



The Influence of Inquiry-based Learning Model on Self-Efficacy and Scientific literacy of High School Students

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ABSTRACT

This study aimed to determine the effect of the inquiry-based learning model on high school students' self-efficacy and scientific literacy. This research employed the quasi-experimental research design with a non-equivalent control group design. The purposive sampling technique determined the samples. The research data analysis was carried out quantitatively using the four-tier test to measure scientific literacy. Also, a non-test instrument was used in the form of a questionnaire to measure the level of self-efficacy. The hypothesis testing was used to determine whether the model affected students' self-efficacy and scientific literacy. The analysis result of MANOVA obtained the significant value of self-efficacy was $0.001 < 0,05$ and the significant value of scientific literacy was $0.000 < 0.05$. therefore, H_0 was rejected, and H_1 is was accepted. Based on these results, it can be concluded that the inquiry-based learning model affected students' self-efficacy and scientific literacy.

Keywords: Inquiry-based Learning model, Self-Efficacy, Scientific Literacy

INTRODUCTION

Low scientific literacy in Indonesia is an urgent educational problem. The Program for International Student Assessment (PISA) in 2006, 2009, 2012, and 2015 showed that Indonesian scientific literacy scores were 395, 383, 382, and 403 with an average score of 500 (Solihin & Nisa, 2016). However, the 2018 PISA results, released on December 3, 2019, showed that Indonesia's PISA ranking has decreased to 396 (Tohir, 2019). The score is considered low because the score is far below the average standard.

All opinions refer to the need for scientific literacy skills due to learning activities and science education obtained by students. Scientific literacy skills can be interpreted as a person's skills to distinguish scientific facts from various kinds of information, recognize and analyze the facts scientifically, and organize, analyze, and interpret quantitative data and scientific information (Della, et.al., 2018).

Physics as an exact science requires students and educators to have high analytical skills. It cannot be equated with other basic sciences. Students need a longer time to understand the scientific concept deeply. Problem-solving in physics learning can be

considered a benchmark of students' conceptual understanding of learning physics (Abidin & Nelly, 2018).

The low concept mastery on several physics subjects is due to the practice question-oriented learning process in cognitive aspects and the lack of scientific literacy in the learning process. Therefore, students are expected to have scientific literacy skills to solve problems in their surroundings.

Besides scientific literacy, greater attention has recently been paid to the affective factors that influence learning outcomes. In the learning process, the focus has shifted to convey opinions, thoughts, or ideas based on the process's concepts. Each stage contained in the learning process has challenges that students must face. Therefore, it takes a strong belief to solve these challenges, which is known as self-efficacy. Self-efficacy is a self-assessment of one's ability to organize and carry out the actions needed to achieve specified performances (Bandura, 1997).

Based on the results of initial observations of physics learning in classrooms, students have not increased their self-efficacy and scientific literacy because the learning model used is teacher-centered. The data of scientific literacy and self-efficacy questionnaires showed that students' scientific literacy was classified as inferior, and the level of self-efficacy was low.

Based on the explanations, it was necessary to conduct research to support scientific literacy skills and self-efficacy in the learning process at school. One alternative solution is to apply the inquiry-based learning model. The inquiry-based learning model is an active, student-centered, and independent learning that holds students accountable for their learning. In an inquiry-based formal learning environment, teachers act as facilitators to develop students' scientific knowledge through investigative processes and experiences (Turner & Elizabeth, 2017). The researchers consider it very important to research the inquiry-based learning model's effect on high school students' self-efficacy and scientific literacy.

Problem of Research

Based on the results of preliminary observations, physics learning carried out in class still does not facilitate students to increase their self-efficacy and scientific literacy optimally. The cause is due to the often-used methods are lecturing and discussion methods. One way to overcome this problem is through the application of an inquiry-based learning model.

Research Focus

This research focused on applying the inquiry-based learning model to students' self-efficacy and scientific literacy.

METHODOLOGY OF RESEARCH

General Background of Research

The research method used was quasi-experimental with a non-equivalent control group design. In this design, the experimental group and the control group were not randomly

selected. Before the treatment, the experimental class and the control class were given a pretest to determine their ability level. After the pretest, the experimental class was taught using the inquiry-based learning model, while the control class was taught using a conventional learning model. After the two classes had been given treatments, the two classes were given a posttest to compare the treatments' results.

Subject of Research

The research sample consisted of two classes determined by the purposive sampling technique. The classes were XI IPA 1 as the experimental class and XI IPA 2 as the control class.

Instrument and Procedures

The instruments used in this study is:

1. Questionnaire

The questionnaire used to measure students' self-efficacy. The questionnaire used in the form of 20 statements using a likert scale.

2. Test

Instrument test used to measure scientific literacy of students. The questions given were 15 question of a four-tier diagnostic test on the material of fluid static, and test is given at pretest and posttest. Pretest is the provision of learning outcomes tests at the time before the fluid static material meeting. The result of the pretest is used as the pretest value. Posttest is a test of learning outcomes after the research is completed to obtain student learning outcomes after implementing the inquiry based learning. The results of the posttest are used as the posttest scores. The questions given are the same questions at the time of the pretest

Data Analysis

The normality test was performed using the Kolmogorov-Smirnov formula, and the homogeneity test was performed using the homogeneity of variances test. After that, the data were analyzed using MANOVA to determine whether there was an effect on applying the inquiry-based learning model. After the effect had been known, then the N-gain calculation was performed to determine how much influence the model.

RESULTS AND DISCUSSION

The percentage of average scores of students' self-efficacy on each dimension in the experimental class and the control class is presented in Figure 1.

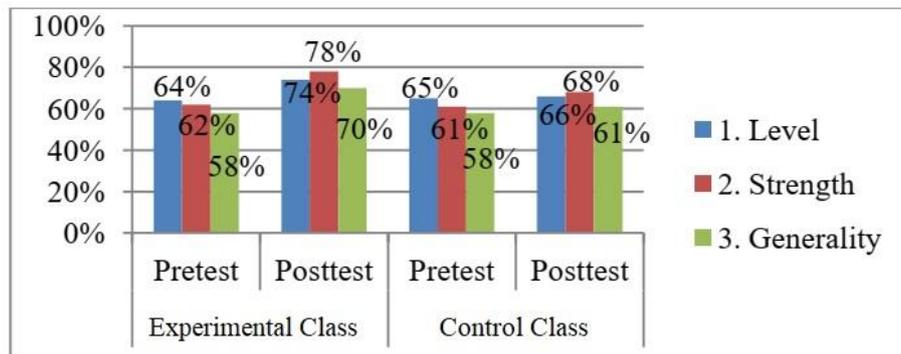


Figure 1.The Percentage of Self-Efficacy Scores

Based on Figure 1, the inquiry-based learning model influenced students' self-efficacy because the experimental class results were more significant than the control class. The criteria for each dimension was "high." The percentage of students' scientific literacy scores for each scientific literacy indicator in the experimental class and control class is presented in Figure 2.

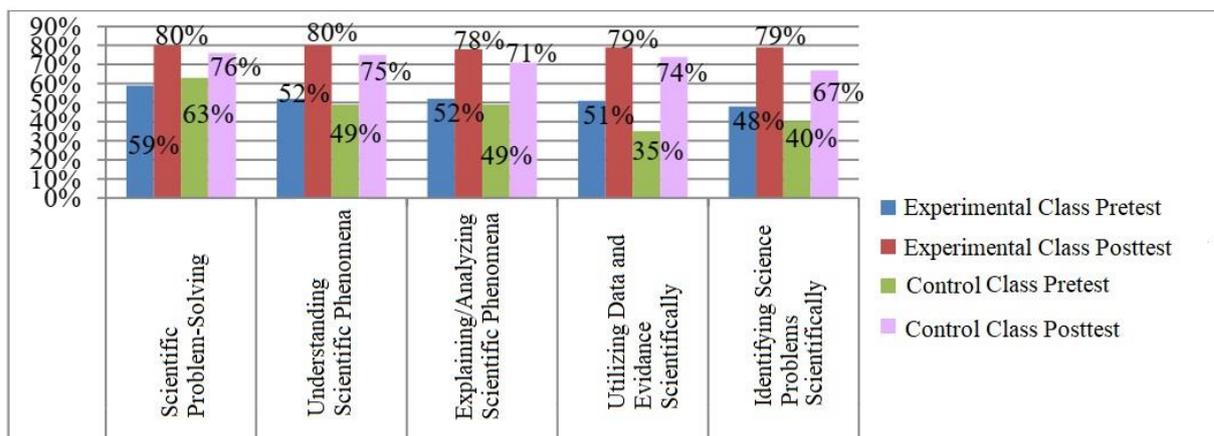


Figure 2.The Percentage of Scientific literacy Scores

Figure 2 shows that the inquiry-based learning model improved students' scientific literacy. The experimental class obtained has a more significant percentage than the control class percentage, with the criteria for each indicator being "Good."

The data were analyzed using MANOVA. The results obtained were sig <0.05. The significant value of self-efficacy was 0.001 <0.05, and the significant value of scientific literacy was 0.000 <0.05. Therefore, H_0 was rejected, and H_1 was accepted. The details of the analysis are shown in the following table:

Table 1. MANOVA Data Analysis Results

Statements	Mean Square	Df	F	Sig.
<i>Self Efficacy</i>	1215,279	1	40,917	,000
Literasi Sains	1449,941		11,778	,001

These results indicated positive effects of the inquiry-based learning model on students' self-efficacy and scientific literacy. Furthermore, the data analysis was continued by the N-Gain test to determine how much influence the model. The N-gain calculation results are presented in the following table:

Table 2. The Results of N-Gain Analysis

Statements	Group	N	Mean	N-Gain(%)
<i>Self Efficacy</i>	Posttest	34	0,3322	33%
Literasi Sains			0,6645	66%

The results showed that the self-efficacy value was 33% (moderate category). On the other hand, the scientific literacy's value was 66% (moderate category). This proves that the inquiry-based learning model influenced students' self-efficacy and scientific literacy.

The inquiry-based learning model is an active, student-centered, and independent learning model that makes students responsible for their learning. In the inquiry-based formal learning environment, teachers act as facilitators to develop scientific knowledge, mathematics, technology, and related conceptual techniques through a process of investigation and experience (Arsal, 2017). The inquiry-based learning model allows students to be active and gain real learning experiences. They are trained to solve problems while making decisions. The inquiry-based learning model's advantage can foster students' self-efficacy because the students are optimally directed to understand and observe existing problems to solve the problems actively (Jeong, et.al., 2019). Therefore, in the investigation process, students must have strong confidence in planning and solving the problems so that answers and conclusions can be obtained.

Semanur and Mine (2018) state that the inquiry-based learning model makes students have better self-efficacy because they are directed to work on a problem ask questions, observe, assume, collect data, and present their findings by building connections with their previous knowledge. During the discussions, they explain problem-solving to support their reasoning. Thus, they have an active role in the learning process. Besides increasing self-efficacy, the inquiry-based learning model also builds students' scientific literacy by facilitating them through the learning stages, namely orientation, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and formulating conclusions to solve scientific problems, scientific phenomena, or concepts.

The orientation step of the inquiry-based learning model can develop competence and scientific phenomena to understand the knowledge domain. In the formulating problem step, scientific data and evidence can help identify scientific problems in the competence domain. The formulating hypotheses step can develop the indicators of identifying scientific problems of the scientific competence domain. The collecting data step can develop scientific data and evidence in the domain of scientific competence. The testing hypotheses step can develop scientific problem-solving in the scientific context domain. Furthermore, the formulating conclusions step can develop an understanding of scientific phenomena indicators in the knowledge domain and explaining phenomena scientifically indicators in the scientific competence domain (Haerani, et.al., 2020).

Based on this statement, the inquiry-based learning model can support students' scientific literacy abilities because its learning steps contain the basis for achieving the three scientific literacy domains. The inquiry-based learning model is essential for the learners to learn by investigating problems related to physics to find concepts or principles. Experimental activities carried out during learning serve to gain knowledge where the students are invited to seek, try, and obtain their concepts in groups. Therefore, the students can discuss or find the concept they are looking for and then discuss it. The inquiry-based learning model can support scientific literacy in the three domains: context, knowledge, and competence. The inquiry-based learning model can also support self-efficacy in all three dimensions, namely level, strength, and generality.

CONCLUSIONS

From the results of the research that has been done, it can be concluded that the average results of the self-efficacy and scientific literacy taught using inquiry-based learning model are higher than the average self-efficacy and scientific literacy are taught using the conventional model. The use of inquiry-based learning model is influential on the increase in self-efficacy and scientific literacy. This can be seen from the results of questionnaire self-efficacy and test of scientific literacy between two classes.

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References

- Ramalis, T. R., & Purwanto, P. (2018). Pengembangan tes kemampuan literasi sains pada materi momentum dan impuls dengan Analisis Item Response Theory (IRT). *Jurnal Riset Dan Kajian Pendidikan Fisika*, 5(1), 40-45.
- Cheung, D. (2018). The key factors affecting students' individual interest in school science lessons. *International Journal of Science Education*, 40(1), 1-23.
- Bandura, A. (1997). *Self Efficacy The Excercise of Control*. New York: WH Freeman and Company
- Desmiatun, S. H. (2021). *Pengaruh Model Pembelajaran Inquiry Based Learning Terhadap Self Efficacy Dan Literasi Sains Siswa Sma* (Doctoral Dissertation, Universitas Islam Negeri Raden Intan Lampung).
- Jeong, J. S., González-Gómez, D., Gallego-Picó, A., & Bravo, J. C. (2019). Effects of active learning methodologies on the students' emotions, self-efficacy beliefs and learning outcomes in a science distance learning course. *JOTSE: Journal of Technology and Science Education*, 9(2), 217-227.
- Kandil, S., & Işıksal-Bostan, M. (2019). Effect of inquiry-based instruction enriched with origami activities on achievement, and self-efficacy in geometry. *International Journal of Mathematical Education in Science and Technology*, 50(4), 557-576.
- Wulandari, N. (2016). Analisis kemampuan literasi sains pada aspek pengetahuan dan kompetensi sains siswa smp pada materi kalor. *Edusains*, 8(1), 66-73.
- Pasaribu, Abidin, and Nelly Andriani, 'Analysis of Errors in Solving Problems in the Application of Physics Using Self-Efficacy Sheets', *Periodic Physics Education Scientific*, 6 (2018)
- dahsah, c., & coll, r. k. (2008). thai grade 10 and 11 students' understanding of stoichiometry and related concepts. *international journal of science and mathematics education*, 6(3), 573-600.
- Tohir, Muhammad. 2019. Indonesia's 2018 PISA Results have decreased compared to 2015. Available Online: <https://matematohir.wordpress.com/2019/12/03/hasil-pisa-indonesia-year-2018-down-compared-year-2015/>