The effectiveness of quantum phenomenon learning media with think pair share model implementation on understanding concept of students

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Abstract. This study aims to examine the effectiveness of quantum phenomenon learning media with a think pair share model in improving students understanding of concepts at the high school level. The development of quantum phenomenon learning media uses a research model developed by Borg and Gall. To determine the effectiveness of instructional media on understanding concepts, learning media were tested in a limited group in one of the high schools in Central Lombok Regency, West Nusa Tenggara province, Indonesia. Indicators of understanding concepts according to the theory developed by Anderson and Krathwol which consist of interpreting, giving examples, classifying, summarizing, drawing references, comparing and explaining. The development process goes through several stages, namely the stages of validation, data collection and literature. The results of the N-gain analysis for one indicator obtained an increase in students understanding of concepts in both classes, namely the control class with a low category (0.29) while the experimental class with a high category (0.75) for black body radiation subject matter section. The t_{test} results obtained t_{count} (23.08) are greater than the t_{table} (1.67). The results of the analysis show that the quantum learning media with the implementation of the think pair share (TPS) model is effective in improving students conceptual understanding.

1. Introduction

The advancement of technological development and human thought requires teachers to be more creative [1]. The learning process is an important thing that needs to be considered by every teacher in delivering learning material. The teacher can provide a variety of ways to deliver material so that students are not bored with learning. Learning media is the right tool to help students in learning. The results showed that there was a significant effect on the Macromedia flash animation media on conceptual understanding.

Based on the results of preliminary observations, the physics learning achievement of students is low, especially material that is abstract and requires complex mathematical calculations. This is because students' understanding of a concept of material has not been fully controlled. The results of the analysis of the material that makes students physics learning achievements low are one of them is the material of quantum phenomena. Where the content of this material is the result of research from several scientists, and cannot be practiced directly for high school level because it requires expensive and sophisticated equipment.

One way to overcome this problem is to apply quantum phenomenon learning media implemented by the think pair share (TPS) model. This learning model is a learning model that provides opportunities for students to share ideas and solutions to solve a problem. The combination of quantum phenomena learning media and TPS learning models is expected to improve students understanding of concepts [2]. The application of the cooperative learning model of TPS makes teachers able to give at least eight times more opportunities for each student to recognize and show their participation to others [3].

Based on these considerations, it is necessary to research to determine the level of understanding of students concepts after being given quantum phenomenon learning media with TPS learning models.

2. Methods

The steps of learning TPS were: (1) Thinking, students were divided into six groups, each group consists of four students then ask a question or problem-related to the lesson and ask students to use a few minutes to think for themselves answers or problems; (2) Pairing, the teacher asks students to pair up and discuss what they have gotten; (3) Sharing, at the final step, the teacher asks the couple to share with the whole class about what they have talked about [4].

For media development using the Borg and Gall model. This research was conducted in class XII IPA, which consisted of two classes, namely XII IPA 1 as the experimental class and XII IPA 2 as the control class. The experimental class is given treatment by applying quantum phenomenon learning media with the TPS model, while the control class uses the TPS model without quantum phenomenon learning media. Before the quantum phenomenon learning media was given, the experimental class and the control class were given initial tests to determine the initial knowledge of the two classes. Then the final test was given to find out an increase in understanding of the concepts of both classes. The initial test and the final test are in the form of multiple choice questions which refer to indicators of understanding concepts [5].

Quantitative data analysis is used to analyze the increase in understanding of students concepts. The initial test and final test scores were tested for significance with a t_{test} at a significance level of 5%, while an increase in understanding the concepts was measured by a normalized N-gain test with a high category (N-gain> 0.7), medium (0.70> N-gain ≥ 0.30), and low (N-gain <0.3) [6]. The equation for t_{test} and N-gain are respectively as equation 1 and 2.

$$N - gain(100\%) = \frac{Posttest - Pretest}{Maximum\ Value - Pretest} \quad (1)$$

$$t_{hitung} = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{(n_1 - n_2)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (t - test\ polled\ varian) \quad (2)$$

3. Result and Discussion

3.1. N-gain Analysis

The results of the N-gain analysis of the understanding of the experimental class concepts on subject matter section of black body radiation, photoelectric effects and Compton effects were 0.65, 0.78 and 0.63 with the high category respectively. While for the N-gain value control class on black body radiation subject matter section, the photoelectric and the Compton effect are in a low category, namely, 0.13, 0.20, and 0.18. The results of the N-gain analysis concept understanding in the subject matter section are shown in Figure 1.

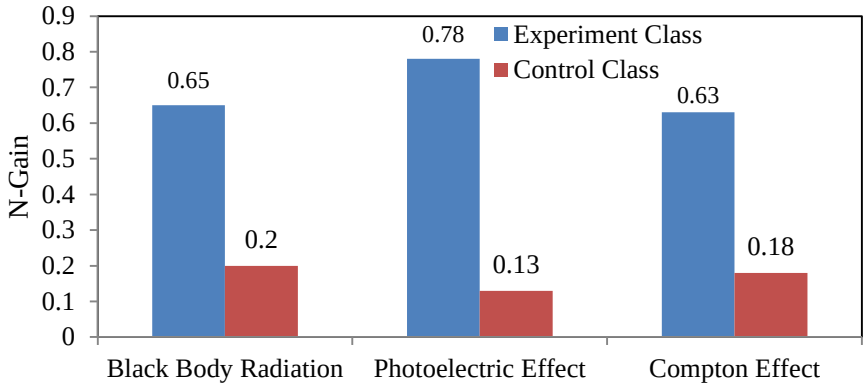

Figure 1. N-gain Understanding Concepts of Subject Matter Section

Based on Figure 1, it is clear that increasing the understanding of the experimental class concept is higher than the control class. This means that the use of quantum phenomenon learning media is very useful in improving students understanding of concepts.

The results of the N-gain analysis on the understanding of concepts are seen based on indicators of conceptual understanding. The results of N-gain analysis based on indicators of conceptual understanding are shown in figure 2.

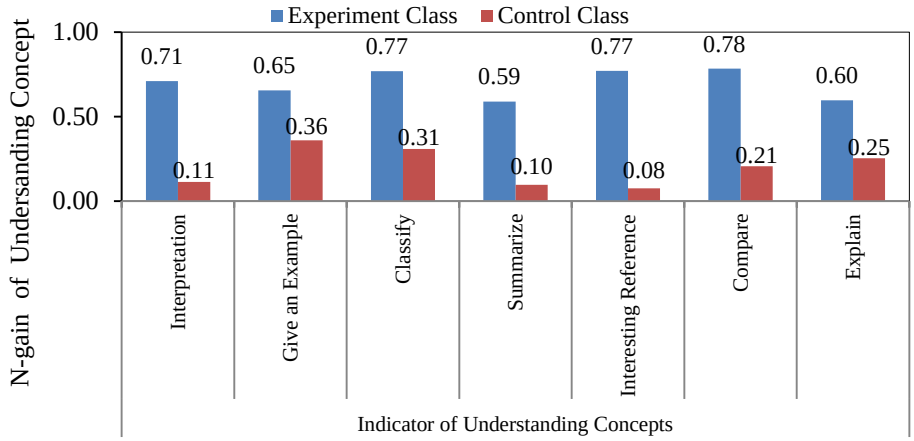

Figure 2. N-gain of Indicator Understanding Concepts

Figure 2 shows that the N-gain value of the experimental class was in the high category on the indicator interpreting, classifying, drawing references, and comparing, while the indicator gives an example, summarizes and explains it in the medium category. Also, the N-gain values of the control class were in the low category on all indicators. The increase of indicator understanding concept of the experimental class was higher than the control class. The results of the study showed that the average mastery of the concept of students using interactive multimedia was higher than students who did not use it [7].

This result is supported by research conducted [8] who found that learning using computer simulations or other related media will help students improve their process skills, especially those related to the ability to experiment and hypothesize. The use of media is proven to be able to help increase students' creativity in learning, which then helps students to understand the concepts learned [9].

The results of the N-gain analysis as a whole from the subject understanding concept of quantum phenomena, show that N-gain of experiment class (0.75) greater than N-gain of control class (0.29). It is shown in figure 3.

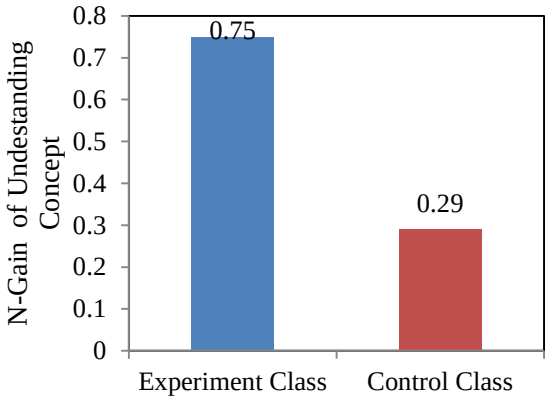

Figure 3. N-gain of Understanding Concepts

3.2. T_{test} Analysis

T_{test} is one of the testing methods used to assess the effectiveness before and after treatment. The results of the t_{test} on subject matter section and conceptual understanding indicators are shown in tables 1 and 2.

Table 1. The result of t-test Analysis on Subject Matter

Subject Matter	t_{count}	t_{table}	Analysis
Black Body Radiation	11.69	1.67	Ho rejected
The Photoelectric Effect	8.81		
The Compton Effect	8.62		

Based on table 1, it is clear that the t_{count} is higher than t_{table}. It is means that the use of the TPS model influences the understanding of students concepts [10].

Table 2. The results of the t_{test} Analysis Based on Concept Understanding Indicators

Understanding indicators	t_{count}	t_{table}	Analysis
Interpretation	13.01	1.67	Ho rejected
Given an Example	6.88		
Classify	5.74		
Summarize	3.30		
Interesting Reference	5.03		
Compare	7.38		
Explain	3.22		

Based on table 2, show that the t_{count} is higher than t_{table}. It means that the use of the TPS model influences students understanding of concepts. The results of the t_{test} analysis as a whole from the

subject understanding concept of quantum phenomena show that t_{count} (23.08) greater than t_{table} (1.67). It is mean Ho rejected, as shown in table 3.

Table 3. The t_{test} analysis the subject understanding concept of quantum phenomena

Subject Matter	t_{count}	t_{table}	Analysis
Understanding the Concept	23.08	1.67	Ho Rejected

These results are supported by several previous studies, which found that the computer-assisted learning model proved to be able to motivate and help students understand the concept better [11]. The use of computer media with the right design in learning will help students in solving problems related to concepts and understanding in the part of the concept itself [12]. The combination of computer-based media with various innovative learning models has proven to help improve the mastery of students' concepts [13, 14, 15, 16]. Students who get visualization related to the concept become more understanding of the concepts learned. Their ability increases in making judgments regarding the concept [17].

4. Conclusion

N-gain values on subject matter section quantum phenomena and concept understanding indicators were higher in the experimental class than in the control class. The value of t_{count} in the experimental class is higher than the control class, both for each subject matter section and overall. These results indicate that the use of quantum phenomenon learning media implemented through the TPS model is more effective in improving students conceptual understanding.

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