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Effects of Scientific Inquiry Learning Model of Using a Media PhET and Creative Thinking Ability Against Science Process Skills

Syahruddin Aritonang*
Post Graduate, State University of Medan, Indonesia

Mara Bangun Harahap
Post Graduate, State University of Medan, Medan, Indonesia

Karya Sinulingga
Post Graduate, State University of Medan, Medan, Indonesia

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Abstract
This study aims to determine the effects of *scientific inquiry* learning model using a media *PhET* and the ability to think creatively about science process skills in MAN 1 Padangsidimpuan. This research is a *quasi-experimental* design with *two-group pretest posttest.* The subjects of this study were all students of class X MAN 1 Padangsidimpuan. The sample selection is done *cluster random sampling* as applied experimental class *scientific inquiry* learning model using the media *PhET* and grade control applied learning directly. The instrument used in this study is a questionnaire ability to think creatively and instrumen science process skills in the form of essays that have been declared invalid by a team of experts. The final conclusion is that the science process skills of students who apply *scientific inquiry* learning model using the media *PhET* is better than science process skills of students with hands-on *learning.*
Keywords: Scientific inquiry learning model, the ability to think creatively, *PhET* media, science process skills

1. Introduction

Education in general aims to develop human resources that are intact and reliable, but often very idealistic and without direction, making it less relevant to the needs in the field. Only human beings are capable of overcoming problems in life. Therefore it is necessary that human beings are tough, reliable, intelligent, characteristic and competent. This is strongly influenced by three factors, namely the nature of innate, environmental, and exercise. The role of education is certainly on environmental factors and training, which is able to create a conditioned atmosphere and provide the necessary exercises related to problems in life. (Daryanto and Darmiatun, Suryatri, 2013).

Science as a product because it consists of a collection of knowledge in the form of facts, concepts, principles and laws about natural phenomena. Science as a process, because it is a series of structured and systematic activities undertaken to discover concepts, principles and laws about natural phenomena including the ability to think to compose and discover new concepts. Science education, especially physics as part of education in general has a role in improving the quality of education, especially in producing quality of Indonesian human beings.

Based on the result of observations conducted by researcher at MAN 1 Padangsidimpuan obtained information that the process of teaching and learning in schools, physics teachers more emphasis on physics as a transfer or transfer of science alone and students try to memorize it, the authors also interviewed the teacher of physics in class X MAN 1 Padangsidimpuan to obtain data in real, and data that the researcher get one of them is the average value of daily physics examination class X student learning year 2015-2016 is 70. When viewed from the completeness of the minimum competence in the school for student repeat value is still below from 75 (the KKM score).

The conclusion is reinforced by the statement through interviews of researcher with some students at MAN 1 Padangsidimpuan, that they never practicum, whereas in school there are laboratories (physics, biology, chemistry, and computer). As a result learning is only focused on memorizing concepts. The knowledge of the physics concepts that students gain during learning tends to be just theory. This is in accordance with the results of observation of the students of class X MAN 1 Padangsidimpuan that they are spared doing practicum activities in learning.

As a result, the students become passive in the process of learning activities in the classroom. This has a negative impact on students' science process skills that are still low and unsatisfactory. Responding to concerns over the need for a model that involves active learning students to improve the ability to think creatively and science process skills of students, one of which is the *scientific inquiry* learning model. According to Joyce

(2009: 212), this model offers research strategies, values, important attitudes in research, which include observing, collecting, and processing data, identifying and controlling variables, formulating and testing hypotheses and Explanation, draw conclusions. *Scientific inquiry* is an approach to learning that presents a field of research, compile a problem, identify problems in research and speculated to clarify the issue so as to get a conclusion of the answer to the problem given.

The ability of students' scientific processes is influenced by several factors, including the learning model used by teachers in the classroom. According to Joyce (2009: 199), biological sciences research model designed to teach the processes of biological research, affect the ways students process information, and educate their commitment to conduct scientific research. Students have learned the scientific process, have mastered important concepts from several disciplines of science, have gained basic information about science, and have developed a positive outlook on science.

According to Annelies Raes (2016-125) Inquiry Science has an effect on students integration of knowledge and satisfaction of student needs. Hsu Chih-Chao (2015-46) in research o bjective of this study was to determine the effect of using a structured argument scaffold to improve skills in building a scientific explanation on the process of scientific inquiry. Johari (2014), concluded on the results of his research that this scientific learning can improve learning outcomes and basic science process skills. In addition, Rahayu (2011: 109) also concluded that the application of learning with a process skill approach implemented by practicum.

According Arsyad (2013: 10) learning media is anything that can be used to convey messages or information in the process of teaching and learning so as to stimulate the attention and interest of students in learning. Many media that can be used by teachers in the study of physics to make students more easily understand and master the concepts of the material being studied, one of which is using the *PhET*.

Learning *scientific inquiry* can be helped by using m edia *PhET* which provides animation in both physics, biology, and other sciences. In the media there are the sub-sub *PhET* that can be individually selected files, the animation you want to show. In this media can be shown a material that is abstract and can be explained directly by this media so that students easily understand the material such as the flow of electrons in electrical circuits and electric current flowing in a closed circuit. According Mubarrok (2014) concluded *PhET* media can enhance students' understanding of the concept. Then, according Nurhayati (2014) taught learning outcomes with media-assisted method of animation *software*demonstration *PhET* better than student learning outcomes using conventional methods. Learning by using animation media *PhET Software* can motivate student learning in a dynamic electric material.

1.1 *Scientific inquiry* learning model

Scientific inquiry learning model first employed researcher in biology. This model emphasizes content and processes. The purpose of this learning model is to teach the important processes of science and at the same time important concepts and formations about the various disciplines that have been developed.)

Scientific inquiry learning model is designed to bring students directly into the process of investigation. Through *scientific inquiry* model of students are expected to actively ask the question why something happened and then look for and collect and process the data to determine the answers to these questions. Application of *scientific inquiry* learning model In teaching and learning activities aims to develop a deeper understanding of science concepts and shaping students' scientific knowledge. Through experimental activities students can try various ways to complete experiments conducted so as to develop the ability to think it has. Students are expected to be responsible for conducting investigations in identifying problems, hypotheses, designing methods to prove hypotheses, analyzing them and making final conclusions. *Scientific inquiry* learning model Is a learning model that involves students in truly original research problems by confronting students in the field of investigation, helping to identify conceptual or methodological issues. The phases in this model are (1) the students presented a field of study, (2) the students put the problem, (3) students identify problems in the study, (4) students venture to clarify the issue (Joyce, Well & Calhoun, 2009) .

The nature of *scientific inquiry* approach is to teach students to process information with the techniques that have been used by biologists, for example, identify the problems and methods to solve the problem. Learning model emphasizes *scientific inquiry* content and processes.

Table 1. Syntax *scientific inquiry* learning model

Phase One Students presented a field of research
Phase Two Students make a problem
Phase Third Students identify problems in research
Fourth phase Students speculate to clarify the problem

The following explanation of the syntax of *scientific inquiry* learning model by (Joyce, Well & Calhoun, 2009) are: 1) In the first phase the students presented the research, which includes the methodologies used in the study. 2) In the second stage, the problem begins to be organized so that the student can identify the problem in the research. 3) In the third stage, students are asked to speculate about the problem, so that students can identify the difficulties involved in the research. 4) In the fourth stage, students are asked to speculate on ways to clarify the difficulty, by redesigning trials, processing data in different ways, generating data, developing constructs and so on.

The teacher's job is to guide, train, and educate research by emphasizing the research process and persuading students to reflect on the process. Teachers should be careful that identifying facts is not the main issue that should be emphasized in research. Furthermore, the most important thing in this regard is how teachers can encourage students to deal with complex and well-researched research questions.

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1.2 The Ability of Creative Thinking

Creative thinking is defined in a different way. Jonhson (Siswono, 2004: 2) says that creative thinking that implies perseverance, personal discipline and attention involves mental activities such as asking questions, considering new information and unusual ideas with an open mind, making connections, especially between something similar, connecting one another freely, applying imagination to every situation that arouses new and different ideas, and considers intuition.

Sabandar (2008), that creative thinking is actually a thinking ability that begins with a sensitivity to the situation at hand, that the situation is visible or identified a problem that wants to be resolved. Furthermore, there is an element of originality of ideas that arise in the mind of a person related to what is identified.

Evans (1991) explains that creative thinking is a mental activity to make connections *(concection)* continuous (continuous), so I find a combination that is "right" or until the person is surrendered. Creative associations occur through the resemblance of something or through analogical thinking. Idea associations form new ideas. So think creatively ignore established relationships, and create relationships.

1.3 Skills of the science process

Science process skills is a device commonly used complex skills in conducting scientific investigations into a series of learning process (Harlen & Elstgeest, 1994).

Table 2. Indicators Skills of the Science Process

No	Indicators of science process skills	Descriptors of Science Process skills
1	Observe	1.1 Use the senses to gather information
		1.2 Identify the similarities and differences of an object or event
		1.3 Recognize the order and sort in accordance with the criteria
2	Asking question	2.1 Ask questions based on hypotheses
		2.2 Asking questions that can be answered through inquiry
3	Formulate hypotheses	3.1 Formulate an explanation of the relationship of some principle or concept based on previous observations and experiences
4	Predict	1.1 Use logical reasons to make predictions
		1.2 Explicitly use patterns or relationships to make predictions
5	Find patterns and variable relationships	5.1 Collect and make inferences based on existing information
		5.2 Find regularity through information obtained from measurements and observations
		5.3 Identify the relationship between one variable with another variable
6	Communicate effectively	6.1 Create an experiment report to create a relationship or an idea
		6.2 Listen to ideas from others and respond
		6.3 Processing data in the form of images, graphs or tables
7	Designing an experiment	7.1 Deciding on the tools and materials needed in the experiment
		7.2 Determine the procedures to be performed in the experiment
		7.3 Succeed in modeling with certain criteria
		7.4 Identify variable modifiers, control variables and measured variables
8	Conducting an	8.1 Carry out experiments with prescribed procedures

No	Indicators of science process skills	Descriptors of Science Process skills
	experiment	
9	Manipulate effective materials and tools	9.1 Handling and manipulating the material carefully for safety and efficiency. 9.2 Use effective and safe tools. 9.3 Work with the precise level of precision for the task at hand
10	Make a conclusion	10.1 Use facts and evidence to draw conclusions
		10.2 Change ideas by evidence

2. Method

2.1 Population and sample

Population is the goal that becomes the object of research. Fraenkel, *et al* (2012) explains that the population refers to all members of a particular group that generalize. The population in this study were all students of class X MAN 1 Padangsidimpuan. Sampling by means of *cluster random class to* which each class (class random) have an equal opportunity to be sampled in the study. The sample was divided into two classes, namely as an experimental class that learned to use *scientific inquiry* learning model using themedia *PhET* and a control class that learned with menggu nakan direct learning.

2.2 Data collection technique

This research is a kind of *quasi-experimental* research that aims to determine the result of something that is imposed on the subject of the student. The study involved two different sample classes treated. The experimental class were treated in the form of learning to use the *scientific inquiry* learning model using *PhET* media.

Control class is treated in the form of learning using learning directly. The variables of this study consist of two types of independent variables and dependent variables. The independent variable is the variable that affects the dependent variable. The independent variable in this study is a *scientific inquiry* learning model using *PhET* media.

The dependent variable is the variable that is influenced or the result is due to the independent variable. The dependent variable in this study is the science process skill consisting of ten indicators, ie observation (obsevation), asking questions, formulating hypotheses, predicting, finding patterns and variable relationships, communicating effectively, designing experiments, conducting experiments, manipulating materials and equipment Effective, measuring and counting.

The study involved two different treatment classes. To find out the student learning outcomes done by giving tests on both classes before and after being treated. The study design is *quasi-experimental* design: *two group pre -postest design.* Thus the study design i ni are listed in Table 3.

Table 3. Research design

Sample	Pretes	Treatment	Postes
Experiment	$X_1 2$	X	$X_2 2$
Control	$X_1 3$	Y	$X_2 3$

Information :

$X_1 2$ = Results of experiment class pretest
X = Treatment with *Scientific inquiry* learning model
$X_2 2$ = Postes result of experiment class
$X_1 3$ = Pretest result of control class
Y = Treatment by applying direct learning model.
$X_2 3$ = Results of postest control class

The collecting data in this study using research instruments, namely questionnaire creative thinking abilities and the science process skills test of students. The instrument of creative thinking abilities questionnaire of 20 questions and test of skill shaped science process is an essay test.

Before the test is used, first reviewed the validity of its content through the opinions of experts as a validator. Content validity refers to an instrument that has the conformity of the content in the reveal / measure to be measured (Margono, 2009). In addition, content validation is also intended for the content of the test to be tested in accordance with the contents of the current curriculum. Validation of this content is determined by expert consideration, to give an idea of the validity of the test before it is followed up. Questionnaire ability to think creatively and science process skills test divalidkan by faculty of Physical Education Graduate University Negeri Medan, a panel of experts in determining the suitability Test indicators.

First, the researchers provide the 25 questionnaires ability to think creatively, as validation of the instrument there are some improvements include improvements to the sentence and 5 items omitted matter because

improperly used, then there are only 20 questionnaires that can be used.

Second, for the instrument science process skills in the form of votes practical exam where researchers provide the answer sheet about the science process skills indicators. It should there be 10 indicators of science process skills according to Harlen & Elgest. When validating a skill instrument there is a suggestion from the validator that is 8 indicators used and 2 indicators are not used because indicator number (3) formulates the hypothesis, (4) predicts the same meaning so that indiactor (4) need not be used. Then , the indicator (9) manipulates the material and the effective equipment is also not used because based on tools and materials provided there is nothing to be manipulated. After the process of revision and improvement of the suggestions provided by the expert, it is concluded that the test has been used to determine the level of understanding of concepts and skills of the process of physical science.

Data collection was conducted in two stages, the first stage of collecting data on the ability to think creatively and the second stage to collect data on students' science process skills. Data obtained in the study were analyzed descriptively and inferentially. Descriptive analysis aims to describe the ability to think creatively and science process skills.Inferential analysis to test the hypothesis pen elitian done with 2-way ANOVA, prior to 2-way ANOVA first tested for normality and homogeneity test with SPSS 20.

3. Results

Table 4. Research ANOVA

Creative thinking ability (B)	Learning Model (A)		Average
	Direct learning	Model of *scientific inquiry* using *Phet*	
Above average ($B_{1)}$	68.31	80.42	74.89
Below average ($B_{2)}$	60.50	68.40	63.64
	Average	64.18	74.68

Table 5. Output of ANAVA Two Line calculation

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3812.463 [a]	3	1270.821	78.645	.000
Intercept	322413.722	1	322413.722	19952.712	.000
Model	1522306	1	1522306	94.209	.000
Think_creative	1828.650	1	1828.650	113.167	.000
Model * think_kreatif	114.298	1	114.298	7,073	.010
Error	1034.169	64	16.159		
Total	332609.000	68			
Corrected Total	4846632	67			

A. R Squared = .787 (Adjusted R Squared = .777)

Based on Table 5, anava column creative thinking class gained significant value 0,010. Therefore, the significance value of 0.010 <0.05, it can be said that the test results is rejected Ho and or receive Ha in the alpha level of 0.05. Thus, it can be concluded that there is an interaction between the scientific inquiry learning model using Phet media and the ability to think creatively to the students' science process skills.

Based on the results of the above research hypothesis testing can be described the interaction between learning models and the ability to think creatively to the students' science process skills, such as yan g shown in figure 1.

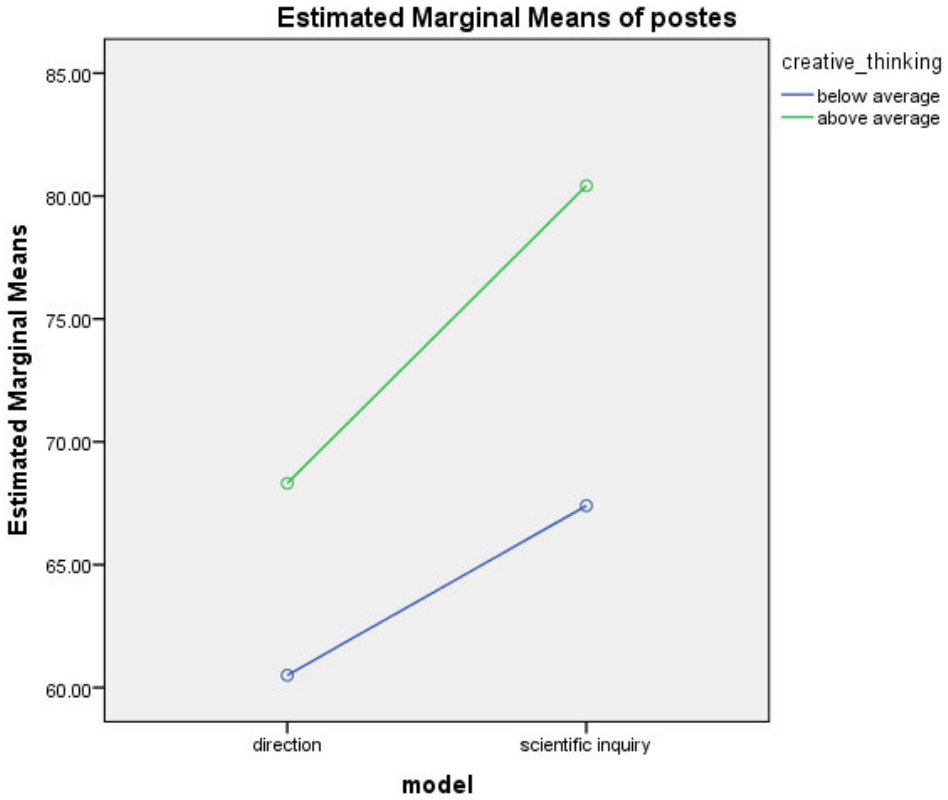

Figure 1. Interaction Learning Model directly and *Scientific Inquiry*

In the graph above is the output of SPSS 20. which as the dependent variable is postest. Postest used for its output is the score of postest result if in value 68 and 60 so that in graph there is interaction between model of learning with ability of creative thinking.

In summary the observation of science process skills in the experimental class every meeting in Figure 2.

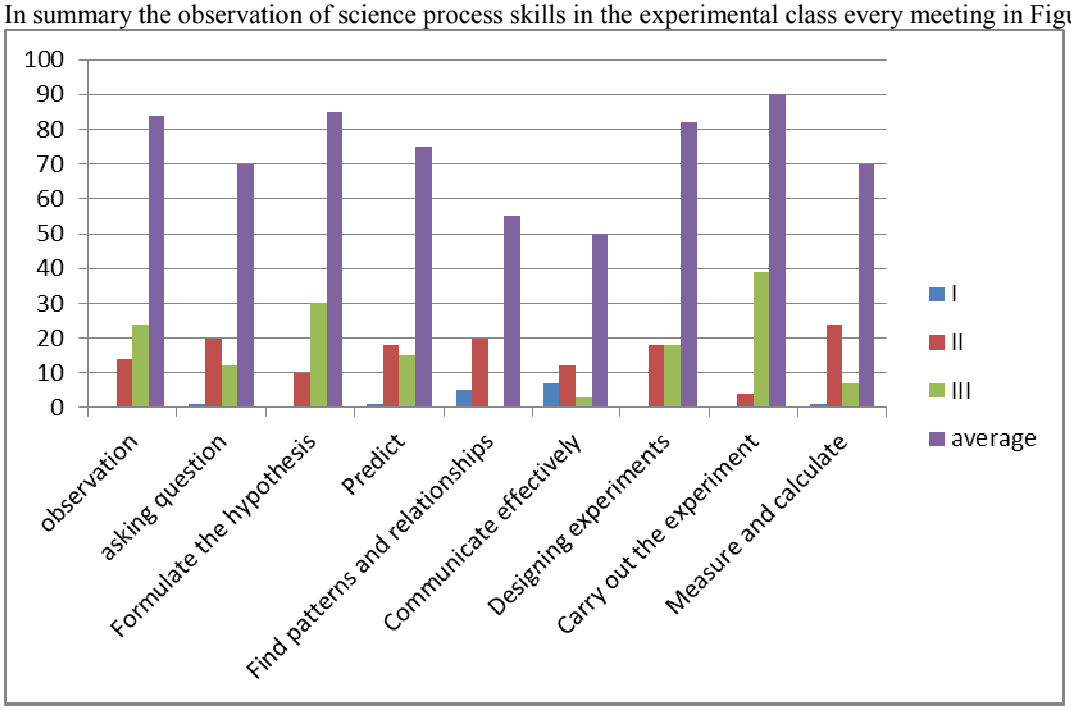

Figure 2. Observation Results

The result of observation of science process skill in all three meetings as shown in Figure 4.3. Shows the result that students showed improvement in students' science process skills, from observations made by three observers obtained the mean score for observing indicator of 84, asking question 70, formulating hypothesis 85, predicting 75, finding patterns and relationships 55, communicating effectively 50, designing experiments 82,

conducting 90 experiments, and measuring and counting 70 of some of the science process skill indicators, the highest level of indicators were: carrying out experiments of a mean of 90, then proceeding with formulating hypotheses, followed by observing of 85 and 84. And for the lowest indicator lies in the indicator communicate effectively 50 and find the relationship pattern 55, but in this case from each meeting the students experience an increase from the first activity until the third activity.

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