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THE IMPACT OF GUIDED INQUIRY LEARNING MODEL USING VIRTUAL PHET EXPERIMENT METHOD ON STUDENTS' CRITICAL THINKING SKILLS**Bimo Susetyo^{1*}, Ishafit²****Master of Physics Education Study Program****Ahmad Dahlan University, Indonesia**

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<https://doi.org/10.22202/jrfes.2022.v9i2.6332>**Abstract**

The purpose of this study was to determine whether the use of the guided inquiry learning model with the Phet virtual experiment method had more effect on the critical thinking skills of students at SMA N 1 Kalasan compared to conventional learning models. This type of research is a quasi-experimental using an experimental class that uses a guided inquiry learning model and a control class that uses a conventional learning model. Data was collected by conducting pretest and posttest on students' critical thinking skills in both classes. Data analysis was performed using MANOVA analysis. The results showed that the use of the guided inquiry learning model with the Phet virtual experiment method had more effect on students' critical thinking skills than the use of conventional learning models.

Keywords: Guided Inquiry, Virtual Phet, Critical Thinking**Abstrak**

Tujuan penelitian ini adalah untuk mengetahui apakah penggunaan model pembelajaran inkuiri terbimbing dengan metode eksperimen virtual Phet lebih berpengaruh terhadap kemampuan berpikir kritis siswa di SMA N 1 Kalasan dibandingkan dengan model pembelajaran konvensional. Jenis penelitian ini adalah eksperimen semu dengan menggunakan kelas eksperimen yang menggunakan model pembelajaran inkuiri terbimbing dan kelas kontrol yang menggunakan model pembelajaran konvensional. Pengumpulan data dilakukan dengan melakukan pretest dan posttest kemampuan berpikir kritis siswa di kedua kelas. Analisis data dilakukan dengan menggunakan analisis MANOVA. Hasil penelitian menunjukkan bahwa penggunaan model pembelajaran inkuiri terbimbing dengan metode eksperimen virtual Phet lebih berpengaruh terhadap kemampuan berpikir kritis siswa dibandingkan dengan penggunaan model pembelajaran konvensional.

Kata Kunci: Pembelajaran Inkuiri, Virtual Phet, Berpikir Kritis.

I. INTRODUCTION

Physics is one of the branches of science that underlies the development of advanced technology and the concept of living in harmony with nature (Subagyo & Wilujeng, 2013). By learning Physics will equip students with knowledge, and improve students' thinking skills that are useful in everyday life. Thinking skills are very important in the learning process and teachers must be able to develop students' thinking skills (Yen & Halili, 2015).

The results of PISA 2018 Indonesia's scientific ability are ranked 71 out of 79 countries with a score of 396 (Kemendikbud, 2019). These results indicate that most Indonesian students have not been able to skillfully process science concepts in everyday life so that most students are only able to know and process physics concepts by memorizing, counting, linking, which in Bloom's taxonomy are at levels C1 and C2.

One of the minimum thinking skills that a person must have in understanding a problem and solving it is critical thinking skills (Costa, 1985). These thinking skills are included in complex thinking skills or higher-order thinking that are able to process information around them to be used in any conditions that arise (Presseisen, 1985).

One of the learning methods that can help students to develop critical thinking skills is guided inquiry learning (Khulthau, et al., 2007). In addition, learning media is an important point

in the teaching and learning process, because it is expected to create learning conditions that are able to improve critical thinking skills and active and fun learning. In the matter of black body radiation, some students have difficulty understanding the concept, for that one of the media that can be used is Phet's virtual experimental media. Virtual laboratories have similar characteristics with real laboratories, this allows students to explore without the need to go to the laboratory and facilitates transfer of learning, expands the range of testing and is able to apply previously acquired knowledge (Budhu, 2002). Conditions that resemble the actual media are also able to improve thinking skills (Mc Kagan, 2008), increase achievement (Salam, 2004) and mastery of concepts (Cengiz, 2010). Through the guided inquiry learning model using Phet media, it is hoped that it can affect students' critical thinking skills in black body radiation material.

II. METHOD

This research was conducted at SMA N 1 Kalasan in class XII. The research was conducted in the odd semester of the 2021/2022 school year, which is from November 2021 to December 2021. The research was carried out during physics lesson hours using the Phet virtual experiment. The type of research used is quasi-experimental or quasi-experimental.

This study used two classes at SMA N 1 Kalasan as the experimental and control classes.

The technique of collecting data is done by using a test technique. The test technique was conducted to determine problem solving skills and initial critical thinking skills (pretest) as well as problem solving skills and final critical thinking skills (posttest) of students after participating in learning activities.

To investigate the effect of using the guided inquiry learning model with the Phet virtual experimental method and conventional methods on critical thinking skills, the Paired Sample T Test, the Independent Sample T Test and the Ngain Score test were carried out.

The independent variables in this study were the guided inquiry learning model with the virtual Phet experimental method in the experimental class and conventional learning methods in the control class. The dependent variable in this study is critical thinking skills.

III. RESULT AND DISCUSSION

In learning, Phet is used as a virtual experimental medium. Students are distributed LKPD which contains basic theories and guidelines for conducting experiments. Students are first directed to do literacy on the theoretical basis before doing experiments. After conducting the experiment, students record the data obtained, process the data and carry out an analysis to get answers to the questions in the worksheet

The data obtained in this study is data on the effect of using the guided inquiry learning model with the Phet virtual experiment method on critical thinking skills consisting of pretest results and posttest results in both classes.

Table 1. Description of Pretest Results

Description	Experiment Class (Guided inquiry learning model)	Control Class (conventional learning model)
Average	37,2547	37,3297
Middle value	38,5700	37,4450
Standard Deviation	8,7218	8,6723
variance	76,069	75,029
Maximum Value	54,28	53,42
Minimum Value	22,85	23,05

Table 2. Description of Posttest Results

Description	Experiment Class (Guided inquiry learning model)	Control Class (conventional learning model)
Average	81,4677	72,360
Middle value	80,1700	74,280
Standard Deviation	10,6541	8,7170
variance	113,509	75,986
Maximum Value	100,00	88,57
Minimum Value	57,14	51,42

Based on table 1 and table 2, it can be seen that there is an average similarity in the pretest results of the experimental class and the control class, it can be concluded that there is an average similarity in the two

classes before receiving treatment. In table 1 and table 2, it can also be seen the increase in the average value of the pretest and posttest results for each class. The change in the mean value in the experimental class was greater than that in the control class. Based on the change in the standard deviation of the pretest and posttest scores in each class, it can be interpreted that the increase in the value of each class is quite varied, meaning that the change in the value of each student also varies.

The correlation test aims to determine whether or not there is a relationship between the pretest and posttest results of critical thinking skills in the experimental class using the Phet virtual experiment method and the control class using the conventional method. The results of the correlation test results of the pretest and posttest results in the experimental class and control class are shown in table 3.

Table 3. Correlation test of pretest and posttest results

Class	Correlation coefficient	Significance
Experiment class	0,773	0,000
Control Class	0,180	0,340

Table 3 shows that the significance value of the correlation between the results of the pretest and posttest in the experimental class is less than 0.05. This shows that there is a relationship between the results of the pretest and posttest in the experimental class. For the control class, the significance value of the correlation between the results of the pretest and posttest in the control

class is more than 0.05. This shows that there is no relationship between the results of the pretest and posttest in the control class.

The value of the correlation coefficient between the results of the pretest and posttest in the experimental class is positive, namely 0.773. In the control class the value of the correlation coefficient between the results of the pretest and posttest is positive, namely 0.180. Based on this, it can be concluded that the relationship between the two variables is positive (enough) and significant. If the correlation coefficient is negative, then there is no significant relationship between the two dependent variables.

The statistical test used was a two-group test (Two Group Multivariate Analysis of Variance or MANOVA) on the pretest and posttest scores. The multivariate analysis test on the pretest aims to find the similarity of the mean values before being given treatment. The posttest data aims to see the difference in the mean which indicates a difference in the results of the treatment given. Table 9 shows the results of the difference in the mean of the pretest and posttest results for the two classes using MANOVA.

Table 4. Results of the Differences in Means of Two Groups with MANOVA

Effect	Value	F	df	Error df	Sig.
Wilk's Lambda	0,764	8,807	2	57	0,025

Table 4 shows that the significance value of the tests carried out is 0.025 or less than 0.05. Based on this, it can be concluded that H_0 is rejected, so there is a difference in the average critical thinking skills in the experimental class using the Phet virtual experiment method and in the control class using conventional methods.

This study was conducted to determine the effect of the guided inquiry learning model with the Phet virtual experiment method on students' critical thinking skills. The study used two classes, namely the experimental class using the guided inquiry learning model with the Phet virtual experiment method and the control class using the conventional method. The study began with a pretest in both classes and a posttest was carried out at the end of the learning activities.

The study was conducted in four meetings, namely two meetings for the pretest and posttest, one meeting for the implementation of learning with black body radiation and one meeting for the implementation of the Wien shift learning.

Based on the results of the description of the pretest and posttest data, it can be seen that there is an increase in the posttest score compared to the pretest of critical thinking skills in both classes. The difference in the mean treatment of the two learning methods on critical thinking skills was analyzed using the MANOVA multivariate test. The results of the hypothesis

test in table 4 show that there is a difference in the average class using the guided inquiry learning model with the Phet virtual experiment method and the class using the conventional method in terms of critical thinking skills. Based on table 2, it can be seen that the average critical thinking skills in the class using the guided inquiry learning model with the Phet virtual experiment method is greater than the average class using the conventional method. Because of these two things, it can be concluded that the use of the guided inquiry learning model with the Phet virtual experiment method has a significantly more effect on critical thinking skills than the use of conventional methods.

IV. CONCLUSION

the use of the guided inquiry learning model with the Phet virtual experiment method has a significant 13.230% more effect on critical thinking skills than the use of conventional methods which is only 3.74%.

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