



# Analysis of Laboratory Use in Doing Scientific Work in Elementary Schools

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**Abstract.** This research was conducted with the aim of describing the use of real laboratories in carrying out scientific work on science learning in elementary schools. The method used is qualitative research. The research subjects were carried out in 46 elementary schools in the Surabaya area. The data sources for this action research include students, teachers, learning outcomes documents, and the learning process. Data collection techniques are carried out in the following way: Interview methods are carried out with teachers and students who carry out the learning. The Observational Method is a way of collecting data by direct observation and systematic recording of the object to be studied. Data analysis techniques according to Miles and Huberman include data reduction, namely making an abstraction of all data obtained from all field notes resulting from observations, interviews and document review. Presentation of data, namely a collection of structured information that gives the possibility of drawing conclusions in taking action. Based on the results of the study, it was shown that 67.5% of elementary schools did not have laboratories. occurred as many as 64.7% of respondents said there was no laboratory. 95.5% of respondents stated that they continued to carry out practicums with various obstacles, the first obstacle was 60.9% stated time constraints, 58.7% stated a lack of tools and materials, and 52.2% stated that there was no laboratory, namely a collection of structured information that gives the possibility of drawing conclusions in taking action. Based on the results of the study, it was shown that 67.5% of elementary schools did not have laboratories. occurred as many as 64.7% of respondents said there was no laboratory. 95.5% of respondents stated that they continued to carry out practicums with various obstacles, the first obstacle was 60.9% stated time constraints, 58.7% stated a lack of tools and materials, and 52.2% stated that there was no laboratory, namely a collection of structured information that gives the possibility of drawing conclusions in taking action. Based on the results of the study, it was shown that 67.5% of elementary schools did not have laboratories. occurred as many as 64.7% of respondents said there was no laboratory. 95.5% of respondents stated that they continued to carry out practicums with various obstacles, the first obstacle was 60.9% stated time constraints, 58.7% stated a lack of tools and materials, and 52.2% stated that there was no laboratory,

**Keywords:** Scientific Work, Elementary Science Learning, real laboratory,.

## 1 Introduction

Natural science is a part of knowledge related to facts, concepts, principles and laws as well as natural phenomena which are obtained from the results of thought and experimentation using scientific methods and attitudes. Natural Science is defined as knowledge obtained through data collection by experiment, observation, and deduction to produce an explanation of a phenomenon that can be proven.

In essence, IPA consists of three dimensions, namely the process dimension, the attitude dimension and the product dimension. Realizing the product dimension requires science process skills. In elementary science learning, science process skills are needed. This is because in its application, learning is centered on students to find concepts independently and meaningfully. Gagne in [1] states that by developing science process skills students will become more creative and able to understand science concepts in a shorter time. In its application, teachers should be able to cultivate process skills according to the stage of development of children's thinking.

Scientific work activities aim to prove concepts, facts, principles, laws using the scientific method. With scientific work activities, it is hoped that students will be able to construct scientific knowledge, attitudes and values through direct experience. So that students will be trained to find concepts independently, thoroughly, meaningfully, authentically, actively and have an impact on increasing student learning achievement.

In line with the theory put forward by Constructivism comes from the word to construct which means to build or compose. According to Von Glasersfeld [2] constructivism is a philosophy of knowledge which emphasizes that our knowledge is our own construction (formation). Knowledge is formed by the structure of one's conception when interacting with the environment. To construct knowledge in practicum activities in elementary science learning, laboratory facilities are needed. This is in line with Machperson's opinion, For practical and experimental purposes in the fields of natural science, chemistry and biology, a special place is needed in the form of a laboratory. In the laboratory, students get learning experience through interaction with raw materials according to Reigeluth. In learning activities, students are directly involved starting from determining learning goals, preparing materials and practical procedures, doing it themselves, seeing the results, recording, analyzing, and making conclusions. Learning activities in the laboratory/practice place can increase the desire of students to do various experiments to acquire new knowledge.

The science laboratory is a place for teachers and students to carry out scientific activities in the context of learning science. A science laboratory must meet technical requirements as well as management requirements. Technical requirements consist of requirements for facilities and infrastructure, including building and facility layout, equipment and materials, and personnel. Meanwhile, management (governance) requirements cover various aspects such as organizational structure, quality systems, documentation, administration, as well as monitoring and evaluation systems. The role of the science laboratory in learning is to grow and develop skills in observation, measurement and collection, the ability to compile data and analyze and interpret the results of observations, the ability to draw conclusions logically based on experimental results,

The science laboratory has a function to support the achievement of learning objectives in schools, so that the quality of the results is increasing. The science laboratory is functioned to provide reinforcement in order to enrich and deepen students' understanding of basic science concepts. Besides that, it is also to describe abstract science concepts, develop science concepts and principles, develop science process skills, as an educational tool for training, build and develop curiosity about the natural environment.

In line with the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, it defines that learning is a process of interaction between students and educators and learning resources in a learning environment. To realize a good learning interaction, of course, it must be supported by several components, one of which is the laboratory. This is also supported by the regulation of the minister of national education number 24 of 2007 dated 28 June 2007 that a science laboratory is one of the infrastructure provisions that must be owned by elementary schools.

However, conditions in the field show that there are still many schools that do not have laboratories. Based on Pustadin (Ministry of Education and Culture Data and Information Center) 2019 data contained in the Ministry of Education and Culture's strategic plan for 2020-2024 that the percentage of laboratory shortages reaches 62.7% on average nationally. For the existence of elementary school laboratories, based on the 2020 basic education data (Ministry of Education and Culture's DitPSD Strategic Plan), of the 149,046 elementary schools in Indonesia, only 11,291 elementary schools have science laboratories. This means that only 7.6% of elementary schools have science laboratories.

Based on several findings from literature studies related to the not yet optimal scientific work activities in elementary schools and related to the existence of laboratories that are still not available in schools, this is an effort to introduce and train the critical thinking skills needed in scientific work activities. So that researchers conducted research with the title "Analysis of Laboratory Use in Doing Scientific Work in Elementary Schools"

## 2 Methods

This study applies a qualitative research approach, in which qualitative research is carried out to develop knowledge through understanding and discovery. The main objective of this study is to describe in depth the results of the analysisThe use of laboratories in carrying out scientific work in elementary schools in an effort to foster critical thinking skills.

If so, how far is the use of laboratories in carrying out scientific work in elementary schools in an effort to foster these critical thinking skills in elementary schools? The results of the research can be used as a reference for carrying out further research in the development of real laboratory alternatives.

The research subjects were carried out in 46 elementary schools in the Surabaya area. The data sources for this action research include students, teachers, learning outcomes documents, and the learning process.

Data collection technique. The data collection technique is carried out in the following way: Interview methods are carried out with teachers and students who carry out learning. Interviews in this study were conducted to determine the extent to which teachers and students understand learning with the use of laboratories in carrying out scientific work in elementary schools in an effort to foster these critical thinking skills in elementary schools along with the obstacles experienced by teachers and students.

The Observational Method is a way of collecting data by direct observation and systematic recording of the object to be studied. In this study, researchers will observe teachers and students during the learning process. Analyzing how the application of learning with the use of laboratories in carrying out scientific work in elementary schools

Documentation is a document that can be in the form of learning tools used in learning, photos or videos in carrying out research activities, analysis of laboratory use in carrying out scientific work in elementary schools

Data analysis technique. Data Analysis Techniques are the process of arranging data sequences, organizing them into a pattern, category and description unit so that they can be found and can formulate research results. In this study, data analysis was carried out irrationally from start to finish, both in the field and outside the field using the techniques discovered by Miles and Huberman.

Data reduction, namely making abstractions of all data obtained from all field notes from observations, interviews and document reviews. Data reduction is a form of data analysis that sharpens, expects important things, classifies directs, discards unnecessary and organizes data so that it is systematic and can make a meaningful conclusion. So, the data obtained through observation, interviews and document review is collected, selected.

Presentation of data, namely a collection of structured information that gives the possibility of drawing conclusions in taking action. The process of presenting this data reveals the whole set of data obtained so that it is easy to read and understand, which is most often used for presenting data in qualitative research, namely in the form of narrative text. Conclusion and verification Data that has been arranged in such a way (first patterned, then focused, and finally data systematically arranged) are then concluded so that the meaning of the data can be found.

After obtaining the necessary data, an in-depth description of the results of the analysis can be described the use of laboratories in carrying out scientific work in elementary schools in an effort to foster critical thinking skills. has it been applied or not? If so, how far is the application of scientific work in the laboratory in elementary schools. Then the results of this research can be used as a reference for carrying out further research in the development of laboratories in elementary schools.

### **3 Findings and Discussion**

This research was conducted using 3 methods, the first was by using online interviews and the third was conducting observations and interviews directly at the school and the third was using Googleform filling with the aim of reaching samples that could not be

done offline. Retrieval of data using a zoom meeting by providing the same questions as those on Googleform. The following results were obtained regarding the existence of laboratories in elementary schools:

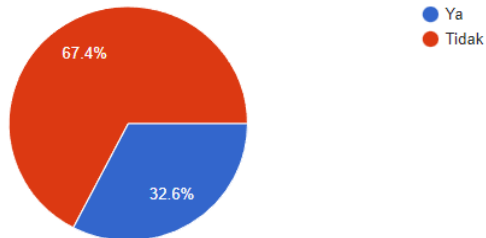


Diagram 1. Availability of Science Laboratory in elementary schools

Based on the results of diagram 1, one of them is the first related aspect existence elementary schools that still do not have laboratories. Based on the results of the study, it was shown that 64.7% of elementary schools did not have laboratories. From the results of observations in two private schools, one school has a laboratory with its own room. After conducting in-depth interviews regarding the existence of the laboratory, the results obtained were that the function of the laboratory was not optimal, there was no schedule for the use of the laboratory and even the laboratory room was used for various activities. Laboratory equipment is still limited and a lot of equipment is damaged. The laboratory room is also used for other activities. So it is not purely used for scientific activities. There is no specific schedule for scientific work activities. Meanwhile, the second private school, which does not have a real laboratory, uses classrooms to carry out scientific work activities. In addition, sometimes they also take advantage of the field and yard in doing scientific work. Tools and materials are placed in a special cupboard in the teacher's room.

In essence, learning science is essentially developing science process skills, thus basic skills such as making observations, formulating problems and hypotheses, designing and carrying out experiments, collecting and analyzing data are part of science learning activities. The science laboratory is a place for the development of these science process skills. Given the importance of the role and function of the laboratory to develop various skills in students, the existence of a laboratory is an absolute thing.

In order to construct knowledge in practicum activities in elementary school science learning, laboratory facilities are needed. This is in line with Machperson's opinion, For practical and experimental purposes in the field of natural science studies, a special place is needed in the form of a laboratory. In the laboratory, students get learning experience through interactions with raw or raw materials according to Reigeluth. In learning activities students are directly involved starting from setting learning goals, preparing materials and practical procedures, doing it themselves, seeing the results, recording, analyzing, and making conclusions. Learning activities in the

laboratory/practice place can increase students' desire to carry out various experiments. to acquire new knowledge.

Likewise the results obtained when conducting interviews at 2 public elementary schools in the Surabaya area. The two schools do not have science laboratories. There are very few tools and materials and they are placed in a special cupboard together with sports equipment. However, these limitations do not prevent the school, be it teachers or students, from carrying out scientific work activities. The school continues to carry out scientific work even though there are several obstacles as outlined in diagram 2 below:

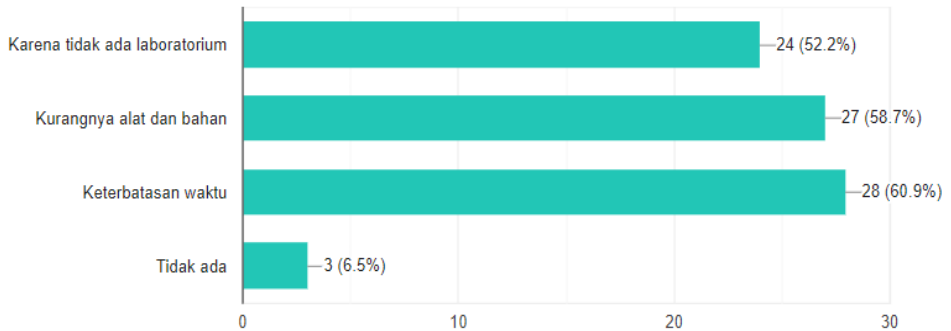


Diagram 2. Obstacles faced when carrying out scientific work activities

Based on the results of observations, it was found that real laboratories in elementary schools could not be said to be 100% ready, because out of 46 schools, only 64.5% of schools had laboratories. 95.5% of respondents stated that they continued to carry out practicums with various obstacles, the first obstacle was 60.9% stated time constraints, 58.7% stated a lack of tools and materials, and 52.2%. Thus, science learning at the elementary school level is oriented towards achieving science in terms of products, processes and scientific attitudes. In terms of products, students are expected to be able to understand scientific concepts in the form of facts, concepts, principles, laws and theories and their relation to everyday life; process, students are expected to have the ability in the process to develop knowledge, ideas, and apply the concepts they have acquired to explain problems and solve problems in everyday life; In terms of attitudes and values, students are expected to have an interest in learning about objects in their environment, to be curious, diligent, critical, introspective, responsible, able to work together and independently, and to cultivate a love for the natural surroundings.

Based on the expert's opinion, it can be concluded that science learning is an interaction that occurs between teachers and students to achieve learning objectives through an active process of finding knowledge. Science learning should provide student experiences, in the form of important ways to process and gain knowledge through the percentage that is obtained is very small. Even some schools in carrying out scientific work are very minimal, the results obtained are as follows:

46 responses

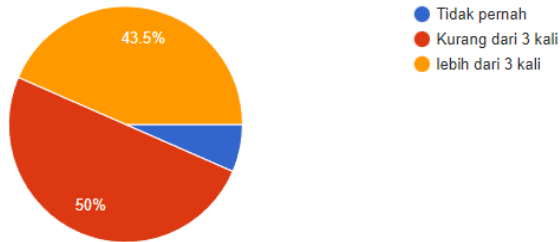
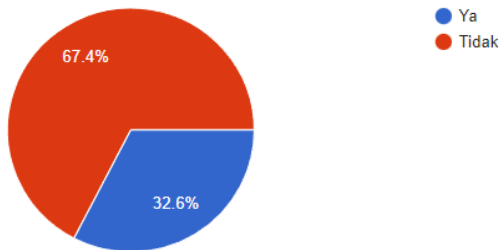


Diagram 3. Percentage of schools in carrying out scientific work activities for 1 semester

46 responses



Based on the data from diagram 3, it shows that there is very little scientific work to do. As many as 16.5% of schools have never done scientific work at all. Then 43.5% carried out more than 3 times and 50% carried out less than 3 times in one semester. From these data it can be seen that scientific work activities are still lacking. According to Prihanto Laksmi, science education in schools has the objectives of a) giving students knowledge about the world and how to behave; b) instill a scientific attitude to life; c) provide skills to make observations; d) educate students to know how to work and appreciate inventors; and e) apply the scientific method in solving problems.

The science learning process should bring students to learn to observe and conduct experiments as well as cultivate a scientific attitude to life. The same opinion was expressed by Cullingford, that in science learning children must be given the opportunity to develop an attitude of curiosity and various logical explanations. Students do not just know without understanding the process of theory can be formed. In the end, students not only memorize knowledge but can understand.

From the interview results, the researchers' observations tried to provide an alternative in carrying out scientific work by using a virtual laboratory. Researchers

tried to ask about virtual laboratory, it turned out that the results obtained were as follows:

46 responses

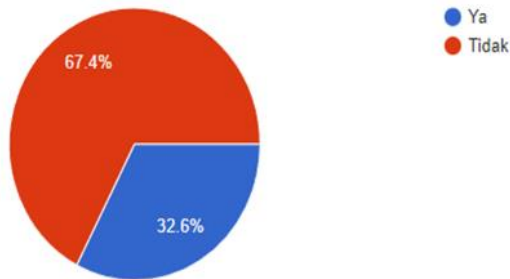


Diagram 4. Percentage of knowledge related to science virtual laboratory

46 responses

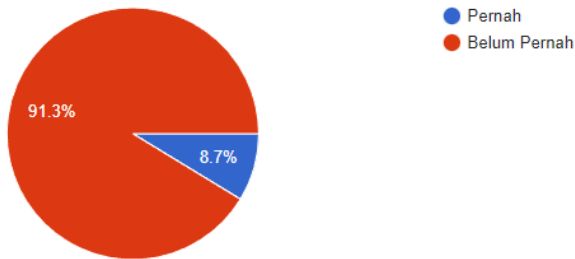


Diagram 5. Implementation of science virtual laboratory

Based on the results obtained, 67.4% of teachers were not aware of a virtual science laboratory and as much as 91.3% had never used a virtual laboratory at all. There are many obstacles related to laboratory limitations, so a solution is needed to deal with this, one of which is related to the existence of a science virtual laboratory.

#### 4 Conclusion

Scientific work activities aim to prove concepts, facts, principles, laws using the scientific method. With scientific work activities, it is hoped that students will be able to construct scientific knowledge, attitudes and values through direct experience. So that



students will be trained to find concepts independently, thoroughly, meaningfully, authentically, actively and have an impact on increasing student learning achievement.

## 5 Suggestions

With this research, it is hoped that there will be a solution to laboratory limitations, namely with a science virtual laboratory, so that scientific work activities can still be carried out properly and are able to foster an understanding of science concepts.

## References

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