# Effectiveness of Inquiry Learning to Empowering Science Process Skills: Case Study of Junior School Pre-Service Teacher

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***Abstract*— Mastery of science process skills through inquiry learning in students is needed as a provision in the future. The purpose of this study was to determine the feasibility of inquiry learning in empowering science process skills in junior high school students. This research method is Research and Development (R & D), which at this level is included in the feasibility test. There were 4 prospective science teachers, 4 accompanying teachers and 296 students taken randomly in 3 Kendal Regencies, Semarang Regency and Demak Regency. Semarang Central Java. Using the effect size method to show the difference between the experimental class and the control class. Effect size in this study is 1.5 for the four results of the study. Findings from this research inquiry learning can empower science process skills. Whereas the overall scientific process skills that are dominant are observing and measuring while the not optimal is concluding and predicting. This finding is recommended to be a reference for education observers in applying inquiry learning to junior high school students.**

***Keywords—effectiveness, inquiry learning,empowering, science process skills, Pre-Services Teacher***

## I. INTRODUCTION

Various skills needed in the 21st century are formulated by each expert. There are 4 main components of skills needed in the 21st century, namely: digital-age literacy, inventive thinking, effective communication, and high productivity [1]. Meanwhile, the criteria for graduates needed by the work world are 10 criteria and grouped into 4, namely: ways of thinking, ways of working, tools of working, and living in the world [2]. Both of these views are in line with what was initiated by UNESCO for the world of education, namely: learn to know, learn to do, learn to be, and learn to live together. Every individual must be able to master the right thinking skills. The right way of thinking can produce the right action [3]and can determine how to consider decisions well [4]. The weakness of students in mastering this thinking skill can lead to errors in understanding learning well. In learning in junior high school, thinking skills are packaged in science lessons through science process skills. this is because science process skills support a person to think and think scientifically [5]. In other words, it can be said that science process skills are a way of gaining knowledge through a series of methods known as the scientific method.

Learning science is believed to be able to produce individuals who show honest behavior, discipline, responsibility, caring (tolerance, mutual cooperation), polite, and self-confidence, in interacting effectively with the social and natural environment within the range of their association and existence " [6]. Attitudes and skills that are continuously trained in science learning can become habits that affect the perpetrators during the learning process and after learning.

But unfortunately scientific literacy, including science process skills in students classified as still low [7];[8];[9];[10], one of the causes is that science learning in the classroom is still dominated by cognitive activities and lectures by teachers [11];[12]. Science process skills are still not fully trained in learning because the science material that must be given is more than training science process skills. whereas science process skills and science products should be integrated as a whole of science lessons. Science process skills are not taught separately as a collection of knowledge but are automatically trained in science learning. Science process skills are an integral part of science itself [13].

Science process skills are divided into two, namely basic and integration. Basic science process skills consist of observing, measuring, classifying, predicting, concluding and communicating. Observing is the use of the five senses on objects that are around us. Observations are carried out in detail, complete and structured so that reliable data can be obtained. Measuring is the activity of comparing an object with an existing amount. The amount used can be in the form of principal amount, derivative amount, standard quantity and not

standard. Measuring must also be done appropriately in order to obtain reliable data. Classification means grouping objects according to similarities, differences, and relationships. Classifying makes it easier for researchers to simplify their observations and measurements so that they are easier to understand. Predicting is the activity of predicting events that will occur in the future based on the activities of observing, measuring, and classifying. Predictions that approach truth are even truth when previous activities are correct. Summing up is an explanation of the definition of an object that we observe. Conclusions can be in the form of principles, laws, theories, and concepts. The final part of basic process skills is communicating. All results of activities that have been carried out will have no meaning or no benefit when not delivered to others. Good forms of communication can make it easier for someone to understand a new concept. The six basic science process skills are then measured to find out how far the mastery of these skills is for junior high school students. Science process skills can be trained through the learning process at school.

To train science process skills, inquiry learning was used in this study developed and has been adjusted to the structure of science materials in junior high school. The syntax in inquiry learning is: observation, manipulation, generalization, verification, and application [14]. Process skills that are trained at the junior high level are basic science process skills, consisting of: observing, measuring, predicting, classifying, concluding, and communicating [15];[16]. Each syntax of learning is carried out to train science process skills. The purpose of this study was to analyze the effectiveness of inquiry learning in training science process skills in science subjects in junior high school.

## II. METHOD

### A. Research Setting

This research method is a non equivalent pretest method post control group design test. The study was conducted in 4 junior high schools in 3 districts, namely Semarang Regency, Demak Regency and Kendal Regency. The sampling method uses purposive this is due to various considerations related to licensing and the reach of the place, so that each district is only represented by 1 school. At each school consists of one physics teacher candidate researcher and one assistant teacher. Learning uses the syntax of inquiry that has been developed previously.

Learning tools used to train science process skills, validation and reliability have been proven in previous research projects. The next device that has been validated is then applied in classroom learning by 4 prospective science teachers.

### B. Participant

Objects in this study are prospective science teachers and students found in schools in four schools in 3 districts. Briefly the participants in this study are shown in Table 1.

Table 1. Participant of Research

| School | Class | Number of Student | |
|---|---|---|---|
| | | Experiment | Control |
| A | VII | 34 | 36 |
| B | VII | 34 | 34 |
| C | VIII | 40 | 40 |
| D | VII | 38 | 38 |
| Total | | 146 | 148 |

### C. Data Analysis

Data collection using questionnaires, learning outcomes tests and classroom observations.

Data analysis used descriptive test to find out the mean values and standard deviations, and the effect size to determine the effectiveness of inquiry learning to train science process skills from 4 different schools. To determine the effect size accumulation using a method written using the Formula 1[12]:

$$\overline{ES} = \frac{\sum(w\ x\ ES)}{\sum w}$$

ES = effect size
w = invers of standart error square
The effect size criteria used using the Cohen's d scale, for values below 0.2 are low, 0.5 is medium, and above 0.8 are high.

## III. RESULTS AND DISCUSSION

The purpose of this study was to determine the effectiveness of inquiry learning applied in science learning in junior high school to train science process skills. Simultaneously the inquiry learning that has been validated before is then used in classes. Inquiry learning used refers to the syntax compiled by Wenning. Each syntax is used to train science process skills in junior high school students. Learning devices adapted to the structure of the material and then its effectiveness at different levels and materials. For further purposive sampling, choosing the school used to test the effectiveness of the results of the data from the experimental class and the control class in four schools is shown in Table 2.

Table 2. Total number of effect size

| Sch | Ex.Group | | | Control Group | | | Cohen's D | wx ES |
|---|---|---|---|---|---|---|---|---|
| | N | M | S | N | M | S | | |
| A | 34 | 82,7 | 6,6 | 36 | 51,0 | 15,2 | 2,6 | 0,42 |
| B | 34 | 80,7 | 10,6 | 34 | 75,0 | 13,4 | 0,47 | 0,08 |
| C | 40 | 53,1 | 16,3 | 40 | 39,8 | 12,4 | 2,9 | 0,76 |
| D | 38 | 62,9 | 12,5 | 38 | 43,8 | 15,3 | 1,36 | 0,21 |
| | 146 | | | 148 | | | | 1,5 |

Inquiry learning emphasizes student activities to train science process skills. Science process skills in this study were measured through learning outcomes instruments given to students in the experimental class and control class. Based on the Cohen's score shown in Table 2, the effect size in study B had the lowest score compared to the effect size in other schools. But overall the size of the effect size for all schools is in the position of more than 0.8, meaning that inquiry learning is effective for training science process skills in junior high school students. This experiment was conducted by 4 prospective science teachers, for further description of each activity of prospective science teacher in teaching science in junior high school using inquiry learning model to train science process skills described in the following explanation.

School A, pre-service teacher = Tiara Yulianti

The material used is Light and Optical Instruments for eighth grade students. Learning is done in the laboratory and in the classroom. Students formed groups to do the practicum. Teacher candidates explore the skills of the processes that arise during practice and learning in class. Process skills that are trained are: observing, concluding, measuring, communicating and predicting. At the end of the learning students are given a post test and at the beginning of the learning the pretest is given. Based on observations and test results, the most prominent aspect of process skills is observing skills, while aspects that are still not optimal aspects communicate.

School B, pre service teacher = Dewi Oktavianita

The material used in the study is Pressure in class VIII. Learning is carried out in a laboratory to investigate factors that influence changes in object shape due to variations in types of pressure. Students observe, measure, classify, communicate, predict and conclude. Besides that, also trained in critical thinking. However, the critical thinking variable is not included in the discussion of this article.

School C, pre ervice teacher = Asti Nopriani

This school is the only private school used in research. The material used is Vibration for VIII grade students. Students are trained to have simple process skills consisting of: observing, measuring, predicting, communicating, concluding and classifying. Based on observations, observing skills include abilities that have the highest score, meaning that each student can make good observations. But the ability to predict, including in the category of skills that are still relatively low is only 48%. This means that it has not reached half of all students mastering this skill. Students cannot predict the results of the experiment or predict the phenomena that occur in the future.

School D, pre service teacher = Tri Argianti

The subject matter used in the study is the Pressure Chapter VIII Substance. There are 6 process skills that are trained, namely measuring, observing, predicting, concluding and communicating. Besides using the inquiry learning model, mind mapping is also used. Based on the experiment, observing aspect is the dominant aspect while the measuring aspect is the aspect that is least controlled by students.

Based on the description of the four teacher candidates, it can be concluded that inquiry learning can be used to train science process skills. Evidenced by the size of the 1.5 effect size. Six basic science process skills that are trained to the most dominant junior high school students are observing aspects. While aspects of predicting, communicating, and measuring are included in aspects that still need to be optimized in subsequent studies. This is similar to what has been done[17]; Nyoman [18], and Juhji[19].

## IV. CONCLUSION

Inquiry learning effectively trains science process skills for junior high school students. The magnitude of the effectiveness of the use of inquiry learning is 1.5 with the calculation using the effect size. This means that its effectiveness is on a high scale.

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