AN ANALYSIS OF JUNIOR HIGH STUDENT'S SCIENCE PROCESS SKILLS AFTER COVID-19

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AN ANALYSIS OF JUNIOR HIGH STUDENT'S SCIENCE PROCESS SKILLS AFTER COVID-19

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ABSTRACT

This research aims to analyze the science process skills (SPS) of junior high school students after 2 years of distance learning or post-COVID-19. The research method used is a descriptive quantitative method using multiple choice questions with 30 items and 4 answer options with 5 SPS indicators: operationalizing definitions, designing experiments, identifying and controlling variables, formulating hypotheses, and describing and interpreting data. The SPS instrument was given to 28 9th grade students of private junior high school in Surabaya. The results obtained were that the indicator of operationalizing definitions was 33.40% with a low category, designing experiments was 38.89% with a low category, identifying and controlling variables was 40.00% with a low category, formulating hypotheses was 33.00% with a low category, and describing and interpreting data was 44.00% with a low category. The questions 2 and 4 with the indicators of recognizing and controlling variables and articulating hypotheses yielded the fewest correct answers from the students. On question 25, students with the indicator of detecting and controlling variables received the majority of the right responses.

Keywords: *Science Process Skills; after-COVID-19; Junior High School*

INTRODUCTION

The COVID-19 pandemic has devastated Indonesia's educational system since it first arrived there in March 2020 (Lie et al., 2020). Distance learning with a variety of learning methods has taken the place of classroom instruction (Lestari et al., 2021b, 2021a). Learning may occur anywhere, according to distance learning, and is not just limited to the classroom, library, and lab. *Merdeka Belajar*, which offers students more flexible and independent learning options, is built on this principle. The modernization of education, the application of technology to education, and the quick dissemination of information are COVID-19's positive philosophies. Following COVID-19, these best practices must be preserved and enhanced in the spirit of *Merdeka Belajar*.

In an effort to improve the quality of teaching and learning, it is necessary to implement the Merdeka curriculum in schools with a focus on mathematics, literacy, and science (BSKAP, 2022). Science literacy is the main goal of science education using scientific concepts, process skills, values in decision making when interacting with others, and understanding the interrelationship between science, technology, and all aspects of life in society (Özgelen, 2012; Tilakaratnea & Ekanayake, 2017). Science literacy is defined by the OECD (2017) as the capacity to engage in scientific ideas and concerns that can analyze data, assess, and plan scientific research.

Through scientific activities, science education contributes to increasing students' involvement in the learning process (Nisa et al., 2018). It is impossible to separate scientific activities from the scientific method, which involves students observing, experimenting, evaluating, forming conclusions, and communicating. The

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skills necessary for the scientific method are built on scientific activity. Students need SPS in order to conduct scientific tasks (Tilakaratnea & Ekanayake, 2017). According to Inayah et al. (2020), SPS are thought to improve students' science literacy and aid in their thorough and accurate understanding of ideas. SPS are considered to provide meaningful experiences for students as they can help students achieve higher-level thinking (Darmaji et al., 2019; Harahap et al., 2019). In addition, SPS can help students increase their sense of responsibility and involvement in learning. During the learning process, students are expected to actively discover physics concepts through observation activities, experiments, drawing, creating graphs, tables, and communicating results to others. SPS are not only useful in learning, but can also help solve problems in daily life.

According to Özgelen (2012), there are 2 categories in scientific process skills, namely basic scientific process skills and integrated scientific process skills. The basic scientific process skills consist of observing, predicting, calculating, grouping, and communicating. While integrated scientific process skills consist of operational definition, control variables, formulating hypotheses, interpreting data, presenting data, reading or drawing graphs, and experimenting. Harahap et al. (2019) stated that students are considered to achieve scientific process skills when they can perform all indicators of scientific process skills, which include classifying, interpreting, predicting, formulating hypotheses, asking questions, communicating results, planning experiments, and implementing concepts. The indicators of scientific process skills used in this study are formulating operational definition, designing experiments, identifying and controlling variables, formulating hypotheses, and drawing and interpreting data.

Based on the explanation above, it can be known how important the science process skills are in daily life, especially during learning activities. Therefore, there is a need for research on the analysis of students' science process skills after-COVID-19. From these results, the researcher can provide a picture to the wider community about students' science process skills after COVID-19.

LITERATURE RIVIEW

SPS are knowledge and abilities that prepare students to engage in a variety of physical activities during the discovery process (Hands-on Activities), as well as thinking process skills (Minds-on Activities), and to develop a scientific mindset (Heart on Activities) (Ermininingsih et al., 2013; Ratnasari et al., 2017). SPS is a tool that scientists utilize to deepen their understanding, find solutions to issues, and formulate new findings (Özgelen, 2012). The goal of SPS is to help students become more adept at understanding concepts and information, acquiring necessary knowledge, and growing autonomously (Siahaan et al., 2017). Applying SPS to learning goes beyond teachers merely imparting information to pupils and places a strong emphasis on scientific inquiry. SPS has developed into a significant educational objective and is crucial for understanding knowledge, claim Ratnasari et al. (2017).

According to Özgelen (2012), basic SPS and integrated SPS are two kinds of SPS. The elements of basic SPS are observation, communication, predicting, classifying, inferring, and measuring. Meanwhile, integrated SPS consists of interpreting data, controlling variables, experimenting, formulating hypothesis, and modelling.

Observation

One of the fundamental methods for gathering information about a phenomenon with the senses is through observation. The outcomes of observation are derived from observations that have been converted into information or data. In SPS, observation is valued highly and serves as the foundation for other skills (Duruk et al., 2016).

Classifying

Classifying is grouping the characteristics of an object or observed object. This step is very important because classifying has a role in constructing concepts (Duruk et al., 2016).

Communication

Communication is the process of sharing information, thoughts, ideas, and experiences in their own ways. The most important thing in communication is to reach a mutual agreement and have the same understanding (Duruk et al., 2016).

Measuring

Measuring is the process of measuring or determining the magnitude of an object, substance, or phenomenon using specific tools or techniques. The purpose of measurement is to obtain accurate and objective quantitative information about the characteristics of the object or substance being measured (Duruk et al., 2016).

Predicting

Predicting or prediction is an action or ability to predict or anticipate an event or occurrence in the future based on available data or information. Predicting is a very important skill in various fields. The predicting process is usually done by using relevant historical data and information to build models or algorithms that can predict future outcomes (Duruk et al., 2016).

Inferring

Inference is a summary or conclusion drawn from information or arguments that have been previously given. Inference can be considered as the answer to a question or problem that has been analyzed and considered carefully (Duruk et al., 2016).

Interpreting data

Interpreting data is a process or activity to understand the meaning of data that has been collected and processed. The purpose of interpreting data is to produce useful information that can be used as a basis for making decisions or policies. The process of interpreting data usually involves systematic data analysis and statistical methods to identify patterns, trends, and relationships between variables in the data. In addition, interpreting data also requires the ability to interpret the results of the analysis accurately and usefully (Duruk et al., 2016).

Controlling variables

Controlling variables is a process to ensure that the variables that affect the results of a research or experiment remain stable or controlled during the data collection process. The variables referred to here are factors that can directly or indirectly affect the observation or experiment results (Duruk et al., 2016).

Experimenting

Experimenting is a research method conducted to test hypotheses or to determine the relationship between one or more variables with other variables. This method is carried out by creating certain treatments or conditions on the variables under study, then observing the results or changes that occur in other variables (Duruk et al., 2016).

Formulating hypothesis

Formulating hypotheses is the process of formulating a statement based on assumptions or conjectures about the phenomenon or problem to be studied. This hypothesis will then be tested for its truthfulness through appropriate research methods (Duruk et al., 2016).

Defining operationally

Operational definition is the process of defining an abstract concept or variable into a concept or variable that can be measured concretely. Operational definition explains how a concept or variable will be measured in the context of a particular study (Duruk et al., 2016).

Modelling

Modeling is the process of creating a mathematical model or representation of a system, concept, or phenomenon. The model created can be used to predict, understand, and control the behavior of the system or phenomenon. A good model can help obtain useful information about a system or phenomenon, as well as facilitate better decision-making (Duruk et al., 2016).

RESEARCH METHODS

This research uses a quantitative descriptive research method. The instrument used in this study is a science process skills test consisting of 30 items with 4 answer options. The instrument contains 5 SPS indicators, which are formulating operational definitions, designing experiments, identifying and controlling variables, formulating hypotheses, and describing and interpreting data. The five indicators are spread out into 30 items, with item numbers 1, 7, 10, 18, 21, 22 corresponding to formulating operational definitions, item numbers 2, 6, 19, 25, 28, 29, 30 corresponding to identifying and controlling variables, item numbers 3, 13, 15 corresponding to designing experiments, item numbers 4, 5, 9, 11, 14, 17, 24, 27 corresponding to describing and interpreting data, and item numbers 8, 12, 16, 20, 23, 26 corresponding to formulating hypotheses. The instrument was then tested on 28 students from a private junior high school in Surabaya, grade 9, who had experienced distance learning for 2 years during the COVID-19 pandemic. The obtained data was analyzed using equation (1) adapted from Purwanto (2013) and Elvanisi et al., (2018) , which is:

$$P = \frac{R}{MS} x\ 100\ \% \qquad (1)$$

Description:

P = Percentage for each science process skills indicator

R = The science process skills indicator's score

MS = Maximum score for each science process skills indicator

Using the formula in Table 1, the percentages for each indicator are then classified as very high, high, moderate, low, and very low. From Azwar (2003), the following is modified as follows:

Table 1. Science Process Skills Indicator Categorization Formula

No.	Formula	Category
1	X > Mi + 1,5 SBi	Very High
2	Mi + 0,5 SBi < X ≤ Mi + 1,5 SBi	High
3	Mi – 0,5 SBi < X ≤ Mi + 0,5 SBi	Moderate
4	Mi – 1,5 SBi < X ≤ Mi – 0,5 SBi	Low
5	X ≤ Mi – 1,5 SBi	Very Low

Description:

Mi = Ideal Mean ($\frac{1}{2}$ [$Highest\ Score + Lowest\ Score$])

X = Percentage of KPS indicator obtained

SBi = Ideal standard deviation ($\frac{1}{6}$ [$Highest\ Score - Lowest\ Score$])

The first step in fulfilling the categorization formula is to determine the values of Mi and SBi first. After Mi and SBi are obtained, they are then entered into the formula in Table 1. The categorization of the KPS indicator can use the range of values in Table 2 as follows:

Table 2. SPS Indicator Mastery Category

No.	Score Range	Category
1	X > 82,50	Very High
2	64,17 < X ≤ 82,50	High
3	45,83 < X ≤ 64,17	Moderate
4	27,50 < X ≤ 45,83	Low
5	X ≤ 27,50	Very Low

FINDINGS AND DISCUSSION

Darmaji et al. (2019) state that science process skills are crucial for students in understanding abstract concepts through hands-on activities. Science process skills enable students to be actively involved in learning, develop a sense of responsibility during learning, and apply research methods like scientists. This study focuses on five indicators of SPS, namely designing experiments, formulating hypotheses, operationalizing definitions, describing and interpreting data, and identifying and controlling variables. The results of this study are the results of a SPS test taken by 28 students in grade 9. The analyzed test results for each indicator can be seen in Table 3:

Table 3. Results of Science Process Skills Test for each indicator

No.	Indicators of Science Process Skills	Percentage (%)	Category
1	Operationalizing Definitions	33.40	Low
2	Designing Experiments	38.89	Low
3	Identifying and Controlling Variables	40.00	Low
4	Formulating Hypotheses	33.00	Low
5	Describing and Interpreting Data	44.00	Low

Based on Table 3, the percentage of SPS test scores for each indicator can be seen. The score for the indicator of operationalizing definitions was 33.40% with a low category. The indicator of designing experiments was 38.89% with a low category. The indicator of identifying and controlling variables was 40.00% with a low category. Formulating hypotheses was 33.00% with a low category, and the indicator of describing and interpreting data was 44.00% with a low category. Out of the five indicators, the indicator with the lowest score was formulating hypotheses, while the highest score was for describing and interpreting data. From these results, it can be seen that the students have difficulty with questions with the indicator of formulating hypotheses, while they are familiar with questions with the indicator of describing and interpreting data. The percentage of students who answered correctly for each item can be seen in Table 4:

Tabel 4. Percentage of students answered correctly for each question number

No.	Indicators of Science Process Skills	Question Number	Percentage of Correct Answer (%)	Average
1	Operationalizing Definitions	1	53.57	39.88 %
		7	53.57	
		10	35.71	
		18	25.00	
		21	53.60	
		22	18.00	
2	Designing Experiments	3	53.60	41.67 %
		13	53.57	
		15	17.86	
3	Identifying and Controlling Variables	2	14.00	45.41 %
		6	36.00	
		19	54.00	
		25	89.29	
		28	36.00	
		29	54.00	
		30	36.00	
4	Formulating Hypotheses	8	46.00	37.50 %
		12	54.00	
		16	18.00	
		20	17.86	
		23	36.00	
		26	54.00	
5	Describing and Interpreting Data	4	14.00	46.88 %
		5	54.00	
		9	71.00	
		11	35.71	
		14	18.00	
		17	57.00	
		24	54.00	
		27	71.00	

According to Table 4, it can be seen that the average score of students' correct answers in the indicator "describing and interpreting data" is medium. On the other hand, the average score of students' correct answers in the indicators "planning experiments," "formulating operational definitions," "formulating hypotheses," and "describing and interpreting data" is low. Out of the 30 questions given to the students, their lowest understanding is on questions 2 and 4 at 14%, with the SPS indicator on question 2 being "identifying and controlling variables" and the SPS indicator on question 4 being "formulating hypotheses." This result is in line with the research by Elvanisi et al. (2018), which showed that the lowest SPS score among students was in the indicator "formulating hypotheses." Elvanisi et al. (2018) reported that students' low SPS score in the indicator "formulating hypotheses" was due to students not focusing in class. Similarly, the research by Ratnasari et al. (2017) found that students received a low SPS score in the indicator "formulating hypotheses" because students were not trained to make hypotheses. To address this issue, students can be trained to formulate hypotheses before conducting practical work (Ratnasari et al., 2017).

This problem also arises when distance learning during the pandemic is applied in Indonesia. Many students do not turn on their cameras during class and students are not active at all when asked by the teacher. Setiani (2020) stated that during distance learning, students do not fully follow the lessons conducted by the teacher, causing their cognitive, psychomotor, and affective aspects to decrease. In addition to formulating hypotheses, the SPS indicator that is low in this study is identifying and controlling variables. In accordance with

the results of research from Handayani et al. (2016), the SPS indicator for students identifying and controlling variables is 44.90% with low category.

From the analysis conducted, it can be seen that distance learning during COVID-19 has an effect on students, causing a decrease in their scientific process skills. In accordance with the results of research by Utami dan Astuti (2021), during the pandemic, teachers were confused in implementing lessons that require properties because students had to do it directly. During the pandemic, the learning activities conducted by teachers and students are not maximized, causing many shortcomings, including learning loss in skills. In addition, according to Eliyana (2020), the decrease in SPS of students during the pandemic is because students are forced to do distance learning, causing many students not to understand the material taught by the teacher.

CONCLUSION AND SUGGESTIONS

The analysis of the scientific process skills of private junior high school students in Surabaya shows that their SPS post-COVID-19 is low. The results show that the operational definition indicator is 33.40% with a low category, designing experiments is 38.89% with a low category, identifying and controlling variables is 40.00% with a low category, formulating hypotheses is 33.00% with a low category, and describing and interpreting data is 44.00% with a low category. The least number of correct answers were obtained by students on questions 2 and 4 with the indicator of identifying and controlling variables and formulating hypotheses. The largest number of correct answers were obtained by students on question 25 with the indicator of identifying and controlling variables.

This result is an illustration of the SPS score of students obtained after distance learning ended or post-COVID-19. This result can be used by researchers and teachers to improve the SPS of students. One way to improve the SPS of students is to conduct practical work directly, implement self-directed learning models, and apply the scientific approach in learning.

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