

Application of the Nature of Science in Elementary Science Learning During the Covid-19 Pandemic

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Abstract. This study aimed to analyze the application of the nature of science in high-grade elementary science learning and the obstacles faced by teachers and students during the Covid-19 pandemic. This study used a qualitative descriptive method to provide an overview of the application of the nature of science in elementary science learning during the Covid-19 pandemic. The subjects in this study comprised of 41 teachers and 127 high-grade students from various regions in Indonesia. The instrument used in this study was a questionnaire containing 29 statement items for teachers and 21 statement items for students with four answer choices namely always, often, sometimes, and never based on three indicators, namely (1) Science Product, (2) Science Process, (3) Science Attitude. Based on the results of the analysis, it is shown that the indicators of science product and science attitude have the highest percentages chosen by students with answers of always; meanwhile, the science process indicator has the highest percentages chosen by students and teachers for answer of sometimes. Therefore, it can be concluded that elementary science learning in high-grade during the Covid-19 pandemic did not run optimally due to the lack of application of the nature of science, especially the science process.

Keywords: The Nature of Science, Elementary Science Learning, High grade, Learning Obstacles, Covid-19 Pandemic

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INTRODUCTION ~ Natural Sciences Learning is one of the lessons related to how to find out about natural phenomena systematically, so that science is not only about mastering a collection of knowledge in the form of facts, concepts, or principles but also is a process of discovery. Science learning directs students to find out and act, so that students can gain a deeper understanding of the surroundings (Kemendikbud, 2014). The essence of learning science is not only remembering and understanding concepts discovered by scientists. Science learning places more emphasis on providing direct learning experiences, so

that students can understand the surroundings scientifically.

Nature of Science (NOS) can be interpreted as the epistemology of science as a way to acquire knowledge or values and beliefs inherent in the development of science or in scientific knowledge (Putri, D.S., et al, 2021). Nature of science is so important to both students and teachers because it can provide benefits, such as having an important and detailed background on how science and scientists work and how scientific knowledge is created, validated, and influenced; have an accurate view of what science is, the types of questions

science can answer, how science differs from other disciplines, the strengths and limitations of scientific knowledge; and also can recognize and reject scientific product claims when encountered in everyday life (Adi & Widodo, 2018).

The nature of science learning in elementary schools is expected to be a vehicle for students to be able to learn about themselves and the natural environment around them so that they can be useful and applied in students' daily lives (Rini, 2018). The process of science learning activities emphasizes providing direct experience to students in order to develop their potential and also gain a deeper understanding of the natural environment around students (Azizah, 2018).

The nature of science can also be interpreted as a knowledge of how science can work (Listiani & Kusuma, 2017). Students' and teachers' understanding of the nature of science is an important part of helping in learning. However, in reality in the field, elementary science learning is often done conventionally in which learning is still teacher-centered, students listen, take notes, and students memorize afterwards. On the other hand, Indonesia, according to the results of the 2018 Program for International Student Assessment (PISA) study, ranks 74th out of 79 PISA member countries. In this survey, there are three student abilities assessed, namely math skill, reading skill, and scientific skills (science). This shows that the thinking ability of Indonesian students is still in the low category. One of the reasons for the low thinking ability of Indonesian students is the learning process that has not developed the

aspects tested in the comparative study test. In fact, in the field of learning is still conventional or learning that is dominated using the lecture method (Sopandi, W., dkk., 2019).

The nature of science generally contains components of scientific product (scientific knowledge), scientific process (scientific method) and scientific attitude (Widodo, 2021). One of the ways to gain knowledge of science is by reading books because basically the content of science textbooks is actually the product of thoughts and findings of experts, including facts, concepts, generalizations, laws, and theories that have an equally important position in science. Thus, studying textbooks or other science textbooks is essentially studying the products of the work of scientists, because every information we read from textbooks is the product of the thoughts and research of previous scientists.

Knowledge of the work of scientists has several properties, including scientific knowledge is tentative, subjective, and empirical. Tentative means that the truth of science is not absolute, so that knowledge can change, improve, or be wrong so that it is left behind. Subjective means that science has an influence from the subject side; in this case the researcher. Empirical means that science knowledge is generally based on empirical evidence from observations or experiments and scientific reasoning (Widodo, 2021).

Science has a knowledge development method called scientific method, which includes formulating research questions, planning investigations, carrying out investigations, analyzing data, making conclusions, and communicating results.

However, the scientific method is not the only way to gain scientific knowledge. One of the things that teachers can pay attention on planning and implementing a learning process is to innovate in the learning process. There are various ways that teachers can do in carrying out learning innovations, one of which is by using innovative learning models that can develop various abilities and skills needed by students (Sujana, A., 2018).

In science learning, there are certain attitudes that must be owned by everyone who learns science. This attitude is called the scientific attitude. These scientific attitudes include curiosity, honesty, unyielding, open, critical, and able to work together (Widodo, 2021). Scientific attitude in learning is needed by students because it can motivate their learning activities. Through a scientific attitude, students have an idea of how they should behave in learning, dealing with and solving a problem, carrying out a task, and developing themselves. This of course will affect the results of student learning activities positively. By instilling a scientific attitude in learning students will be able to learn to understand and discover (Dewi, P. S., 2016).

However, at the end of 2019, all citizens of the world were shocked by the presence of a dangerous virus and its transmission was tremendously fast, namely the Corona virus (Covid-19). This virus first appeared in Wuhan, China. This virus is extremely easy to transmit and spread from one human to another. To prevent the transmission of the virus, various activity restrictions have been carried out, including the closure of all educational institutions (Handayani, 2021). Since then, on March 24, 2020,

learning that is usually done in schools has been stopped and learning is carried out online. Learning in this network aims to increase the level of efficiency and effectiveness in the learning process (Popa, et al., 2020).

Definitely, there are many challenges in distance learning during the Covid-19 pandemic. According to one study, online learning has a negative side, namely that it can interfere with educational progress caused by inequality. Students with limited resources will have less parental support and risk being left behind, widening pre-existing gaps. Meanwhile, in school, students can share the same space, lessons, teachers, and resources, which can increase opportunities to some extent (Thomas, 2020). In other research results, it is shown that this learning is absolutely helpful to restore learning gaps during the Covid-19 pandemic. Based on the problems aforementioned, a research was conducted on the description of the online science learning process during the COVID-19 pandemic (Biswas, et al., 2020). This study aimed to analyze the application of the nature of science in high-grade elementary science learning and the obstacles faced by teachers and students in high-grade elementary science learning.

METHOD

This used descriptive qualitative research. This research used survey method. The survey method was used to obtain data regarding the application of the nature of science in high grade elementary science learning and the obstacles faced by teachers and students in high grade elementary science learning during the covid-19 pandemic.

The data collection technique used an online questionnaire by utilizing the google form application regarding the application of the nature of science in high grade elementary science learning. The questionnaire contains 29 statement items for teachers and 21 statement items for students.

The subjects in this study were 41 high school elementary school teachers consisting of 19.5% fourth grade teachers, 43.9% fifth grade teachers and 36.6% sixth grade teachers and 127 high grade elementary school students consisting of 22% fourth grade students, 26% of the fifth grade students and 52% of the sixth grade students from various regions in Indonesia, including Asahan, Bandar Lampung, Badung, Jakarta, Sumedang, Bekasi, Situbondo, Purwakarta, Bogor, Cirebon, Bondowoso, Tapin, Cianjur, Bandung West, Palembang, and Mandailing Natal. The data were collected in research by using statement questionnaires based on 3 indicators of the nature of science, namely: (1) Science product, (2) Science process, (3) Science attitude.

The instrument was used to obtain primary data regarding the application of

the nature of science in elementary science learning during the Covid-19 pandemic. In the questionnaire. the researchers used four answer choices, namely: Always (SL), Often (SR), Sometimes (KD), and Never (TP). Due to the research being conducted during the Covid-19 pandemic, the questionnaire was distributed via Google forms.

RESULTS

The application of the nature of science in elementary science learning is known by providing a statement scale questionnaire associated with three indicators of the nature of science using four answer choices, namely, Always, Often, Sometimes, and Never.

The processing and analysis of the data obtained from the questionnaire was carried out through tabulating the data and determining the percentage of teacher and student answers. The formula for determining the percentage of students is as follows:

$$\text{Percentage (\%)} = \frac{(\text{Number of Parts})}{(\text{Total Number})} \times 100\%$$

The following is the result of percentage of teacher and student statement questionnaires.

Table 1. Percentage of Teacher Questionnaire Results Regarding the Application of the Nature of Science in Elementary Science Learning during the Covid-19 Pandemic

No	Statements	Response (%)			
		SL	SR	KD	TP
A.	Indicator: Science Product				
1.	During the Covid-19 pandemic, I, as a teacher, prepared plans for the implementation of science learning and other subjects.	61	29,3	7,3	2,4
2.	During the Covid-19 pandemic, I, as a teacher, explained in advance the science material that students would study.	70,7	17,1	12,2	0
3.	During the COVID-19 pandemic, I, as a teacher, used textbooks as a learning resource.	73,2	17,1	9,8	0

4.	During the COVID-19 pandemic, I, as a teacher, used other learning resources besides textbooks (environment, print media, electronic media).	46,3	24,4	29,3	0
5.	During the COVID-19 pandemic, I, as a teacher, followed changes in science material if there were changes.	43,9	26,8	19,5	9,8
6.	During the covid-19 pandemic, I, as a teacher, applied personal assessment or personal experience in science learning.	19,5	34,1	46,3	0
7.	During the covid-19 pandemic, I, as a teacher, taught science through the process of observation or experimentation for proof.	12,2	24,4	63,4	0
8.	During the Covid-19 pandemic, I, as a teacher, taught science by linking social and cultural circumstances.	29,3	31,7	39	0
B	Indicator: Science Process	SL	SR	KD	TP
9.	During the COVID-19 pandemic, I, as a teacher, gave students the opportunity to formulate questions during science learning.	17,1	31,7	46,3	4,9
10.	During the covid-19 pandemic, I, as a teacher, assigned students to find out the answers to the question formulation through investigation.	19,5	39	39	2,4
11.	During the COVID-19 pandemic, I, as a teacher, assigned students to analyze the results of the investigation.	14,6	19,5	63,4	2,4
12.	During the COVID-19 pandemic, I, as a teacher, assigned students to draw conclusions from the results of the investigation.	19,5	41,5	39	0
13.	During the COVID-19 pandemic, I, as a teacher, assigned students to present or communicate the results of the investigation.	14,6	34,1	46,3	4,9
14.	During the COVID-19 pandemic, I, as a teacher, used the scientific method in science learning.	12,2	22	61	4,9
C.	Indicator: Science Process	SL	SR	KD	TP
15.	During the COVID-19 pandemic, I, as a teacher, fostered student curiosity in science learning.	34,1	53,7	12,2	0
16.	During the Covid-19 pandemic, I, as a teacher, fostered students' honesty.	68,3	29,3	0	2,4
17.	During the Covid-19 pandemic, I, as a teacher, fostered an open attitude in students.	51,2	48,8	0	0
18.	During the COVID-19 pandemic, I, as a teacher, cultivate a critical attitude in students.	43,9	48,8	7,3	0
19.	During the COVID-19 pandemic, I, as a teacher, fostered students' creative attitudes.	36,6	43,9	19,5	0
20.	During the COVID-19 pandemic, I, as a teacher, fostered student collaboration.	31,7	41,5	24,4	2,4
21.	During the COVID-19 pandemic, I, as a teacher, fostered students' unyielding attitude.	43,9	53,7	2,4	0
22.	During the COVID-19 pandemic, students showed an honest attitude in learning science.	34,1	48,8	17,1	0

23.	During the COVID-19 pandemic, students showed an open attitude in science learning.	46,3	31,7	22	0
24.	During the COVID-19 pandemic, students showed a critical attitude in learning science.	43,9	36,6	17,1	2,4
25.	During the COVID-19 pandemic, students showed a creative attitude in learning science.	31,7	46,3	19,5	2,4
26.	During the COVID-19 pandemic, students showed a collaborative attitude in science learning.	29,3	39	31,7	0
27.	During the COVID-19 pandemic, students showed an unyielding attitude in learning science.	36,6	36,6	26,8	0
28.	During the Covid-19 pandemic, I, as a teacher, concluded the material at the end of the science lesson.	39	39	22	0
29	During the COVID-19 pandemic, the obstacles I faced in teaching science were:	68,3	17,1	12,2	2,4

Table 2. Percentage of Student Questionnaire Results regarding Application of the Nature of Science in Elementary Science Learning during the Covid-19 Pandemic

No	Statements	Response (%)			
		SL	SR	KD	TP
A.	Indicator: Science Product				
1.	During the COVID-19 pandemic, the teacher explained the science learning material to be studied.	55,9	16,5	23,6	3,9
2.	During the covid-19 pandemic, I understood the explanation of science material from the teacher.	41,7	26,8	27,6	3,9
3.	During the covid-19 pandemic, I used textbooks (Package Books) as a learning resource.	71,7	18,9	8,7	0,8
4.	During the covid-19 pandemic, I used other learning resources besides textbooks (environment, printed media, electronic media).	25,2	32,3	40,9	1,6
5.	During the Covid-19 pandemic, I followed changes in science material if there were changes.	43,3	26	22,8	7,9
6.	During the covid-19 pandemic, I used personal assessment or personal experience in science learning	16,5	18,9	52,8	11,8
7.	During the Covid-19 pandemic, I learned science through the process of observation or experimentation to prove it.	20,5	25,2	47,2	7,1
8.	During the COVID-19 pandemic, I studied science by linking social and cultural circumstances.	29,1	32,3	34,6	3,9
B	Indicator : Science Process				
9.	During the Covid-19 pandemic, I asked a question while studying science.	14,2	15,7	55,9	14,2

10.	During the Covid-19 pandemic, I searched for answers to questions through investigation/observation.	23,6	26,8	40,2	9,4
11.	During the Covid-19 pandemic, I explained the results of the investigation.	14,2	15,7	57,5	12,6
12.	During the Covid-19 pandemic, I made conclusions from the results of the investigation.	22	29,1	37,8	11
13.	During the Covid-19 pandemic, I presented or communicated the results of the investigation.	19,7	18,1	50,4	11,8
14.	During the Covid-19 pandemic, the teacher concluded the material at the end of the science lesson.	48	26	21,3	4,7
C.	Indicator : Science Attitude	SL	SR	KD	TP
15.	During the Covid-19 pandemic, I enjoyed finding out about science learning materials.	37	29,1	31,5	2,4
16.	During the Covid-19 pandemic, I was honest in the implementation of science learning.	58,3	26	15	0,8
17.	During the Covid-19 pandemic, I received new things in science learning.	44,9	42,5	8,7	3,9
18.	During the Covid-19 pandemic, I was able to find the right answer in science learning.	37,8	39,4	21,3	1,6
19.	During the COVID-19 pandemic, I enjoyed doing experiments in science learning.	29,1	24,4	39,4	7,1
20.	During the COVID-19 pandemic, I enjoyed collaborating with friends in science learning.	31,5	27,6	29,9	11
21.	During the covid-19 pandemic, I was excited when I learned science.	51,2	27,6	19,7	1,6

DISCUSSION

Based on the results obtained from the questionnaire that has been distributed to high-grade students and teachers via Google Forms, further discussion will be made on the Application of the Nature of Science in Elementary Science Learning during the Covid-19 Pandemic Period. In the first indicator, namely the product of science, the teacher gave a percentage value of 44.51% for the answer choice of Always (SL), 25.61% for the answer choice of Often (SR), 28.35% for the answer choice of Sometimes (KD) and 1.53% for the answer choice of Never (TP). Meanwhile, students gave a percentage value of

37.99% for the answer choice of Always (SL), 24.61% for the answer choice of Often (SR), 32.27% for the answer choice of Sometimes (KD) and 5.1% for the answer choice of Never (TP). From the acquisition of these percentages, it can be concluded that during the COVID-19 pandemic, the application of science as a product in high-grade elementary science learning can still be carried out by most respondents, both teachers and students. However, there are still respondents who have never applied science as a product in high-grade elementary science learning.

In the second indicator, namely the science process, the teacher gave a percentage value of 16.25% for the

answer choice of Always (SL), 31.3% for the answer choice of Often (SR), 49.17% for the answer choice of Sometimes (KD) and 3.25% for the answer choice of Never (TP). Meanwhile, students gave a percentage value of 23.62% for the answer choice of Always (SL), 21.9% for the answer choice of Often (SR), 40.7% for the answer choice of Sometimes (KD) and 8.65% for the answer choice of Never (TP). From this percentage gain, it can be concluded that during the COVID-19 pandemic, the application of science processes in high-grade elementary science learning was sometimes carried out by most of the respondents, both teachers and students. However, there are still respondents who have never applied the science process in high-grade elementary science learning.

In the third indicator, namely the attitude of science, the teacher gave a percentage value of 40.75% for the answer choice of Always (SL), 42.69% for the answer choice of Often (SR), 15.86% for the answer choice of Sometimes (KD) and 0.69% for the answer choice of Never (TP). Meanwhile, students gave a percentage value of 41.4% for the answer choice of Always (SL), 30.9% for the answer choice of Often (SR), 23.64% for the answer choice of Sometimes (KD) and 4.06% for the answer choice of Never (TP). From the percentages, it can be concluded that during the COVID-19 pandemic, the application of science attitude in high-grade elementary science learning can still be carried out by most respondents, both teachers and students. However, there are still respondents who have never applied science attitude in high-grade elementary science learning.

Based on the percentage results of the statements from each of the indicators above, it can be concluded that science learning in high school elementary schools is not carried out optimally so that the learning objectives cannot be achieved. Science learning, which should have three indicators of the nature of science, in fact still does not fulfill one of the indicators of the nature of science, especially on indicators of the science process. This can be seen from the small percentage value of the science process indicators as well as learning obstacles proposed by teachers and students. The scientific process is difficult to implement due to limited time and teacher guidance so that many students find it difficult to prepare experimental or observational activities. Students also feel confused and bored in the learning process because there are no teachers and friends. Not a few also argue that learning obstacles come from the limitations of learning media and the limitations of the internet network. As a result, the science process in high grade elementary science learning is difficult to apply.

The following is a quote from the teacher's answer to the statement of obstacles to learning science in elementary school:

Answer 1: "The duration of teaching time. Although now PTM (Face-to-Face Learning) has been implemented in schools, but still, with the rule that students enter 50% plus an allocation of only 2 hours, while schools ask not to focus solely on learning but also rerouting habits from 7 Days of Character Education, I, as a teacher, is quite confused in teaching material, especially

science for grade 6 so that children really understand and can apply the knowledge they learn later in everyday life. I have designed various activities interesting learning through group activities, study discussions, video media, science practicum, or field practicum, but in fact, it is all limited by time. I once tried to do group assignments, and it was difficult, because the students themselves were used to learning online, so it is possible to learn directly in class like today, plus group assignments for discussion, so it took a little longer to think about it. Not to mention the problem of literacy/interest in reading, students who are very, very lacking due to online learning so far. Once I tried one method where I conveyed the material in the GCR (google classroom) through interesting videos and even a summary of interesting material, then assignments and group work or practicums were carried out during PTM at school, in fact the material provided online was not paid attention at all. As a result, in the end, I explained the material again in class, only then could they understand, and well... time was up. The practicum was postponed again. Things like that hampers the other material as well. Yeah approximately like this. I am so sorry in advance if I am venting, I hope I can help from this minimal experience, if you need information or other help, please be very open, good luck ahead!"

Answer 2: "There were some students who have difficulty even not doing and collecting science practical assignments because of cost issues and the distance from their homes is far from their friends so they cannot work in groups in doing science practical assignments."

Answer 3: "It is difficult to interact directly when teaching practical science material. Thus, during this pandemic, learning activities often explain material in theory."

Answer 4: " I cannot do classical practice, so the students' ability in practice has not been directed."

On the other hand, some quotations from students' answers to the statement of obstacles to learning science in elementary school are as follows:

Answer 1: "The problem is the internet connection to study due to the decreasing income from my father."

Answer 2: "Sometimes I do not understand the material because I study online and I do not know the answer."

Answer 3: "I run out of internet quote; having bad signal."

Answer 4: "Usually when I study science, the obstacle I face is maybe the material at face-to-face is very limited, so there are some materials that I do not understand, such as about human organs, and the next obstacle is that my friends and I cannot practice any material that has been learned in science, because the pandemic period makes it unusual for us to practice together."

Besides the statement questionnaires, based on previous research, it was stated that science learning required more understanding of the material and detailed explanations from the teacher. During normal learning, students are not necessarily able to understand the subject matter as a whole (Handayani, 2021). In accordance with the research results of Dwi, et al. (2020)

that obstacles to online learning can certainly affect the effectiveness of learning activities. The research done by Hamdani & Priatna (2020) showed that the level of learning effectiveness is only around 66.97%, so it needs to be increased again so that learning is more effective for improving the quality of learning and student learning outcomes. In line with the research of Purwanto, et al. (2020), 70% of online learning is not effective and 63.35 of the Core Competencies of learning in science are not fully taught. Obstacles are the cause of the ineffective implementation of learning during the covid-19 pandemic.

CONCLUSION

Based on the results and discussions that have been presented, it can be concluded that the COVID-19 pandemic in Indonesia has had various impacts on society, especially learning activities in schools that have become less than optimal. Learning is perceived to be less effective because of limitations so that the material is not delivered thoroughly. The activities that are most often carried out are providing materials and assignments and students collecting assignments. In this study, the indicators of the science process have the smallest percentage of application in high-grade elementary science learning.

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