00	18.41

After being treated, the learner is given a final test. The final test results of physics problem solving learners can be seen in Table 2.

Table 2. Final Problem Solving Ability Test Results

Class	Student Number	Higest Score	Lowest Score	Ave-rage
Experiment	20	94.00	70.00	85.45
Control	22	85.00	40.00	60.64

The data of the initial test and the final test of the physical problem solving ability have been tested for homogeneity and normality and it is stated that the initial test and final test data are homogeneous and normally distributed. After that is done hypothesis test using test-t polled variance. Based on the results of hypothesis testing found that the value of $t_{table} = 2.00 < t_{count} = 3.11$. This indicates that H_0 is rejected and H_a is accepted. This means that there was an effect of the POGIL learning model assisted by the Virtual Lab on the physics problem solving ability of the X grade high school students at SMAN 1 Kuripan. These results were reinforced by previous relevant research by Nugraheni (2014) which states that the application of the POGIL learning model assisted with effective teaching aids to the problem-solving abilities of grade VIII students of Kuwarasan 1 State Middle School, Kebumen District in the academic year 2012/2013 on the circumference and area of the circle because with the POGIL learning model assisted by teaching aids, student activeness is emphasized so that it can construct students' knowledge independently through group discussion activities.

The influence of POGIL learning model assisted by Virtual Lab on students' physical problem solving ability because the phases in the POGIL assisted learning model Virtual Lab can make students more focused on problem solving. In the questioning phase, the teacher presents the problem by connecting the material beforehand and the learner studies the problem in groups so that students can recognize the problem well. Furthermore, in the phase of observing, trying and reasoning, the teacher provides full guidance and monitors data collection activities and students experiment and collect observation data so that students can plan strategies to solve problems that are given optimally. In the phase of forming networks students apply strategies or concepts from the results of exploration to be applied to problem solving in the form of practice questions. The last phase of the POGIL learning model assisted by the Virtual Lab which is the closing and conclusions can make students evaluate the solutions that have been used in solving problems given because in this phase students present the results of group work and the teacher guides, gives reinforcement and provides an assessment so that students can evaluate the problem solution well and then make a conclusion from the learning outcomes.

In addition to testing the effect, this study also tested the improvement of problem solving abilities after being treated in the form of the application of the Virtual Lab-assisted POGIL learning model (Moog et al, 2013, Pratiwi, 2016, Zawadzki, 2010). Improved physics problem solving capabilities can be seen from the results of N-gain analysis in Figure 1:

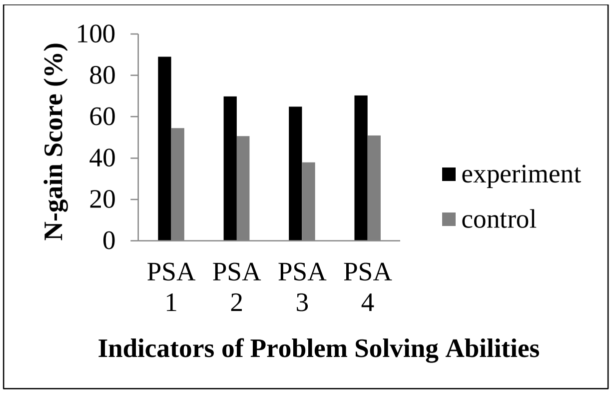

Figure 1. The Comparison of Problem Solving Ability N-gain Score.

Hints :
PSA 1 : Recognizing Problems
PSA 2 : Planning a Strategy
PSA 3 : Implementing the Strategy
PSA 4 : Evaluating Solutions

The results of the N-gain analysis in the experimental class showed a greater value than the control class as a whole. This is also reinforced by Rosidah's (2014) research which states that students 'problem solving abilities are subject to learning by applying the POGIL learning model assisted by the Student Activity Sheet (LKPD) higher than the students' problem solving abilities subject to conventional learning models in the subject matter Class XI Opportunities because learners are actively involved in learning. POGIL has a phase that guides learners through exploration activities in order for learners to build their own understanding (inquiry). The N-gain in the experimental class on each indicator is greater than the control class shown in Figure 2 below:

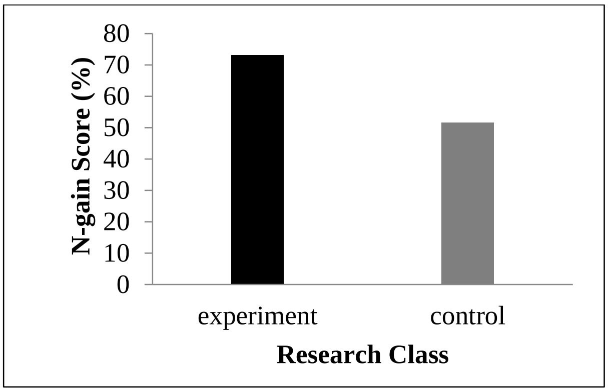

Figure 2. The N-gain Score Comparison for Each Indicators of Problem Solving Ability.

Indicators of problem solving abilities that experience the highest increase are indicators recognizing problems in the experimental class. This is because students in the experimental class (X MIA 3) are very active in asking questions compared to the control class (X MIA 2) and coupled with the existence of Virtual Lab media in the questioning phase in the POGIL learning model makes students in the experimental class (X MIA 3) able examine problems in groups more easily so that students can recognize problems that are given well compared to the control class (X MIA 2) which is treated in the form of conventional learning models (Direct Instructions). While the indicator of problem solving abilities that experienced the lowest increase in both the experimental class and the control class is the indicator applying the strategy. This is because students in both the control class (X MIA 2) and experiment (X MIA 3) have mathematical analytical skills that are still lacking to be applied in problem solving in the given problem.

CONCLUSION

Based on the results of the study it can be concluded that there is an effect of the Process Oriented Guided Inquiry Learning model assisted by the Virtual Laboratory to students' physics problem solving ability in class X of Kuripan Senior High School Student.

REFERENCES

Fabian, K., Topping, K. J., Barron, I. G., and Chuah, K. M. 2016.Mobile Technology and Mathematics: Effects on Students' Attitudes, Engagement, and Achievement. *J. Comput. Educ.* 3(1): 77-104.

Jaya, H. 2012. Pengembangan Laboratorium Virtual untuk Kegiatan Paraktikum dan Memfasilitasi Pendidikan Karakter di SMK. *Jurnal Pendidikan Vokasi, 2*(1).

Kathane, B. Y., and Gundalwar, P. R. 2016. Development of Virtual Experiment on Encoding Techniques Using Virtual Intelligent Softlab. *International Journal of Research in Computer Applications and Robotics*. 4(1): 21-25.

Li, M., Zheng, C., Tang, X., and Sang, G. 2015. Exploring the Nature of Teacher-Student Interaction in Small-Group

Discussions in a Chinese University Setting.*J. Comput. Educ.* 2(4): 475-491.

Mason, A., and Singh, C. 2016. Using Categorization of Problemsas an Instructional Tool to Help Introductory Students Learn Physics. *Physc. Educ.* 50: 1-6.

Misbah. 2017. Identifikasi Kemampuan Pemecahan Masalah Mahasiswa Pada Materi Dinamika Partikel. *Jurnal Inovasi dan Pembelajaran Fisika.*

Monika, S. 2014. *Pengaruh Kemampuan Membangun Mode Representasi terhadap Pemecahan Masalah Fisika dengan Menerapkan Inkuiri Terbimbing* (Doctoral disertation, Universitas Lampung).

Moog, Richard S dan James N. Spencer. 2013. *POGIL: An Overview.* Lancaster: Department of Chemistry, Franklin and Marshall College.

Mubarrak, L. 2009. *Model Pembelajaran Berbasis Web pada Materi Fluida Dinamis untuk Meningkatkan Penguasaan Konsep dan Keterampilan Generik Sains Siswa* (Doctoral disertation, Universitas Pendidikan Indonesia).

Naaman, R. M., and Barnea, N. 2012. Laboratory Activities in Israel.*Eurasia Journal of Mathematics, Science & Technology Education.* 8(1): 49-57.

Nugraheni, F., Mastur, Z., & Wijayanti, K. 2014. Keefektifan Model Process Oriented Guided Inquiry Learning Terhadap Kemampuan Pemecahan Masalah. *Unnes Journal of Mathematics Education*, *3*(1).

Pratiwi, A. D. 2016. Pengaruh Model Process Oriented Guided Inquiry Learning (POGIL) terhadap Kemampuan Pemecahan Masalah Matematik Siswa. *Jurnal Universitas Islam Negeri Syarif Hidayattulah. 3(1).*

Rosidah, R. 2013. Keefektifan Pembelajaran Pogil Berbantuan LKPD Terhadap Kemampuan Pemecahan Masalah Materi Pokok Peluang. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *4*(1), 73-79.

Sholikhah, N., Winarti, E. R., & Kurniasih, A. W. 2014. Keefektifan Model Guided Inquiry dengan Pendekatan Keterampilan Metakognitif terhadap Kemampuan Pemecahan Masalah. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *5*(1), 18-25.

Sugiarti. 2015. Pembelajaran Fisika Berbantuan Simulasi Phet dalam Membangun Konsep Siswa. *Wahana DIDAKTIKA, Jurnal Ilmu Kependidikan.* 13 (1): 131-132.

Sugiyono. 2012. *Statistika untuk Penelitian*. Bandung: Alfabeta.

Sujarwanto, E., Hidayat, A., & Wartono, W. 2014. Kemampuan pemecahan masalah fisika pada modeling instruction pada siswa SMA kelas XI. *Jurnal Pendidikan IPA Indonesia*, *3*(1).

Widyaningsih, S. Y. 2012. Model MFI dan POGIL Ditinjau Dari Aktivitas Belajar dan Kreativitas Siswa Terhadap Prestasi Belajar. *INKUIRI*, *1*(3).

Zawadzki, R. 2010. Is process oriented guided inquiry learning (POGIL) suitable as a teaching method in Thailand's higher education. *Asian journal on education and learning*, *1*(2), 66-74.