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The Inquiry Skills of Teachers in Elementary School

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ABSTRAK

Keterampilan inkuiri adalah keterampilan yang penting dimiliki oleh seorang guru. Tujuan penelitian ini adalah untuk menganalisis keterampilan inkuiri yang dimiliki oleh guru sekolah dasar. Penelitian ini menggunakan metode deskriptif kuantitatif dengan desain survei. Partisipan dalam penelitian ini berjumlah 49 orang guru. Pengumpulan data dilakukan dengan menggunakan instrumen tes yang diberikan kepada partisipan dan wawancara mengenai pemahaman mereka mengenai pembelajaran berbasis inkuiri. Kemudian jawaban tersebut dianalisis dan diklasifikasi. Hasil penelitian menunjukan bahwa keterampilan inkuiri guru perlu ditingkatkan karena dari empat kelompok keterampilan inkuiri baik itu mengkonsepsi dan merencanakan desain, implementasi, analisis dan interpretasi, serta mengkomunikasikan semuanya berada pada kategori "lemah" hal ini ditunjukkan dengan persentase rata-rata responden pada setiap kelompok dibawah 50%. Mayoritas responden bukan berlatar belakang pendidikan sains. Mereka juga tidak memiliki pengetahuan yang mumpuni mengenai pembelajaran berbasis inkuiri apalagi dalam menggunakannya dalam proses pembelajaran. Namun, mereka sepakat bahwa keterampilan inkuiri merupakan keterampilan yang penting untuk dikembangkan. Oleh sebab itu, diperlukan sebuah program perkuliahan yang dapat memfasilitasi guru SD untuk dapat mengembangkan keterampilan inkuirinya agar pembelajaran sains di SD dapat menjadi lebih optimal lagi.

ABSTRACT

Inquiry skills are important skills possessed by a teacher. This study aims to analyze the inquiry skills of elementary school teachers and analyze the need for developing these skills in the lecture process in the elementary school teacher. This study uses a quantitative descriptive method with a survey design. Participants in this study amounted to 49 teachers. Data was collected using test instruments given to participants and interviews about their understanding of inquiry-based learning. Then the answers are analyzed and classified. The results showed that the teacher's inquiry skills needed to be improved because of the four groups of inquiry skills, both conceptualizing and planning design, implementation, analysis and interpretation, and communicating all were in the "weak" category, this was indicated by the average percentage of respondents in each group below 50%. The majority of respondents do not have a science education background. They also do not have sufficient knowledge about inquiry-based learning, especially in using it in the learning process. However, they agree that inquiry skills are important skills to be developed for students. Therefore, we need a lecture program that can facilitate elementary school teachers to be able to develop their inquiry skills so that science learning in elementary schools can be even more optimal.

1. INTRODUCTION

Science as the inquiry has been a reform in science education for decades (Constantinou et al., 2018; National-Research-Council, 2013, 2014). In learning science, students need to develop skills in acquiring scientific knowledge by using high-level reasoning to apply their understanding of scientific ideas and communicate scientific information (Berland et al., 2016; Jerrim et al., 2020; Setiawan & Sugiyanto, 2020). Getting students involved in scientific inquiry and developing science inquiry skills in the context of science learning is one of the most important goals of science education (National-Research-Council, 2013;

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Stender et al., 2018). Science learning will be optimally carried out if it has the following 3 (three) things: 1) the teacher must understand the inquiry itself (St. Pierre, 2019); 2) students should have been allowed to practice their skills (Marshall et al., 2017); and 3) students must understand their progress in achieving these skills (Cairns & Areepattamannil, 2019; Cartwright & Hallar, 2018). Based on this explanation, one of the primary keys is that teachers need to understand inquiry skills so that they are expected to be able to provide an optimal science learning process. Two main things result from science lessons, namely process and product. The process is related to the skills possessed by students. At the same time, the product is related to knowledge from the science itself, such as concepts, principles, procedures, and evidence that can be demonstrated (Hardianti & Kuswanto, 2017; Khalaf & Zin, 2018). In addition, the government in Indonesia recommends that the science learning process uses a scientific approach (Anam, 2020). However, in reality, teachers experience problems in carrying out the suggested learning process (Saepuzaman et al., 2019; Widowati et al., 2017).

One of the teacher's difficulties is presenting scientific phenomena to make observations and generate inquiry questions. This difficulty will be followed by further difficulties such as designing investigations which are part of inquiry skills. Some of the things that cause the lack of success of teachers in inquiry are that universities have not provided sufficient provisions so that teachers can conduct an inquiry. Teachers view that the inquiry process is part of learning. Usually, teachers are too confident in the inquiry process they build (Lotter et al., 2018; Pursitasari et al., 2020). Science learning needs to develop various vital skills in inquiry, including conceptualizing and planning designs, implementing, analyzing and interpreting, and communicating (Duncan et al., 2018; Ješková et al., 2018). In the inquiry learning process, teachers need to have qualified inquiry skills to develop the expected skills (Anam, 2020). Thus, Inquiry-based learning can improve students' thinking skills (Dobber et al., 2017). In addition, research conducted by previous researcher shows that inquiry-based learning can increase creativity and positively contribute to student learning outcomes (Rodríguez et al., 2019). Further, other study also state that inquiry serves as a necessary debriefing for science teachers to build student independence in constructing new knowledge (Donohue et al., 2020; Lederman & Lederman, 2019). These inquiry skills need to be developed for students starting in elementary school. Based on an explanation of inquiry-based learning and the development of inquiry skills. This study aims to analyze an overview of the inquiry skills possessed by elementary school teachers. The picture obtained serves to see how they learn when they go to school. Whether the learning process carried out has developed inquiry skills or not. In addition, the results of this study will be an input to improve the lecture process in the future, which should be done to develop elementary school teachers' inquiry skills.

2. METHOD

The research method used in this study is a quantitative method through a survey design used (Braun et al., 2021). The goal is to describe how elementary school teachers' inquiry skills and analyze the need for developing inquiry skills in the lecture process. The number of Respondent in this study was 49 teachers studying at the Open University Elementary School Teacher Education study program. The research process was carried out by distributing the instruments online and then conducting an interview regarding their understanding of inquiry learning.. The research instrument used in this study is the development of the inquiry instrument (Ješková et al., 2018), consisting of four skill groups and sub-skills and question indicators. An explanation of the skill groups, sub-skills, and question indicators on the instrument can be seen in Table 1.

Table 1. Skill Groups, Sub-Skills, and Inquiry Skills Question Indicators

Skill Group	Sub-Skills	Question Indicators
Concepting and planning designs	Defining the problem	Can formulate problems from practical activities to be carried out
	Formulating a hypothesis	Can determine hypotheses from experiments that will or have been carried out
	Designing variables and relationships between variables and the experimental process	Can design experimental or research plans to prove a certain phenomenon
	Predicting experimental results	Can predict from plans and results from experiments/research conducted based on existing patterns or explanations

Skill Group	Sub-Skills	Question Indicators
Implementation	Determine what is measured, observed and recorded	Can determine what is measured, observed, and recorded from the experiment/research that will be carried out
	Processing and analyzing data	Can process and analyze the data presented based on the experiments that have been done
Analysis and Interpretation	Change the data representation in the form of graphs/diagrams and tables	Can change the form of representation in one form to another
	Making generalizations from experimental results	Can make generalizations from research data
	Making conclusions	Can make conclusions based on phenomena and experimental data
Communicating	Outlining a formal report on the results obtained	Can describe a formal report on the results of experiments or research obtained

Two experts have validated the instrument used in this research with doctoral degrees in science education. Based on the results of expert validation through Kendall's Tau calculations, it has a value of 0.853 or is included in the "very high" category, while for the reliability of this instrument based on Cronbach's Alpha calculations, a value of 0.739 is obtained or is included in the "high" category. After the validation and reliability process is obtained, this instrument is given to the respondents. In this study, respondents will be given a score of zero if they give an incorrect answer and one if they are correct. The results obtained from these respondents will then be averaged and converted into percent. The percentage results will then be classified on the interpretation (Anam, 2020). The interpretation of the classification can be seen in Table 2.

Table 2. Interpretation of Value or Percentage of Participants Test

Range	Category
80-100	Very Good
70-79	Good
60-69	Enough
40-59	Less
30-39	Very Less

After providing the instrument of inquiry skills, this research was also continued by conducting interviews with the respondents to get an idea of their understanding of the inquiry learning. This interview is used to determine the science learning process they do in class. Several questions related to the given instrument is shown in Table 3.

Table 3. Questions About Inquiry Learning

No	Questions
1.	Educational background comes from science
2.	Understanding of inquiry-based learning
3.	Using inquiry-based learning in the classroom
4.	Inquiry skills are important for student

3. RESULT AND DISCUSSION

Result

In this section, the results of the research and discussion will consist of two main points: 1) the inquiry skills of the respondents; and 2) respondents' responses about inquiry-based learning.

The Inquiry Skills of The Respondents

Based on the study results, it was found that the inquiry skills based on the distributed instruments showed that the inquiry skills needed to be further developed. Of the four skill groups tested, the average skill is below 50% or falls into the less category. The results of the skills of the respondents is shown in Figure 1.

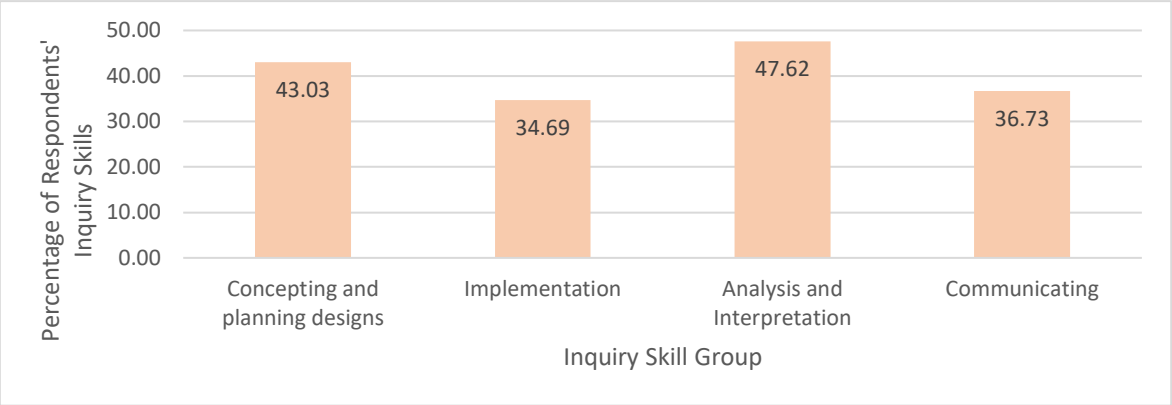

Figure 1. Percentage of Inquiry Skills by Inquiry Skill Group

Based on Figure 1, it can be seen that, in general, Inquiry skills in each Inquiry skill group still need to be developed. All four are below 50%, even though this skill is a provision to become a teacher to provide optimal science learning for students. Complete result about inquiry skills is shown in Table 4.

Table 4. Inquiry Skill Results for each Sub-Indicator

Skill Group	Sub-Indicator	Percentage
Concepting and planning designs	Defining the problem	18,37
	Formulating a hypothesis	44,90
	Designing variables and relationships between variables and the experimental process	83,67
Implementation	Predicting experimental results	40,14
	Determine what is measured, observed and recorded	41,50
	Processing and analyzing data	27,89
Analysis and Interpretation	Change the data representation in the form of graphs/diagrams and tables	41,50
	Making generalizations from experimental results	49,66
	Making conclusions	51,70
Communicating	Outlining a formal report on the results obtained	36,73

Table 4 shows that in almost every sub-indicator, the results obtained from respondents are still far from what was expected. All percentages below 50% indicate that inquiry skills need to be a subject of future attention because inquiry skills are needed to guide students to develop thinking skills, scientific work, and communication skills as aspects of life skills (Anazifa & Djukri, 2017; Hermens et al., 2017).

Inquiry skill is a skill that directs individuals/students to be able to think logically, systematically, and scientifically (Duruk et al., 2017). The process of learning science will be meaningful if the learning process should be adapted to the nature of science, meaning learning science is not only through a collection of facts, principles, laws, and theories but also involves the process of what kind of knowledge is obtained (Candra & Retnawati, 2020; Karmila et al., 2019). Furthermore inquiry is a process to obtain information by conducting observations or experiments to find answers or problem solving thinking critically and logically (Duncan et al., 2018; Gunawan et al., 2019).

Respondents' Responses about Inquiry-Based Learning

Based on the results of interviews conducted with respondents regarding their understanding of inquiry learning, there are four main points, namely 1) educational background comes from science; 2) understanding of inquiry-based learning; 3) using inquiry-based learning in the learning process, and 4) should inquiry skills be taught to students. The results of interviews with respondents can be seen in Figure 2.

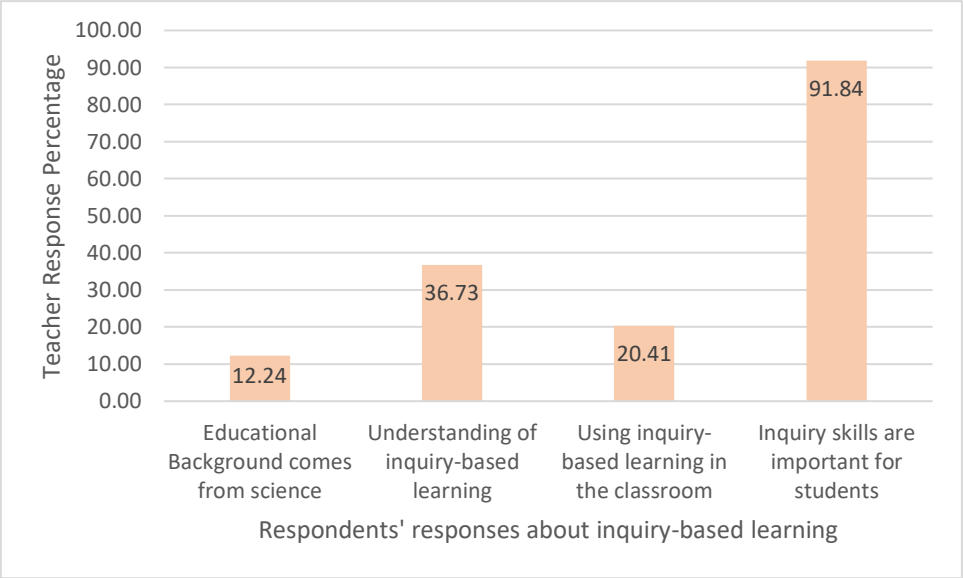

Figure 2. Respondents' Responses about Inquiry-Based Learning

Figure 2 shows that most of the respondents' educational background is non-science, and only 12.24% have a science education background. However, formal science education in Indonesia starts from elementary to middle school, both junior and senior. Each respondent has received science lessons for at least six years, namely in elementary and junior high schools. This shows that inquiry skills have not become a concern in this learning process following to the opinion. Inquiry skills possessed by students will not develop optimally if they are carried out using teaching and learning methods that are not inquiry-based or supportive (Kazeni et al., 2018). Students to develop their inquiry skills.

In addition, respondents' understanding of inquiry-based learning has not been fully understood. This is evidenced by the number of respondents who understand only 36.73%; the rest stated they were not very familiar with inquiry-based learning. This could also be due to their non-science education background and learning experiences not facilitated with optimal inquiry skills. Students must be taught to acquire more complex skills than just learning science products of science (Akgün et al., 2016; Duruk et al., 2017). The next is related to whether the respondents have used inquiry-based learning. The majority of them answered that they had never used inquiry-based learning. Based on their explanations, they are accustomed to carrying out a teacher-centered learning process so that the achievement of learning materials can be delivered more quickly. At the same time, science learning is a lesson that is expected to equip students with scientific knowledge and gain experience that can develop scientific and inquiry skills (Abdurrahman et al., 2019; Tawil & Liliasari, 2014).

Discussion

The development of process skills in the learning process can also increase social interaction between students. Besides that, it can allow students to carry out hands-on activities, encourage them to develop problem-solving skills, help cognitive growth, improve attitudes towards science, and help students build mental images of new ideas (Karmila et al., 2019; Song, 2018). Therefore, to produce a learning process that develops inquiry skills, teachers need first to have these skills. Based on the interviews conducted, the teacher also agreed that inquiry skills are important skills to be developed for students. Material from science lessons is a means to develop inquiry skills in students (Darmaji et al., 2019). Science learning will be optimal if students get experience in the learning process so that they can construct their knowledge from the learning process carried out, especially since science is a lesson that is contextual to their lives (Akgün et al., 2016; Duruk et al., 2017; Herder et al., 2018). Teachers are expected to instill these science process skills in students; therefore, the teacher's conceptual understanding of these skills is essential. Science material taught in science class should be used to develop SPS (Anam, 2022; Irwanto et al., 2018). Pre-service elementary school teachers should be equipped with basic SPS to facilitate the development of these skills to an integrated level. Ensuring that students enhance their research, inquiry, and critical thinking skills and become lifelong learners is a priority among science teaching goals. According to SPS, they are significant in training students who have these characteristics. SPS is considered a decisive and inseparable part of science education (Duruk et al., 2017; Juhji & Nuangchalerm, 2020). In essence, SPS are thinking skills that scientists use to construct knowledge, solve and evaluate problems, and

formulate results. Also, students use the skills they have to organize scientific information, to enable them to process new information through real-life experiences, and to help them understand the nature of science (Akgün et al., 2016; Duruk et al., 2017; Song, 2018).

If science lessons are carried out optimally at school, for example, through experimenting in the learning process, this ability can develop. Because through the process of experimentation, inquiry skills will be honed through how they conduct an inquiry. Therefore, the learning process that develops inquiry skills must be introduced early because these skills play a role in solving various problems in their lives (Constantinou et al., 2018; Khalaf & Zin, 2018). In addition, inquiry skills and knowledge content will complement each other; therefore, teachers and prospective teachers must have the knowledge and understanding that students need to be able to develop these skills (Dobber et al., 2017). Based on previous study that analyse the use of inquiry model with virtual labs to improve students' understanding. This study found that, teachers can plan good inquiry learning, students will be able to improve their inquiry skills (Gunawan et al., 2019). In addition, there is also a significant positive relationship between inquiry skills on the content of science material and the ability to make inquiry-based learning (Guo et al., 2018; Ryoo & Bedell, 2017). In line with this explanation, previous researcher stated that inquiry-based teaching skills improve teachers' teaching abilities. When teachers teach in front of the class, the teacher also learns indirectly (Ješková et al., 2018). This research shows that prospective teachers need to be equipped with inquiry skills in the lecture process so that the learning process they provide to students will achieve the most optimal results. Because in the lecture process, it is necessary to learn about knowledge from science, and more than that, they must also have inquiry skills. Inquiry skills are skills that students need to have to face their lives in the future. In this skill, students are given the skills to conceptualize and plan research/experiment designs, implement their knowledge, analyze and interpret data, and communicate what they get from others.

4. CONCLUSION

Based on this research, it was found that the inquiry skills of teachers need to be improved, this is evidenced by the four inquiry skills tested starting from conceptualizing and planning design, implementation, analysis, and interpretation, as well as communicating everything is in the "less" category, this is indicated by the average percentage of respondents in each group is below 50%. Therefore, the lecture program needs to facilitate pre-service teachers to develop their inquiry skills so that science learning in elementary schools can be even more optimal. This inquiry skill is needed not only when students study science but more than that they need these skills to solve their problems in their lives.

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