

Quantum Phenomenon Learning Media Used in Think Pair Share Models of Learning for Critical Thinking Skills

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Abstract—This study aims to analyze the effect of the use of quantum phenomenon learning media implemented in Think Pair Share (TPS) learning models on improving student's critical thinking skills. The quasi-experimental research methods was used with nonequivalent control group design. The research subject were students from grade XII of one of private school in Central Lombok, West Nusa Tenggara. Two class of students were used for control and experimental group, and were selected based on purposive sampling techniques. Student critical thinking skills were analyzed using the separated variance t-test, obtained at 11.77 and at 1.67 at a significant level of 5%. The research concluded that the learning media quantum phenomenon has a positive effect on student critical thinking skills. The magnitude of the influence of phenomenon Quantum Learning Media by increasing the critical thinking skill of students analyzed using N-gain was obtained 0.68 in the middle category for the experimental class and 0.23 in the low category for the control class.

Keywords: *student critical thinking skills, think pair share, quantum phenomenon learning media formatting*

I. INTRODUCTION

The current era of the industrial revolution requires students to think critically considering that the world can no longer be limited by existing rules. The era of openness comes with all its contents. If the teacher is not capable of directing student behavior then it not only destroys self-identity but can destroy a generation. Therefore, it is important for students to be equipped with critical thinking power [1].

Critical thinking is an ability or thinking skill possessed by someone in analyzing, selecting, developing and solving problems so that they can provide solutions. The ability to think at a high level includes the ability to solve problems (problem solve), critical, creative thinking, the ability to reason (reasoning), and the ability to make decisions (decision making) [2]. The ability to think at a higher level is one of the important competencies in the modern world, so it must be possessed by every student.

Competencies developed in the 2013 curriculum related to critical thinking are developing creativity, curiosity, the ability

to form questions to form critical thoughts that need to live smart and lifelong learning [3]. Each subject has its own characteristics, therefore teachers can adjust material that can develop students' critical thinking skills. Physics is one of the lessons that require students to think more broadly because there is a lot of material in physics and abstract. To develop critical thinking skills on abstract physics material, technology-based learning media such as interactive multimedia are needed. The use of interactive multimedia influences students' critical thinking skills [4,5].

Good learning media are media that are able to provide stimulus to students and as a good communication tool in conveying the abstract messages [6]. Stating communication is one of the vital things in education. If communication is effective then the process of transfer of knowledge and values can be successfully carried out. Conversely, if communication is not effective then the process of transfer of knowledge and values is not optimal. The use of multimedia learning is a good support tool in learning as the study revealed that the critical thinking skills of students who use contextual based interactive multimedia are better than students who do not use contextual based interactive multimedia [7]. We need an appropriate learning model to support the use of instructional media. One that is considered is think pair share learning model. Think pair share is a model of learning that is designed in the form of discussion that can improve thinking skills, communication skills of students and encourage student to participate in class. This statement is strengthened by the research results that the student learning outcomes were improved on using the think pair share method [8,9].

Quantum phenomenon learning media is a learning media which is designed to enhance the learning process quality. The learning media contains physics material related to the subject of quantum phenomena.

The purpose of this study is to implement learning media for quantum phenomena with the help of think pair share learning models that can improve students' critical thinking skills. The formulation of the problem that is the focus of this research is how the learning media of quantum phenomena can

improve students' critical thinking skills through the think pair share learning model.

II. METHODS

This study used an experimental method to explore the effect of the use of learning media for quantum phenomena on improving students' critical thinking skills. In this study the one independent variable is the learning media of quantum phenomena and one dependent variable is critical thinking skills. The research was conducted at one private high school on using two classes, class XII (Science 1) as an experimental class and class XII (Science 2) as a control class with the same model of learning without quantum phenomena learning media. The following research designs are presented in Table 1.

TABLE I. RESEARCH DESIGN

Class	Pre-test	Independent Variable	Post-test
Control	O ₁	X ₁	O ₂
Experimental	O ₁	X ₂	O ₂

(Source:[10]).

O₁ is a pre-test before being given treatment and O₂ is the post-test after being treated, X₁ is the application of conventional media and X₂ is the application of learning media for quantum phenomena. Each class is given a pre-test followed by the treatment of applying quantum phenomenon learning media in the think pair share learning model in the experimental class. After the treatment is finished, the next step is giving a post-test by giving the same questions during the pre-test in the form of critical thinking skills.

The data from this test are analyzed using the N-gain test to find out the increase in students' critical thinking skills. The N-gain equation is as follows.

$$N\text{-gain } (\%) = \frac{\text{posttest score} - \text{pretest score}}{\text{max score} - \text{pretest score}} \quad (1)$$

The results of the N-gain calculation are interpreted according to the criteria in Table 2.

TABLE II. N-GAIN CRITERIA

Percentage	Category
N-gain > 0,70	High
0,70 >N-gain ≥ 0,30	Middle
N-gain < 0,30	Low

(Source: [11]).

In addition, a t-test was also performed by comparing t-count with t-table at a significant level of 5% where the t-table value was set at 1.67.

III. RESULTS AND DISCUSSION

Data on critical thinking skills were obtained by giving students critical thinking questions instruments. This instrument was critical thinking questions in the form of problem description with indicators consist of hypotheses skills, analytical skills, evaluation skills, and concluding skills of each of the two questions. The N-gain test was performed to

determine the increase of students' critical thinking skills based on data from the pre and post tests. By using Equation (1) N-gain values are obtained in each class. The N-gain values of all critical thinking skill indicators for the experimental class are in the middle category, while the N-gain values for the control class are in a low category. For more details, the N-gain value of each indicator of critical thinking skills is presented in Table 3.

TABLE III. THE CRITICAL THINKING SKILL OF THE STUDENT

Class	Critical Thinking Skill Indicator	Pre-test	Post-test	N-gain	Category
Control	Hypothesis	27.31	42.00	0.20	Fair
	Analytical Skills	28.00	42.00	0.19	
	Evaluating Skills	25.00	40.00	0.20	
	Concluding Skills	25.00	42.00	0.23	
Experimental	Hypothesis	37.31	80.38	0.69	Low
	Analytical Skills	36.00	78.00	0.66	
	Evaluating Skills	34.00	79.00	0.68	
	Concluding Skills	38.00	74.00	0.58	

The N-gain values are specifically displayed in graphical form as in Figure 1.

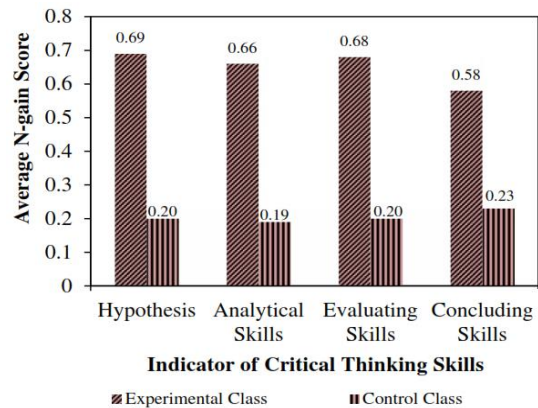


Fig. 1. Comparison of average score of experiment class and control class N-gain.

Based on Figure 1 the N-gain average value is obtained the experimental class is in the medium category and the N-gain value for the control class is in a low category. It can be seen that the improvement of critical thinking skills in experimental class reached the medium category. Based on the results of the analysis this is happen because the test on critical thinking skills given to students are arranged with long sentences and takes more time to understand the questions. This is can be understood since the cognitive level of students for critical thinking skills is still at the intermediate level. In the previous research, student also protested due to so many questions in every item [12]. Nevertheless, the increase in N-gain in the indicator of critical thinking skills in the experimental class is still higher than the N-gain in the control class. This shows that the use of learning media in quantum phenomena can be used as a learning media to improve students' critical thinking skills. This is in accordance with the results of the previous study that there is an influence of flash animation-based virtual laboratory

on critical thinking skills [13]. A similar things was expressed by Syahdiani, that the interactive multimedia was very helpful to be used to improve learning outcomes and train students' critical thinking skills [14]. Based on her research, Zulhelimis also stated that the application of the think pair share model can improve students' critical thinking skills and completeness of students' critical thinking skills tests to reach $\geq 80\%$ [15].

The results of the t-test after comparing the results between the table with t-calculated can be seen in Table 4.

TABLE IV. T-TEST RESULTS ON INDICATORS OF CRITICAL THINKING SKILLS

Indicator of Critical Thinking Skills	t-calculated	t-table	Analysis
Hypothesizing skill	11.77464795	1.67	Ho rejected
Analytical Skill	11.90885554		
Evaluating Skill	14.57330001		
Concluding Skill	13.80509621		

Based on the analysis results from Table 4, t-calculated are greater than t-table for all indicators of critical thinking skills. This shows a significant level that has been set at 5% indicating that the learning media of quantum phenomena can improve students' critical thinking skills. The highest improvement is in the evaluation skills indicator. This is supported by the results of research [16] that influence of interactive learning media on thermochemical material can improve students' critical thinking skills. In line with the results of the study, learning outcomes through a think pair share model assisted by Macromedia flash can improve the quality of science learning [17]. While the results of the study reveal the critical thinking disposition of students who study modern physics with a virtual laboratory ware higher than students who study conventionally and the two classes differ significantly [18].

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