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The Effects of Inquiry Training Learning Model Assisted Mind Map for Conceptual Knowledge and Science Process Skills

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Abstract: *This research aimed to analyze : the students' conceptual knowledge by using inquiry training learning model assisted mind map were better than using convensional learning, the students' science process skills by using inquiry training learning model were better than using convensional learning.This research carried out by a quasi-experimental and design was two group pretest-posttest design.The population of this study was class X SMA As-Syafiiyah Medan. Sample selection was done by total sampling. Sample divided two class, experiment class by using inquiry training learning model and control class by using convensional. The instruments of this study used test conceptual knowledge and science process skills test in the form of a observations which were valid. The data were analyzed by ANOVA two -ways. using spss 22.0 program. Conceptual knowledge posttest results of experimental class is 75,20 and the control class is 56.87. Science process skills posttest results of experimental class is 72,93 and the control class is 66,50. The result indicates the conceptual knowledge and science process skills of students using inquiry training model assisted mind map is better than using convensional learning.*

Keywords: *Inquiry training model, conceptual knowledge, science process skills.*

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I. Introduction

One of the most important goals of science education is to teach students how to get involved in inquiry. In other words, students should integrate skills, conseptual knowledge, and attitudes to develop a better understanding of scientific concepts. So teachers must focus on teaching science skills such as facts, concept and theories, to encourage students through inquiry.[1] stated the teacher not only requires the ability of science but also the ability to carry out the development of appropriate learning to support learning.

Based on the interviews with physics teachers in SMA As-Syafiiyah Medan and observations revealed that the students' conceptual knowledge in physics lessons, especially temperature and heat materials was law. It can be seen from school grade collection list 2016 with average 60 cathegory "enough". When interviewed further problems related to the process of learning in the classroom that is still using conventional learning where students tend to be passive. Then the lack of conceptual knowledge of students in physics lessons. Teachers also still use the assessment in general they were not directly involved in the experiment.

Science process skills of students is low in the learning process of learning physics applied due to still use the lecture method is varied with informed discussion, in addition to the low level of ability of teachers are able to raise the motivation for the students to follow the learning process. Exclusion from the majority of students in learning makes students less in developing science process skills. It will be increasingly difficult for students when they are required to develop science process skills of students while they do not get used to train the skill to experiment or inquiry. Kazempour stated will be a balance between content and education process if: the priority between content and education process is kept, both of them can be taught in the class even briefly. [2] Based on consideration of these issues, efforts to improve the physical science process skills is by means creating a learning effective, efficient, and creative.

Based on the above, there are other things that are needed to make the conceptual knowledge students be more active, namely science process skills. Siddiqui stated inquiry trarining model to teach learners a process how to investigate and explain unusual phenomena[3]. Inquiry training model is significantly more effective than conventional learning [2]. Base on this research inquiry training model assisted mind map can improve the conceptual knowledge and science process skills of students in the class.

II. Literature

Inquiry Training Model

Inquiry training model is one of information processing model which was developed by richard suchman. The inquiry training model is designed to bring students directly into the scientific process through exercises that can condense the scientific process into a short period of time [4] The general purpose of inquiry training is to help students develop qualified intellectual and skill disciplines to raise questions and search for hidden answers from their curiosity [4]. Inquiry training model which was intended to engage tudents in causal reasoning, become precise in asking questions, building hypothesis and testing them. It was also intended to teach students a process to investigate and explain unusual phenomenon and help develop their thinking abilities. It is most commonly used in science and social stud.

Conceptual Knowledge

Conceptual knowledge is the knowledge of interrelationships among the basic elements [5]. Conceptual knowledge is a complex and organized knowledge of some factual knowledge. Conceptual knowledge implies the relationship between factual knowledge in the form of basic elements with larger scientific structures that allow for new knowledge [6] Conceptual knowledge includes three types: knowledge of classification and category, knowledge of principles and generalizations, and knowledge of models, theories, and structures. Classification and category are the foundations in principle and generalization. Principles and generalizations form the basis for theory, model, and structure. The cognitive process dimension (way of thinking) contains six categories: remember, understand, apply, analyze, evaluate, and create [5].

Science Process Skills

Science process skills are known as procedural skills, experimental and investigating science habits of mind or scientific inquiry abilities. [7] Appropriate selections of science process skills can be taught and studied in the early years of primary school the basic skills considered as prerequisite to learning the Integrated skills. Indicator of science process skills according is an activity in the form of observation, collection, organization of data, identifying, giving treatment to variables, formulating, testing hypothesis, giving explanation, and conclude [8].

III. Research Methodology

This research was hold at SMA As-Syafiiyah Medan in the second semester academic year 2016/2017. Samples taken as many as 2 classes, consisting of experimental classes taught by model inquiry training assisted mind map and control classes taught by using conventional learning. Both class consist of 30 students in Physics subject. This type of research is quasi experiment using pre-test and post-test that aims to see the effect of the inquiry training model on conceptual knowledge that distinguishes above average conceptual knowladge and science process skills.

Variable in this research consist of two variable that was independent variable and dependent variable with explanation as follows: a) The independent variable was the variable that influences or causes the change or the incidence of the dependent variable. The independent variables in this study were the inquiry training model assisted mind map and conventional learning. b) The dependent variable was the variable that was influenced or caused due to the independent variable. The dependent variable in this research was the conceptual knowledge and science process skills in the second semester of students in SMA As-Syafi'iyah Medan academic year 2016/2017 on temperature and heat subject.

The study involved two different treatment c'lasses in which the experimental class was treated using the inquiry training model, while the control class was using conventional learning. The treatment was aimed at knowing the conceptual knowledge and science process skills of the students by giving tests and observations in both classes before and after treatment. The design of research was quasi experimental, by design: two group pretest-posttest design. Thus the research design can be seen in Table 1.

Table 1. Research Design

Classes	Pretest	Treatment	Postest
Experimental	Y_1	X_1	Y_2
Control	Y_1	X_2	Y_2

Information:

X_1 = treatment in the experimental class was the application of inquiry training assisted mind map

X_2 = treatment in the control class was the application of conventional learning.

Y_1 = pretest given to the experimental class and control class prior to treatment.

Y_2 = postes given to the experimental class and control class after the treatment.

IV. RESULTS

The implementation of the research took place three times each meeting in the experimental class and control class based on three learning implementation plan which had been designed before the research was conducted. In the experimental class the researchers applied inquiry training model assisted mind map while in the control class the researcher applied conventional learning. The application of inquiry training model was intended to see whether or not the model effect was applied to the students' conceptual knowledge and the student's science process skills in the experimental class and control class. Student's conceptual knowledge on control class and experiment class shown in Table 2 and Table 3 below.

Table 2. Pre-test and Post-test Results of Students' Conceptual Knowledge

	Conceptual Knowledge	
	Control Class	Experiment Class
Pre-test	33.00	32.93
Post-test	56.87	75.20

Based on Table 2, the description of the average pre-test and post-test conceptual knowledge in experiment class and control class as follows: Pre-test on control class and experiment class were 33.00 and 32.93. Post-test on control class and experiment class were 56.87 and 75.20.

Student's science process skills on control class and experiment class shown in Table 3 below.

Table 3. Pre-test and Post-test Results of Students' Science Process Skills

	Science Process Skills	
	Control Class	Experiment Class
Pre-test	47.60	47.90
Post-test	66.50	72.93

Based on Table 3, the description of the average pre-test and post-test science process skills in experiment class and control class as follows: Pre-test on control class and experiment class were 47.60 and 47.90. Post-test on control class and experiment class were 66.50 and 72.93.

Analysis of Conceptual Knowledge Items on Control and Experimental Class

The application of inquiry training model in the experimental class begins by forming groups of students into five groups with each group consisting of six students. Teachers provide sub topics to be chosen by students from the topics to be studied. Teachers and students then plan the procedures and tasks according to which sub topics were selected. At the implementation stage, students carry out the planning made in the previous stage while the teacher monitors and offers help when needed. In the analysis and synthesis stage, students analyze and evaluate the information obtained during the experiment. In the final product presentation stage, the teacher appoints several groups to present the experimental results in front of the class. During the evaluation phase, teachers and students evaluate the contributions given by each group, some groups provided opinions and suggestions on the topic presented, what were the things that differentiate the results obtained by each group. Student experiments aim to improve and train student's conceptual knowledge and science process skills. Students conducted experiments in groups, each group making its own work procedure based on the agreement of the group. During the student's experiments, teachers were assisted by peers to observe the students' science process skills by using the prepared sections. It aim to look directly at the students' science process skills in addition to the postes at the end of the lesson. After the experiment was complete, students were asked to verify the results of their experiments and draw conclusions on each experiment that has been done. After each group presented the results of their discussion, the researcher then gave an explanation.

The effect of this model was that inquiry training model will improve students' conceptual knowledge. This study provided corroborating evidence that the conceptual knowledge of students increases, this may be due to group formation based on different levels of student knowledge in each group, encouraging higher-knowledge students to assist students with lower ability to get the maximum value.

The grade of postest for the classes using the inquiry training model was better than the postest in the class using conventional learning. Based on the results of Harahap, et.al. concluded student's science process skills using inquiry learning model training is better than conventional learning [9]. Inquiry training model is significantly more effective than conventional learning. The result of Vaishnav explains that learning outcomes using inquiry training model is more effective than conventional model [10]. In line with Pandey's research, et al., which states that teaching physics using inquiry training model is more effective than conventional learning [11].

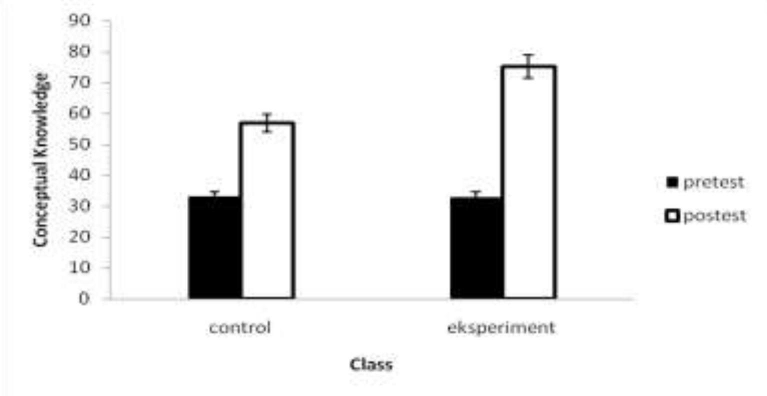

Figure 1. Comparison Conceptual Knowledge in the Experimental Class and Control Class

Figure 1. shows a comparison of the students' conceptual knowledge in the experimental class and control class. Where seen improvement in conceptual knowledge of students before and after treatment, there is an average increase of 42.27 in the experimental class while the control class is 23.87.

When observed from both classes, it was found that students in the experimental class play an active role in conducting the experiments provided. At first the students had difficulties when asked to join the group, but in the next meeting the students were more alert when the teacher instructed the students to join the group. Students can find and develop their own knowledge, conduct an inquiry from what he or she knows, search from various sources and do practicum and share knowledge with fellow classmates will improve students' understanding of a topic thoroughly so as to reduce the impact of knowledge gaps among students .

Analysis of Science Process Skills Items on Control and Experimental Class

The influence inquiry training model would improve the student's science process skills, student's science process skills could be increased due to the trained students doing the investigation applied to the inquiry training model in the learning phase. In this study, there was reinforced evidence that the science process skills of students who treated the inquiry training model turned out to be better than the students who received the conventional learning treatment. The inquiry training learning model had a significant effect on student's science process skills. This research was in line with The results of research conducted by previous researchers showed that: the learning process with inquiry training model can improve the skills of the science process [9]. Other research by Ghumdia and Amina, that inquiry training encourages the acquisition of science process skills better than lecture methods [12]. Furthermore Silitonga. students' science process skills that are taught with inquiry training model is better than students who are taught by conventional learning model [13].

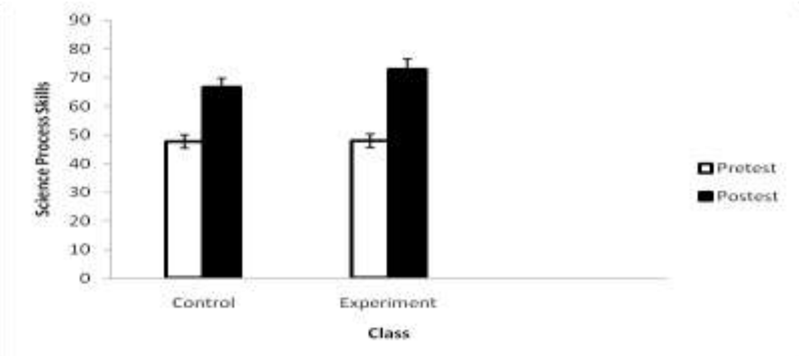

figure 2. Comparison Science Process Skill in the Experimental Class and Control Class

Visible improvement in the science process skills of students before and after being treated, there is an average increase of 25.03 in the experimental class while the control class is 18.90. So it can be concluded that the improvement of science classroom process skills which are taught by the instructional model of inquiry training with the help of mind map is better than the control class that is taught by conventional learning.

If observed from both classes, it is found that students in the experimental class play an active role in conducting the experiments provided. At first the students had difficulties when asked to join the group, but in the next meeting the students were more alert when the teacher instructed the students to join the group. Students can find and develop their own knowledge, to investigate what they know, to seek from various sources and to practice and share knowledge with fellow classmates will improve students' understanding of a topic thoroughly so as to reduce the impact of knowledge gaps among students.

When observed from both classes, it was found that the students in the experimental class were more active in doing the experiments than the students in the control class. In the beginning students experience difficulties when performing experiments, but at the next meeting students was more accustomed to experimenting with their respective groups. The influence of this social group turns out to be an effective way of providing quick solutions for students to complement their ignorance of the subject matter learned.

Physical learning not only helped students acquire knowledge, skills, and attitudes, but more importantly was to help students learn about how to learn the knowledge, skills and attitudes it gained. The process of physics learning was not enough to simply transfer teacher knowledge to students, but it must be through a dialogical experience that was characterized by a learning atmosphere characterized by real experience or directly involved.

The learning model applied to the two sample groups gave better effect to the student's science process skills. Observational data obtained during the learning process still there were weaknesses that students were less accustomed to working with groups that were divided based on the level of knowledge they have also made the students work longer.

The data obtained was normal and homogeneous distributed, then the data were tested assumption using the similarity of variance and the average of pretest value done by Independent sample t test. Independent t-test was used to test experimental research that was to verify whether there was influence of inquiry training model and conventional learning to conceptual knowledge and student's science process skills using SPSS 22 [14].

In the condition to see the influence that was used t test was significant obtained was ½ of significant that was 0.000, because the value significance less than 0.05 then the accepted Ha or conceptual knowledge of the experimental class students was better than the conceptual knowledge of the control class students.

In the condition to see the effect that was used t test was significant that was obtained ½ of significant that was 0.000, because significant value less than 0,05 then Ha accepted or student's science process skills experiment class better than student's science process skills control class.

After analyzing the gain, then testing the normality, homogeneity and similarity were done. The normality test of gain used to determine whether the sample came from normally distributed population or not. Normality test of gain data in control and experimental group was done by Kolmogorov-Smirnov test using SPSS 22 program with level of significance 0.05 where normality test result can be seen in Table 4.

Table 4. Normality Test of Conceptual Knowledge and Science Process Skills Gain in Experimental and Control Group

Group	**Conceptual Knowledge**			**Science Process Skills**		
	Statistic	Df	Significance	Statistic	Df	Significance
Control	0,135	30	0,169	0,133	30	0,182
Experimental	0,156	30	0,062	0,154	30	0,067

Based on normality output in Table 4, the significance value of conceptual knowledge and student's science process skill gain in experimental and control group is higher than 0.05, it can be said that conceptual knowledge and student's science process skills gain data of the experimental and control group are normally distributed.

Testing the homogeneity of conceptual knowledge and student's science process skills postest data variance between the control and the experimental group were done by Levene test through the SPSS 22 program with a significance level of 0.05. After analyzing the data, the output can be seen in table 5.

Table 5. Homogeneity Test of Conceptual Knowledge Gain in Experimental and Control Group

Output	Levene Statistic	df1	df2	Significance
Conceptual Knowledge Gain	1,113	1	58	0,296
Student's Science Process Skills Gain	0,734	1	58	0,395

Based on homogeneity output with Levene Statistic in Table 5, the significance level of conceptual knowledge and student's science process skills gain showed that the significance level is higher than 0.05. It can be concluded that control and experimental group came from population that have the same variance, or both classes are homogeneous.

Hypothesis testing was done after the data feasibility requirements completed and student's science process skills fulfilled by using Independent Sample T-Test with SPSS 22 Program. Data of conceptual and student's science process skills were obtained then calculated by using t- test to see post test different average of the 2 groups.

The output of SPSS 22 program for Posttest score of students' conceptual knowledge and student's science process skills taught by inquiry training model and conventional learning can be seen in Table 6.

Table 6. Hypothesis Testing of Conceptual Knowledge and Science Process Skills Gain in Experimental and Control Group

	Students' Conceptual Knowledge	Students' Science Process Skills

		Sig. (2-tailed)	Mean Difference	Std. Error Difference	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Value	Equal variances assumed	.000	-18.333	2.093	.008	-6.433	2.327
	Equal variances not assumed	.000	-18.333	2.093	.008	-6.433	2.327

Based on table 6, the significance value is 0.000<0.05 and 0.008<0.05 it can be said that H0 is rejected or Ha is accepted in the significance level of 5% alpha. So, it can be concluded that the students' conceptual Knowledge and students' science process skills taught with inquiry training learning model is better than conventional learning. It can be concluded that there is an effect of inquiry training learning model on students' conceptual and students' science process skills. It can be seen from the significant result of students' of inquiry training assisted mind map group compared to conventional learning group.

V. CONCLUTION

Conceptual knowledge of physics students used inquiry training model was better than conceptual knowledge of physics students using conventional learning. This can be shown from the research data showing that the conceptual knowledge of physics students inquiry training model equal to 75.20 and on the conceptual knowledge of physics students using conventional learning of 56.87.

Science process skills of physics students used inquiry training model was better than the students' science process skills using conventional learning. Based on data from the average score of students using inquiry training model of 72.93 for students using conventional learning amounted to 42.34.

Students should be guided by providing sufficient training to improve student's conceptual knowledge and science process skills. The next researchers should use a longer period of time because the time available in the implementation of learning by using inquiry training model and by using conventional learning is still lacking, because adjusted to the school schedule in question. Teachers should choose the learning model in accordance with the purpose of learning. Viewed with the character of the students, the students are not yet accustomed to using inquiry training model, so the students should to be trained to conduct the investigation through simple experiments while studying physics so that students have a fast response in implementing inquiry training model.

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