The Effect of Inquiry Learning Model on Students Science Process Skills

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***Abstract*—Inquiry models are commonly used to assess students problem solving and discovery abilities. However, there are several resistance to Inquiry syntax that can improve students' science process skills. The purpose of this study was to determine the Inquiry model of students' science process skills. This study is a quasi experiment research using samplings techniqe, where IVA class as experiment class I, IVB II as experimental class II, and IVC as control class. Data analysis techniques using covariate analysis (ANACOVA) using by SPSS 23.0 for windows applications and data collection using multiple choice test. Based on hypothesis test with P <0.05 then Ho is rejected and Ha accepted where this means there is significant influence on the application of model Inquiry with average value is 88.20. Its means that Guide Inquiry more positively than Modified Inquiry 87.20, and Direct Instruction model (average value 70.60) to the students science process skill.**

Keywords—Inquiry Learning, Direct Instruction, Science Process Skill

I. INTRODUCTION

Analyzing students' scientific process skills can not only be done with a test, but through a process. This skill process will also not only improve student learning outcomes, but creativity and scientific attitudes in students will also emerge through the learning process with the inqury model. The facts in the field through observation science only instill theory or material to students only, do not pay attention to the development of processes. If only instill theory, science will not give to products and attitudes like scientists that can be useful for students in their personal and social lives. Based on this description, science should be able to develop both dimensions, science as a process includes the skills and attitudes possessed by scientists to achieve scientific products. This means, the development of skills in this process can foster attitudes like those of scientists to achieve scientific products.

If science contains products and processes, then in teaching students not only to deliver science products, but teachers must train students about scientific activities involving various basic skills found in aspects of science process [1] Developing skills such as acquisition obtained from a process, students will be able to find and develop their own facts and concepts and foster and develop the attitudes and values demanded. Those skills are the main cogs and a good foundation in the process of discovery and attitude development carried out by students as scientists do [2]

II. THEORETICAL

According to Joyce [3] inquiry model training is an inquiry learning model that is designed to bring students directly into the scientific process through exercises that can condense the scientific process into a short period of time. The aim is to help students develop discipline and develop the intelligence needed to get questions and find answers about their curiosity. Through this model students learn more oriented to guidance and guidance from the teacher so students can understand the concepts of the lesson. In this model students will be faced with relevant tasks to complete group or individual discussions in order to solve problems and draw conclusions together independently. Azizah & Parmin [4] which states that the inquiry training learning model is a research training model that reinforces the natural drive to explore, giving direction through exploration with great enthusiasm and earnestness. Furthermore Vaishnav [5] added that one of the instructional impacts of applying the inquiry training model is a systematic research procedure. This opportunity can be used to guide how to implement structured research procedures. According to Starko in Chang [6] states that all inquiry processes, making hypotheses are considered as one of the important things to create a relationship between new knowledge and experience, and also train the christian element of scientific inquiry and increase creativity. Through the application of inquiry training models and accompanied by scientific attitudes students are able to achieve educational goals, especially in science learning.

According to Rusman [7] there are 3 theories that support inquiry learning model namely; (1) Constructivism Learning Theory, according to constructivism learning theory, teachers are more emphasized not only to give knowledge to students, but students must build their own knowledge in their minds, in other words teachers teach students to be aware of using their own strategies to learn to find his own knowledge; (2) Jerome Brunner's Discovery Theory, According to Brunner in Dahar [8] meaningful learning can only occur through discovery learning where knowledge gained through discovery learning can last a long time, and has a better transfer effect. Learning discovery can improve the ability of thinking and thinking freely, and practice cognitive skills to find and solve problems; (3) David Ausebel's Meaningful Learning Theory, According to Ausebel, learning can be classified into two dimensions. The first dimension relates to the way information or subject matter is presented to students, through acceptance or discovery. The second dimension concerns the way students can relate information to the cognitive structure are facts, concepts of generalizations that have been learned and remembered by students.

Joey and Freinds states that there are 5 stages of learning in the inqury learning model namely; (1) requires the teacher to present the problem situation and explain the students' research procedures; (2) verification, is the process by which students gather information about an event that they have seen or experienced, in an experiment; (3) students introduce new elements into the problem to find out if something else might have happened when their research data were tested differently; (4) the teacher asks students to process data and make explanations; (5) students are asked to analyze their research patterns. They may find questions that are very effective, ways of asking questions that are productive and not, or the types of information they need and don't get.

Direct learning places direct teachers as learning resources. This strategy is effective enough to be used in conveying information and shaping skills step by step. According to Arends [9] the Direct Instruction learning model is based on three learning theories, namely: behaviorism learning theory, social learning theory and research on teacher effectiveness. Direct Instruction is a teacher-centered learning model and has 5 steps, namely: estabilishing set, explanation and / or demonstration, guide practice, feedback and extended practice. A learning with Direct Instruction (DI) model requires careful concentration by the teacher and a learning environment that is practical, efficient, and task-oriented. The learning environment for direct instruction is focused on academic tasks and is intended to maintain active involvement.

The phases or syntax in direct learning (direct instruction) according to Joyce and Weil are as follows; (1) Learning orientation, in this case the teacher conveys the learning objectives; (2) Presentation of Material, The teacher explains new concepts and skills, presents examples, identifies steps, checks students' skills; (3) Structured training, integrating educator skills through examples and exercises, providing feedback; (4) Guiding Training, giving guidance and training, assessing students' abilities; (5) Self-training, giving students the opportunity to do their own exercise, evaluating. Sani [10] argues that direct learning (DI) is generally deductive in nature, where general rules are presented, then relevant examples are given. The weakness of this strategy is that it cannot be used to develop the abilities, processes, and attitudes needed to think hard and the ability to work in groups.

Process skills can be interpreted as intellectual, social and physical skills that originate from fundamental abilities that in principle already exist in students Dimyanti & Mudjiono [6] Science Process Skills (KPS) are the ability of students to apply scientific methods in understanding, developing and discovering science. KPS is very important for every student as a provision to use scientific methods in developing new knowledge or developing the knowledge possessed. According to Dimyanti and Mudjiono [11] that process skills can provide scientific stimulation, so students can understand the facts and concepts of science well. KPS also provides opportunities for students to work with science, not just to tell or listen to stories about science. This results in students becoming learning processes and products of science. Another opinion states that the science process skills is a learning approach that emphasizes the learning process, activities, creativity of students in gaining knowledge, skills, values, and attitudes and applying them in everyday life [12]. Science process skills are the ability of students to apply scientific methods in understanding, developing and discovering [13].

According to Tawil & Liliasari [14] there are eleven KPS indicators, namely; (1) Observing by using various senses, collecting / using relevant facts; (2) Classifying. Noting each observation separately, looking for differences, similarities, contrasting features, comparing, looking for the basis of grouping or classification; (3) Interpret. Linking the results of observations, finding patterns / regularities in a series of observations, concluding; (4) Forecasting. Using patterns or regularity of observations, expressing what might happen in circumstances that have not yet occurred; (5) Communicating. Describe or describe empirical data on the results of experiments / observations with graphs or tables or diagrams, discussing the results of activities of a problem / event; (6) Asking Questions. Ask what, how, and why, ask to ask for an explanation, ask questions that come from a hypothesis; (7) Knowing the Hypothesis. Knowing that there is more than a possible explanation of an event, realizing that an explanation needs to be tested for truth by obtaining much evidence or solving problems; (8) Planning an experiment / investigation. Determine the tools, materials, or sources to be used, determine the variables or determinants, determine what will be implemented in the form of work steps; (9) Using Tools / Materials / Sources. Using tools or materials or sources, knowing the reasons why using tools or materials or sources; (10) Apply the Concept. Using concepts / principles that have been learned in new situations, using concepts / principles in new experiences to explain what is happening; and (11) Conducting Experiments. The assessment of science learning processes and outcomes requires more comprehensive assessment techniques and methods. All the above indicators of science process skills are used as benchmarks for assessing science process skills in this study.

III. METHOD OF RESEARCH

The population in this study were all fourt grade students of SDN 053981 Langkat. The sample in this study was determined by sampling technique, as many as 3 classes from the 3 existing classes namely IVA class with a total of 30 students taught with the problem based learning model where the problem comes from the students themselves, IVB class with the number of 30 students taught with the problem based learning model where the problem comes from the teacher, and the IVC class with the number of 30 students taught by direct instruction model. This type of research is quasi-experimental research by conducting experiments in the classroom that have been formed before not changing the classroom situation and learning schedule.

TABLE. 1 EXPERIMENTAL GROUP

Class	Pretes	Treatment	Postes
A1	T1	X1	T1
A2	T2	X2	T2
A3	T3	X3	T3

X1 : Guided Inquiry
X2 : Free Modified Inquiry
X3 : Direct instruction
T1 : science process skills

The formula used in this validity test is Biserial Point Correlation. To find out the validity of the science process skills test using biserial correlation points, with the following formula:

$$r_{pbi}=\frac{Mp-Mt}{SD}\sqrt{\frac{p}{q}}$$

Data analysis techniques used in this study are descriptive analysis techniques and inferential analysis. The description analysis technique is used to describe the research data including the mean, median, mode, variant of standard deviation, minimum value and maximum value. Inferential analysis techniques are carried out to test the hypothesis of normality and homogeneity. Test the normality of Kalmogorov-Smirnov using SPSS 23 for Windows. Homogeneity test is carried out using the Levens Test approach on the SPSS 23 for Windows program and anaylisis by ANACOVA.

IV. RESULTS AND DISCUSSION

. The results of research on the application of inquiry learning models (guided and freely modified), as well as direct learning learning models for science process skills can be seen in Table 2.

TABLE 2. DESCRIPTIVE ANALYSIS OF PRETEST

Models	Min	Max	Mean	Std. Deviasi
Guided Inquiry	30	55	43,25	8,472
Free Modified Inquiry	30	55	44, 45	9,903
Direct Instruction	30	55	43,20	8,385

Pretest results show that the science process skills of students in the guided inquiry class obtained the highest value of 55 and the lowest value of 30 with an average value and standard deviation of 43.25 ± 8.472. In the modified free inquiry class the highest value is 68 and the lowest value is 30 with an average value and standard deviation of 44.45 ± 9,093. Whereas in the direct learning class the highest value is 60 and the lowest value is 30 with the average value and standard deviation of 453.20 ± 8.335. For a complete descriptive analysis can be seen in Lampinn 24. Furthermore, the Kalmogorov-Smirnov normality test is carried out in the initial test of critical thinking skills seen in Table 3.

TABLE 3. KALMOGOROV-SMIRNOV NORMALITY TEST PRETEST SCIENCE PROCESS SKILLS

Learning Models	Statistic Test	Significanse
Guided Inquiry	0,185	0,171
Free Modified Inquiry	0,179	4,092
DI_	0.151	0,200

The Kalmogorov-Smirnov normality test results showed that all three classes had a normal distribution with a significant value in experimental class I of 0.071> 0.05, experimental class II of 0.092> 0.05 and control class 0.200> 0.05. For the Leven's Test homogeneity test, a significant value of 0.914 is obtained where the significant value is greater than 0.05, which means the initial ability test has homogeneous variance. After obtaining the prerequisite test results for the initial test (pretest), then the data on the results of the three post-learning models can be seen in Table 4

TABLE 4. DESCRIPTIVE ANALYSIS OF POST-DATA SCIENCE PROCESS SKILLS

Learning Models	Min	Max	Mean	Std. Deviasi
Guided Inquiry	75	96	88,20	6,075
Free Modified Inquiry	63	90	77,20	7,969
DI	63	80	70,60	5,557

From Table 4, data obtained by descriptive analysis of post-test science process skills that apply the guided guiding model has the highest value of 96 and the lowest value of 75 with an average value and standard deviation of 88.20 ± 6.075. In the experimental class II by applying the modified free inquiry model the highest value was 90 and the lowest value was 63 with an average value and standard deviation of 77.20 ± 7.969.

Whereas in the control class by applying the direct instruction model, the highest value was 80 and the lowest value was 63 with an average value and standard deviation of 7.060 ± 5.557.

After the descriptive prerequisite test is fulfilled then the normality test in the initial test of scince process skills can be seen in Table 5.

TABLE 5 KALMOGOROV-SMIRNOV NORMALITY TEST POSTES SCIENCE PROCESS SKILLS

Learning Models	Statistic Tes	Significans
Guided Inquiry	0,152	0,200
Free Modified Inquiry	0,192	0,052
DI	0,143	0,200

From the Kalmogorov-Smirnov normality test on the implementation of the guided inquiry model, the distribution of normal distribution data obtained with a significant value of 0.200> 0.05. In the experimental class II by applying the modified free inquiry model also obtained post-test data distribution of critical thinking skills with normal distribution with a significant value of 0.052> 0.05. Likewise, the control class on the application of the direct learning mode obtained a significant value of 0.200> 0.05 where the posttest data were normally distributed. The results of the Covariate Analysis show that the learning model has a significant effect on the science process skills of fourth grade students of SDN 053981 Langkat with a significant level of (F: 37,345 with p: 0,000). Based on a hypothesis test with a p value <0.05, Ho is accepted and Ha is accepted, which means that there is a significant influence on guided inquiry, modified free inquiry and learning models directly to students' science process skills. For more details the influence of each model can be seen in Figure 1.

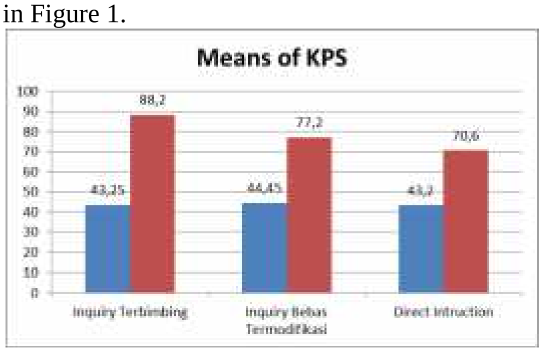

Figure 4.3 Effect of Learning Models on the Science Process Skills of Students in Class IV SDN 053981 Langkat. The learning model shows significantly different)

The data of this research are in line with the results of the research by Hardiyanti [15] which stated that the application of problem based learning models contained differences in Ngain of science process skills by 0.71 and in the control class (lecture and discussion methods) N- gain of 0.52. This is because PBL model facilitates students to construct their own knowledge from beginning to understand the existence of a problem to solve the problem. The influence of the problem based learning model on science process skills in this research is also in line with the research of Tasoglu and Bakac [16] with the study about PBL method is more effective than TTM on students' conceptual development and science process skills positively in 1th class of Department of Physics Teaching in Dokuz Eylül University in Turkey. Keil & Jennifer's [17] research states that the value of students' scientific process skills tests with problem-based learning is very good. This is because the problem based learning model of learning starts from students realizing a problem and then students process the problem to be solved through several experiments so that students' independence is very instrumental in the problem based learning model. Akinoglu and Tandogan [18] said that the implementation of problem-based active learning model had positively affected students' academic achievement and their attitudes towards the science course. It was also found that the application of problem based active learning model affects students conceptual development positively and keeps their misconceptions at the lowest level.

V. CONCLUSION

Based on the findings of research and analysis conducted by researchers, several conclusions are obtained, including: There is a significant influence on the guided inquiry learning model of the science process skills in fourth grade students. The science process skills of students taught with the guided inquiry model averaged 88.20, the modified PBL free inquiry model averaged 77.20, and direct teaching with an average of 70.60.

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