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LEARNING WITH GUIDED INQUIRY MODEL TOWARD THE UNIVERSITY STUDENT'S PROBLEM SOLVING SKILL ON KINEMATICS OF PARTICLE

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Abstract-The objective of this research is to test the effectiveness of the application of guided inquiry learning model to improve the problem solving skill of college student on kinematics of particle topic. The method of this research was quasi experiment with randomized pretest- posttest control group design.Sample of this research was the college student's who taking the course on general physics I in Universitas Negeri Medan odd semester that consist of two classes which determined by cluster random sampling. One of the class as the experimental group by applying guided inquiry learning model and other class as a control group by applying conventional learning. Problem solving skill measured by using an essay test form that has been validated. Analysis technique of the effectiveness testing was the effectiveness of the application of guided inquiry learning model using gain test and different test. Based on the result of resaearch showed the average value of the control class was 22.52 and experimental class 20.60 The average value of posttest in control class was 59.89 and experimental class was 67.25. The result of the research showed that there was significant difference problem solving skill between college student that learned guided inquiry model compared to the conventional learning model. The raising percentage of problem solving skills by applying the model guided inquiry on kinematics of particle topic as 58% while the conventional learning as 48%, respectively in the medium category.

***Keywords*:** guided inquiry model, problem solving skill, particle kinematics

1. INTRODUCTION

Physics is a part of the natural sciences which deals to find out about natural phenomena that can be observed and can be measured systematically so that physics is not just mastery collecting knowledge of facts, concepts or principles but also a process of discovery.

General Physics is a part of the physics learning which has an important role in daily life and in the development of science and technology. Therefore, in stimulating science and technology, the learning process of physics need more attention. One of the major problem in the study of physics, both at school and university nowdays is the difficulty of learning physics, especially on Kinematics Particle. The difficulty of studying this material because the Kinematics of particle is one that includes the vector quantity and also this material is closely associated with the activities of the investigation through experiment.This material is difficult to learn but is very closely related to the problems of daily life. Learning Kinematics of Particle material is usually use conventional with dominant using lecture method which put more emphasis on the application of mathematical equations rather than presenting daily life problems. University students who taught with conventional methods tend to remember and memorize the material which provided by the lecturer so that student understanding becomes less and students problem solving skill students are not trained.While students facing the daily which related to this material, they seemed confused and unable to solve the problem.

Based on these problems, need to be implemented learning that can equip students with skills, one of them is problem solving skill. One of the learning models that can be use to overcome these problems is *guided inquiry*. In this learning model of *guided inquiry*, students are given the opportunity to have a real learning experience and active as well as trained how to solve the problem at the same time making a decision. In addition, the learning model guided inquiry, students can answer questions about natural phenomena or events by conducting scientific investigations in which they work together to develop a plan, gathering evidence, and connecting explanation for scientific knowledge, and to communicate and justify the explanations (*National Research Council,* 2000; 2001).

Model of *guided inquiry* is a design of inquiry learning in which the implementation lecture provide guidance or instructions quite extensive to the learners [3,5]. Implementation of this model is expected to encourage students to construct their own knowledge based on the results of the investigation, discuss and analyze the syntaxs of presenting problems, collecting the data, doing experiments, organizing the data and formulating an explanation so that tcansolve the problem based on the data collected.

The importance of problem solving skills trained on the learning process of physics due to problem solving that is a part of integral in the learning of physics and problems in physics is very closely related to our daily life should not be separated from the study of physics. The statement showed that problem solving skills is one of the important skills in the study of physics.

Inquiry learning is expected to stimulate students how to understand the problem, then thinking of how students can give or make a hypothesis of a phenomenon or situation. Then the students collecting data, doing observations and investigation to provide answers of the hypothesis that have been formulated.

Inquiry helps students to think creatively [5]. Habits of students to think creatively will make the student use representation in learning. [2] said that creativity will provide a very large effect on the multiple representation skill in learning process.Then else increasing the student to think creatively, learning by inquiry model emphasis on problem solving process. [11] said that the problem solving refers to the process of inquiry learning in which students find answers to the relevant questions from the student itself.

2. METHODS

The method which used in this study is quasi-experimental with *pretest-posttest control group design* as shown in Table 1. The sample was university students who taking the course on General Physics I at Universitas Negeri Medan odd semester with academic year of 2015/2016 which consist of two classes determined by *cluster random sampling*. One class as the experimental group which consist of 41 students by applying *guided inquiry* learning model and other class as a control group which consist of 26 students by applying conventional learning. The instrument of problem solving skills measured by using an essay test form and consist of 9 items that has been validated.Indicator of problem solving skills focus on the physics problem, describing problems into physics problem, planning solutions, executing plans and evaluating the answers [1].

Table 1. Control Group Pretest-Posttest Design

Group	Pre-test	Treatment	Post-test
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Information:
O_1 = initial test (pre-test)
X_1 = guided inquiry learning model
X_2 = conventional learning.
O_2 = final test (post-test)

Different test (t-test) use to know the effect on the learning model toward problem solving skills with the normal distribution of and homogeneous. Increasing problem solving skills which analyzed with using the gain ratio that normalized (N-gain) learning outcomes obtained in the experimental class with that obtained in the control class. N-gain is calculated with an equation developed by Meltzer (2002), as follow as:

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

with g is normalized gain, S_{maks} is the maximum score (ideal) of the initial test and final test, S_{post} is the final test score, while S_{pre} is the initial test scores. Higher and lower of gain can be normalized and classified as follows: (1) if $g > 0.7$, so the value of N-gain in a higher category; (2) if $0.3 \leq g \leq 0.7$; so

the value of N-gain in the medium category; and (3) if g <0.3, so the value of the N-gain generated in the low category.

Learning phases of *guide inquiry* that used in this research are: open immers,explore,identify gather,create and share and evaluate [3].

3. RESULTS AND DISCUSSION

Based on pre-test results showed that the experimental class and control class were normal distribution and homogeneous. The average value of pre-test in experimental class was 20.60 and the average value of pre-test in control class was 22.52. According to pre-test by using hypothesis testing with different test (test-t) showed that the student in experimental class and control class have almost the same capability level is almost the same. The average value of post-test in experimental class was 67.25 the average value of control of post-test in control class was 59.89. The results of pre-test, post-test, normality testing, homogeneity and t-test are shown in Table 2. Calculation of normality, homogeneity and t-test for two independent samples t-test using SPSS 15.0.

Table 2. The results of Pre-test, Post-test, Normality Testing, Tomogeneity and t-test

Class	The average value of Pre-test	The average value of Pre-test	Normality Distribution	Variance	*P*
Experimental	20.60	67.25	Normal	homogen	0.000 (significant)
Control	22.52	59.89	Normal		0.000 (significant)

Based on the results of different test (t-test) as as shown on Table 2, obtained that there wa significant effect from the application of guided inquiry learning model of the problem solving skills of students on kinematics of particle material. The application guided inquiry learning model is better to increase students problem-solving skills on the material Particle Kinematics. Application of guided inquiry learning model better improve problem solving skills that usingto conventional learning model.

Testing the effectiveness of *guided inquiry* in improving the problem solving solving skills are expressed with % N-gain on the topic of Kinematics of Particles. Percentage of increasing in problem solving skills in the experimental class as 58% while in the control class as 48%, respectively in the medium category. N-gain average value of problem solving skills for experimental class is bigger than N-gain average value of problem solving skills in the control class. A comparison of the percentage of N-gain problem solving skills in experimental class and control class is shown in Figure 1.

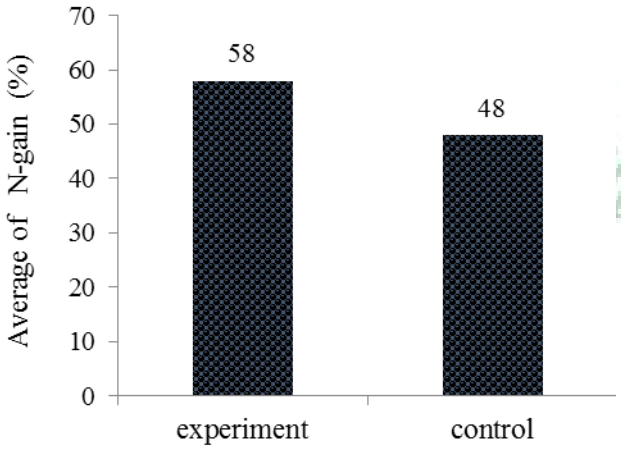

Figure 1. Comparison of Average N-gain Percentage of Problem Solving Skill ofExperimental Class and Control Class

The percentage of N-gain can be described by each indicators of problem-solving skills, which focus on the problem (PS-1), describing into physics (PS-2), planning solutions (PS-3), executing plan (PS-4) and evaluating answers (PS-5) between the experimental group and the control group as shown in Figure 1. Based on Figure 1, for the experimental class % N-gain problem solving skills on indicators and PS-1, PS-2 PS-3 PS-4 and PM-5 in a row were 69%, 67%, 55%, 51%, 47% and 58%.

Pesentase% N-gain problem-solving skills in the indicator PS-1, PS-2 PS-3, PS-4 and PS-5 in a row were 58%, 47%, 49%, 43%, 40% and 48%. Increasing the highest solving skills, both of which achieved by experimental group and the control group occurred in indicators focus on the problem (PS-1) and lowest in the indicators of evaluating the answers (PS-5).

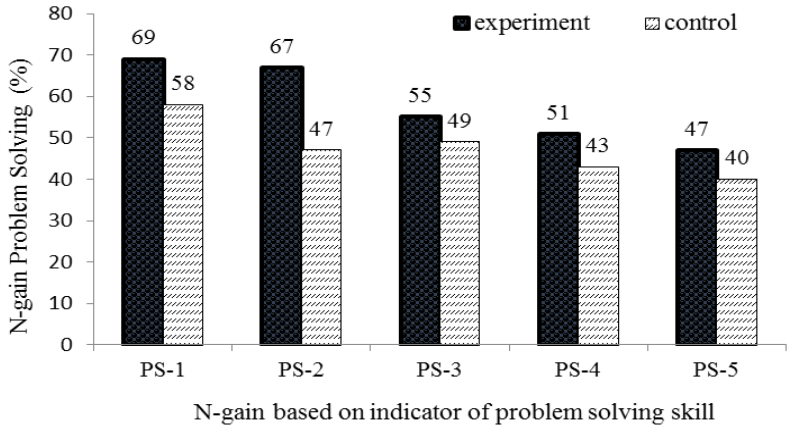

Figure 1. Comparison of percentage of N-gain indicators based on problem solving skills between the experimental group and control group

The implementation of guided inquiry model provides a better effect in increasing students problem solving skills as compared to conventional learning. It is supported by [7] stating that learning with guided inquiry significantly is better to increase problem solving skills in the learning of science compared to conventional learning. Learning with the *guided inquiry* prove university students can develop the skills and mastering the material of science and make the learning process more effective [10].

Guided inquiry learning is better toward problem solving for students with the application of this model, to train university students skills in investigating the process to collect data with the form of facts and processing facts so that the student is able to make a conclusion independently in order to answer any questions or problems which faced. Through scientific inquiry, making university students construct their own understanding so that stimulate their desire to understand the concept more deeply, motivating them to continue their work until they find an answer of a problem, and give them with real and active experiences. Students are given the opportunity to be able to take the initiative to solve problems, make decisions, and training problem solving skills so through the inquiry allows the integration of various disciplines.

Students who aldready accustomed with the problems faced are challenged to be able to solve problem through the process of scientific investigations so that students as a researcher with the guidance of trained lecture trained become a *problem solver*. This is supported by the [8], which revealed that the learning model of guided inquiry can train students to construct answers and think intelligently for finding alternative solutions to the problems posed by the teacher, skills development concept comprehension (understanding skills), build a sense of responsibility (individual responsibility), and training delivery process to find concept. All the activities of inquiry involves the investigation by its problems. By [12] which states that the guided inquiry model can reduce difficulties of learning lbecause in the learning process,lecture provide guidance in the investigation process to the learners.

This is supported by [3,5] which states that by applying *guided inquiry*, students try to inquiry. This activity will bring cognitive skill and problem solving skill of university students become better and more meaningful, because students become more active in acquiring knowledge through direct experience, and not only hearing and receiving knowledge or information of teacher said. Four common and fundamental in the scope of *guided inquiry* application namely: using the constructivist approach in the learning process, provide more extensive information to learn, focus on themes and extensive idea, learning more meaningful through the integration and problem solving [4].

4. CONCLUSIONS

The conclusion is based on the results of research that has been done as follows: (1) based on the research, found that there was significant influence from the application of *guided inquiry* learning model of the problem solving skills of university students on the kinematicsof particle material; and (2) the increasing percentage of problem solving skills to the experimental class was higher than The increasing percentage of problem solving skills to the control class class and including in the medium category.

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