



POGIL (process oriented guided inquiry learning) learning model: How does it influence students' observation skills and scientific attitudes?

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Article Info

Article history:

Received: March 12, 2021

Revised: May 21, 2021

Accepted: May 24, 2021

Keywords:

POGIL,
Observation Skills,
Scientific Attitudes.

Abstract

Poor Observation Skills and scientific attitudes are important factors to note. One of the external factors affecting the problems is the lack of innovative learning models used by teachers. The Process Oriented Guided Inquiry Learning (POGIL) learning model is one of the models that can be used to solve this problem. This research aimed to determine whether the POGIL learning model affects students' observation skills, scientific attitudes, and observation skills and scientific attitudes. The research method used was quasi-experimental with a posttest-only control group design. The research subjects were determined through cluster random sampling technique. The research instruments used were observation sheets and scientific attitudes questionnaires. The obtained data were analyzed using parametric statistics of Multivariate Analysis of Variance (MANOVA). The results showed that the POGIL learning model presented positive effects on 1) students' observation skills, 2) students' scientific attitudes, and 3) students' observation skills and scientific attitudes.

To cite this article: Fitria, F. & Hidayah, N. (2021). POGIL (process oriented guided inquiry learning) learning model: How does it influence students' observation skills and scientific attitudes?. *Journal of Advanced Sciences and Mathematics Education*, 1(1), 1 - 6

INTRODUCTION

Good observation skills are beneficial in studying science, especially biology subjects (Intan Indah Sutrisnowati, 2017; Widoretno & Susilo, 2012) because numerous objects and phenomena require observation skills. Those skills are also beneficial in developing other process skills (Reni, 2013), especially skills in deepening observations of surrounding conditions (Hardi & Rumantir, 2018) and science learning practicum activities (Karlimah, 2007). Therefore, teachers as motivators and facilitators need to create appropriate learning climates to directly involve the students in the classroom learning process. Learning begins with students' initial knowledge or daily life experiences so that they can be interested in following the process. Besides the observation skills, scientific attitudes are also one of the important things that cannot be ruled out by biology teachers.

Students must possess scientific attitudes to analyze and develop new knowledge in science learning correctly (Melani, 2012; Susanto, 2015). Scientific attitudes can also be interpreted as a person's general assessment of an object related to science (Purwanti & Manurung, 2015). Through discussions, experiments, simulations, and project activities, a student is expected to develop his scientific attitudes (Dewi et al., 2013; Maretasari & Subali, 2012; Widani et al., 2019). The development of scientific attitudes in schools should be relevant to students' cognitive development level. Students' scientific attitudes will be directly proportional to their learning outcomes (Razak & Kamaruddin, 2018) and learning independence (Kusuma, 2013). Students with good scientific attitudes will have good learning outcomes and independence as well. Therefore, appropriate learning models are needed to support the development of students' scientific attitudes and observation skills. The POGIL (Process Oriented Guided Inquiry Learning) is considered suitable to be applied.

The POGIL learning model assists the students to master concepts (Malik et al., 2017; Widyaningsih, 2012; Yuliani et al., 2017). This learning model emphasizes students' process skills (Aprilia, 2019). The POGIL learning model is an elaboration of three main components, namely learning teams, guided inquiry activities, and metacognition. Also, it consists of three phases: exploration,

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concept discovery, and application (IW et al., 2017). Each phase is carried out in groups by emphasizing the findings guided by the teacher. Teachers as facilitators are required to prepare media that can help students in doing the phases.

Several relevant studies related to the application of the POGIL learning model reveal that it presents positive effects on students' learning outcomes (IW et al., 2017; Lestari et al., 2016; Aprilia, 2019; Widyaningsih, 2012; Yuliani et al., 2017), students' science process skills (Ramdani & Sedijani, 2017), students' critical thinking skills (Malik et al., 2017), and students' analytical thinking (Sartono et al., 2017). In this research, the POGIL learning model was directed to improve students' observation skills and scientific attitudes. Through the POGIL learning model, students are expected to develop their higher-order thinking skills, metacognition, communication, and teamwork which will have positively effect their observation skills and scientific attitudes.

METHOD

The quantitative research method was used in this research. The type of this research was quasi-experimental because not all variables and experimental conditions can be regulated and controlled. The research's samples were determined using cluster random sampling and then divided into an experimental group and a control group. The design of this research was the posttest-only control group design, which was used to determine the effect of a treatment by comparing the mean of the posttest between the experimental group and the control group.

The instruments used in this research were observation sheets and scientific attitudes questionnaires that had fulfilled the valid and reliable criteria. The observational skills and scientific attitudes data were tested using normality tests, homogeneity tests, and the MANOVA test to achieve the objectives of the research. The research flow is illustrated in the following figure:

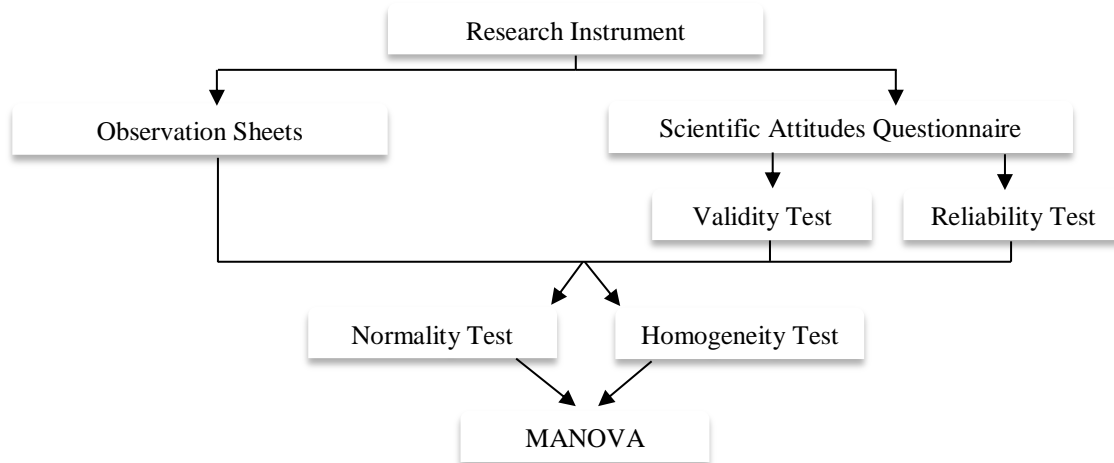


Figure 1. The Flow of the Research

RESULTS and DISCUSSION

This research aimed to determine the effect of the POGIL learning model on students' observation skills and scientific attitudes. The research data were in the form of post-test results of students' observation skills and scientific attitudes. The following are research data to determine the effect of the POGIL learning model on students' observation skills and scientific attitudes.

Table 1. The Observation Skills Data

Classes	Mean	Min	Max	Std. dev	Range
Experimental	82.67	65.47	91.92	6.06	26.44
Control	74.54	58.09	90.24	7.53	32.15

Table 1 shows the experimental class students had a better average score of observation skills than the control class students. Furthermore, the recapitulation of scientific attitudes data can be seen in Table 2.

Table 2. The Scientific Attitudes Data

Classes	Mean	Min	Max	Std. dev	Range
Experimental	78.79	70	88.75	6.12	18.75
Control	72.26	63.75	88,75	5.32	25

Table 2 reveals that the control class and the experimental class had different average scientific attitudes scores. It appears that the mean of the experimental class was greater than the mean of the control class.

The obtained data were then analyzed to determine whether the distribution of the data was normal and homogeneous or vice versa. The normality and homogeneity tests were performed to fulfill the prerequisite tests before performing MANOVA analysis. The following is the summary of the normality and homogeneity tests.

Table 3. The Recapitulation of the Normality Test

Variables	Classes	Sig.	Sig,	Description
Observation Skills	Experimental	0.05	0.12	Normal Distribution
	Control		0.20	Normal Distribution
Scientific Attitudes	Experimental		0.06	Normal Distribution
	Control		0.20	Normal Distribution

Table 4. The Recapitulation of the Homogeneity Test

Variable	Level Sig.	Sig	Description
Observation Skills	0.05	0.14	Homogeneous
Scientific Attitudes		0.31	Homogeneous

Based on tables 3 and 4, it can be concluded that all groups came from normally distributed populations. The last prerequisite test is the variance-covariance test using Box's M test. This test was performed to see if the variances of the two data have the same or homogeneous covariates or vice versa. The Box's M test was performed using SPSS statistical software 17.0.

Table 5. Box's M Test

Box's M	5006
F	1609
DF1	3
DF2	693137,195
Sig.	0.185

Table 5 displays that the variances of the observation skills data and scientific attitudes in the experimental and control classes were homogeneous.

After the three prerequisites had been fulfilled, the data analysis was performed using the Multivariate Analysis of Variance (MANOVA) test. The MANOVA test was used to determine whether or not there was a joint effect of the independent variable (POGIL learning model) on the two dependent variables (observation skills and scientific attitudes). Table 6 displays the summary of the MANOVA test.

Table 6. The Results of the MANOVA Test

	Effect	Value	F	Hypothesis df	Error df	Sig.
Treatments	Pillai's Trace	.285	11.948a	2.000	60.000	.000
	Wilks' Lambda	.715	11.948a	2.000	60.000	.000
	Hotelling's Trace	.398	11.948a	2.000	60.000	.000
	Roy's Largest Root	.398	11.948a	2.000	60.000	.000

Table 6 shows that the treatments' sig. value was $0.000 < 0.050$, so H1 was accepted. It indicated that there was an effect of the POGIL learning model on students' observation skills and scientific attitudes. The Univariate statistical test was used to determine whether there was an effect of the POGIL learning

model on students' observation skills and scientific attitudes one-on-one. The data is displayed in Table 7.

Table 7. The Recapitulation of Univariate MANOVA Test

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Treatment	Scientific attitudes	671,630	1	671,630	20,392	.000
	Observation Skills	1041,417	1	1041,417	22,343	.000

Table 7 contains information that:

- 1) The observation skills variable obtained a sig. value of $0.000 < 0.05$, so H_0 was rejected. It indicated that there was an influence of the POGIL learning model on students' observation skills. Therefore, it can be concluded that the POGIL learning model provided better observation skills than the conventional learning model.
- 2) The scientific attitudes variable obtained a sig. value of $0.000 < 0.05$, so H_0 was rejected. It indicated that there was an influence of the POGIL learning model on students' scientific attitudes. Therefore, it can be concluded that the POGIL learning model produced better scientific attitudes than the conventional learning model.

Discussion

The observation skills were measured when the students observed each practicum meeting. The 1st-meeting was a practicum on the general characteristics of mosses. The 2nd-meeting was a practicum on the general characteristics of ferns. The 3rd-meeting was a practicum on the general characteristics of seeded plants. The instrument used was an observation sheet that contained three observation skills indicators. The students' scientific attitudes were measured using a scientific attitudes questionnaire. The instruments had been validated by expert judgment and had passed the instrument testing stage. The results showed that that the POGIL learning model provided better observation skills than the conventional learning model. The results were in line with (Dionisius et al., 2019) who concluded that the POGIL learning model affects students' science process skills so that observation skills also become better.

Students' observation skills were observed in three meetings. The experimental class students increased their observation skills from the first meeting to the third meeting. In the first meeting, the experimental class students obtained a good category of observation skills, namely 79.91. In the second meeting, their observation skills increased to excellent with a score of 84.04. In the third meeting, their observation skills increased to 84.06. There were improvements in students' observation skills even though at the 2nd and the 3rd meetings, the increases were not too high.

The results were inversely proportional to the control class. In the control class, the increase in observation skills did not always occur but tends to decrease. In the first meeting, the score of the student's observation skills was 75.92, or in the good category. However, the score decreased at the second meeting to 71.89, or in the moderate category. Furthermore, at the 3rd-meeting, there was an increase in observation skills with a value of 75.81. Although there was an increase in the 3rd-meeting, the value was smaller than the first meeting. The results indicate that the control class students' observation skills tend to decrease.

The POGIL learning model increased experimental class students' observation skills proven by 70% or 21 students were classified in the excellent category and only 3.33% or 1 student was classified in the moderate category. The rest of the students were classified in the good category. However, in the control class, 26.67% or 8 students were classified in the excellent category, 63.33% of students were classified in the good category, and 16.67% or 5 students were classified in the moderate category.

Observation skills are part of science process skills. Therefore, the observation skills were measured using the science process skills indicators. The indicators consisted of the skills to use the senses, the skills to collect relevant facts, and the skills to look for similarities and differences. The using the senses indicator had the highest percentage in the control and experimental classes. This indicator is defined as a skill possessed by students who can use all their senses to observe a problem or object of research. The POGIL learning model in the experimental class involved all students to be active in the practicum activities. The application of the POGIL learning model changed the boring learning process to be more fun. The students were interested in the learning process so that they became active in

carrying out practicum activities. The students could use their senses well to observe the characteristics of mosses, ferns, and seeded plants.

The second result of the research is that the POGIL learning model produces better scientific attitudes than the conventional learning model. The POGIL learning model helps students cultivate positive attitudes towards learning and change their perceptions of subjects that are considered difficult. The POGIL learning model positively influences students' scientific attitudes into the good category. The POGIL learning model applied in this research improved students' scientific attitudes.

The scientific attitudes in this research consisted of six indicators, namely curiosity, cooperation, skepticism, positive, accepting differences, and prioritizing evidence. The indicator with the highest percentage was the prioritizing evidence indicator. On the other hand, the indicator with the lowest percentage was accepting the difference indicator. The POGIL learning model applied in the experimental class helped the students to collect facts and data related to the object of research. Through discussions, they can be more confident during the practicum or observing the characteristics of mosses, ferns, and seeded plants. Although conventional learning models can also build the prioritizing evidence indicator, during the learning activities, many students paid less attention to the practical activities. Conventional learning models could not optimally increase students' learning motivation to participate in practicum activities.

The last result of the research is that there was an effect of the application of the POGIL learning model on students' observation skills and scientific attitudes. The results of this research are in line with (Alatas & Ziah, 2018) who state that the POGIL learning model has a good influence on students' science process skills. The POGIL learning model supports meaningfulness in learning so that students become more active during the observation activities. Also, the POGIL learning model, as a part of the inquiry learning model, can improve students' scientific attitudes during the learning process.

CONCLUSION

Based on the results and discussion, it can be concluded that the POGIL learning model produced a positive influence on students' observation skills, students' scientific attitudes, and students' observation skills and scientific attitudes in learning biology. Effective and efficient biology learning will help students to achieve the expected learning objectives. It is the educators' task to select and apply innovative learning models so that these goals can be achieved.

For further research, it is necessary to conduct a study using the POGIL learning model on other abilities. Hopefully, the results of this research can provide benefits and contributions to science.

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