Analysis of Science Literacy Ability of Junior High School Students with the NOSLiT Method of South Konawe Regency

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Abstract

Scientific literacy is seen not only as an important component of science education, but also as an ethical/moral competency. Science education plays an important role in creating responsible citizens, in this case scientific literacy is needed in making social-scientific decisions. Currently the concept of scientific literacy is a learning goal in the educational curriculum in various countries. Scientific literacy emphasizes students to analyze, predict, and apply scientific concepts in everyday life. Likewise with students in South Konawe district for the junior high school level, the majority of whose scientific literacy results are classified as lacking. Therefore, this research focuses on the Analysis of Science Literacy Ability of Junior High School Students Using the Nature of Science Literacy Test (NOSLiT) Method in Konawe Selatan Regency. The research method used in this research is quantitative with a descriptive approach. The sampling technique in this study used a simple random sampling technique. The result is that the scientific literacy skills of SMPN Konawe Selatan students based on the NOSLiT instrument in class IX are still in the low category while those in class VII and class VIII are classified as very low. This can be seen from the acquisition of the overall average NOSLiT score for all grade levels, namely 37%, 39.4% and 45.5% respectively, and after calculating the overall score, the average percentage of scientific literacy ability of Konawe Middle School students is obtained. South is in the low category of 40.8%. The achievement of scientific literacy for the NOSLiT indicator of SMPN Konawe Selatan students at all grade levels obtained the highest percentage of achievement in the scientific naming aspect, followed by the scientific misconception aspect, and the ability to process skills and the lowest percentage of achievement lies in the aspect of science postulates. In general, the highest achievement for all NOSLiT indicators was obtained by class IX, followed by class VIII and class VII. The percentage achievement for class IX for indicators of scientific naming, process skills ability, and major misconceptions reached 50% and was above 50% but still this percentage is still in the low category.

Keywords: Scientific Literacy; NOSLiT; Middle School Students

INTRODUCTION

NOSLiT (Nature of Science Literacy Test) developed by Wenning from the University of Illinois (2006) is a multiple choice test with a total of 35 items designed to assess understanding of the nature of science. NOSLiT can be an alternative test to help identify student weaknesses in scientific literacy skills. Based on the results of scientific literacy research that has been carried out by PISA is held every three years, namely in 2000, 2003, 2006, 2009, 2012, 2015, and 2018, it was obtained that Indonesia's average score was 393, 395, 393, 385, 375, 403, and 396 respectively where the score obtained every three years indicates that the level of scientific literacy in Indonesia it is still at level 1 (score 334.94-409.54) or a very low level. The low scientific literacy in Indonesia is generally caused by

several factors, namely the condition of school infrastructure, school human resources, and school management (Ardianto & Rubbini, 2016).

The low ability of students' scientific literacy in Indonesia is influenced by the curriculum, education system, selection of teaching methods and models by teachers, learning facilities, and teaching materials (Kurnia, 2014). Scientific literacy in science learning in Indonesia is still mostly limited to textbooks or text materials rather than direct learning. Science learning in schools is expected to be able to apply or implement scientific literacy in learning (Wirzal et al., 2022).

Based on student data obtained during initial observations at SMPN 5 Konawe Selatan in the odd semester of 2021/2022 in all classes of 32 class VII students, the lowest score was 55.05, the highest score was 67.50 and the average score was 65.50 with the KKM score of 68, for class VIII of 32 students the lowest score was 57.08 the highest score was 68.50 with the KKM score of 72 and the average score was 67.60, then for class IX of 30 students the lowest score was 69 .50, the highest score is 74.50 with a KKM score of 75 and an average score of 73.50. From these data it can be seen that the learning outcomes of students for all grades VII, VIII, IX have an average score below the KKM. This is because at that school in the learning process there are still few inquiry activities carried out so that students are less trained to learn independently, students do not understand the material, and learning is mostly based on conceptual only, rarely directed to skills, this happens because of the laboratory conditions at school it is inadequate both the room and the tools. The results of this study show that science learning by using the Inquiry learning model can improve student learning outcomes in grade IV at SD No. 5 Roll of the school year 2016/2017. In the first cycle, the average student science learning outcomes was 72.75% medium category and increased to 80% in cycle II which is in the category tall. There was an increase of 7.25%. The purpose of this research is to describe the scientific literacy abilities of Konawe Selatan Regency Middle School students based on the NOSLiT instrument.

METHOD

The research method used in this research is quantitative with a descriptive approach. According to Sugiyono (2016), descriptive quantitative research is research that obtains data from population research samples that are analyzed according to the statistical methods used to describe systematically the facts and characteristics of a particular population. Quantitative descriptive methods are also used to identify and describe trends in population variation. Create new measurements of key phenomena, or even describe research samples to identify causal effects.

This research was conducted in the odd semester of the school year 2022/2023 at Konawe Selatan District Middle School. The target population in this study were students in class (VII, VIII, IX) of SMP Konawe Selatan Regency, with a total of 756 people. The research object is categorized as a homogeneous population element. A homogeneous population, there is no need to question the number of sample sizes to be taken and also the groups to be sampled. The sampling technique in this study used a simple random sampling technique. The reason for using this technique is because the population elements in this study are homogeneous.

The data obtained from each research object is then processed to produce strong conclusions. In this case the type of data used is a test using the NOSLiT Question Instrument Data, Framework for NOSLiT independently developed and later detailed in an article by Wenning (2006), in the form of statistics such as percentages can be calculated if needed to clarify specific details about the phenomenon under investigation (Fraenkel & Wallen, 2006). The data collected after being analyzed is then interpreted or interpreted and described so that important conclusions can be captured. The average test achievement results of each class are calculated using the formula:

$$\overline{X} = \frac{\sum x}{n}$$

X = total score of all students
n = total students
Then calculate the correct percentage of each question for each framework using the formula:

$$S = \frac{R}{N} \times 100\%$$

Information :
S = Expected value
R = Total Score of Items or questions answered correctly. N = Maximum score of the test.
The scientific literacy achievement scores obtained are then interpreted based on the criteria presented in Table 5.
Table 5. Criteria for Achievement of Scientific Literacy

NO.	Category	Percentage (%)
1.	Heigh	> 75
2.	Moderate	60 - 75
3.	Low	< 60

(Huryah, dkk 2017).

RESULTS AND DISCUSSION

Description of the Scientific Literacy Ability of Konawe Selatan Middle School students in grades VII, VIII, and IX for indicators 1,2,3,4,5 and 6 can be seen in the following diagram
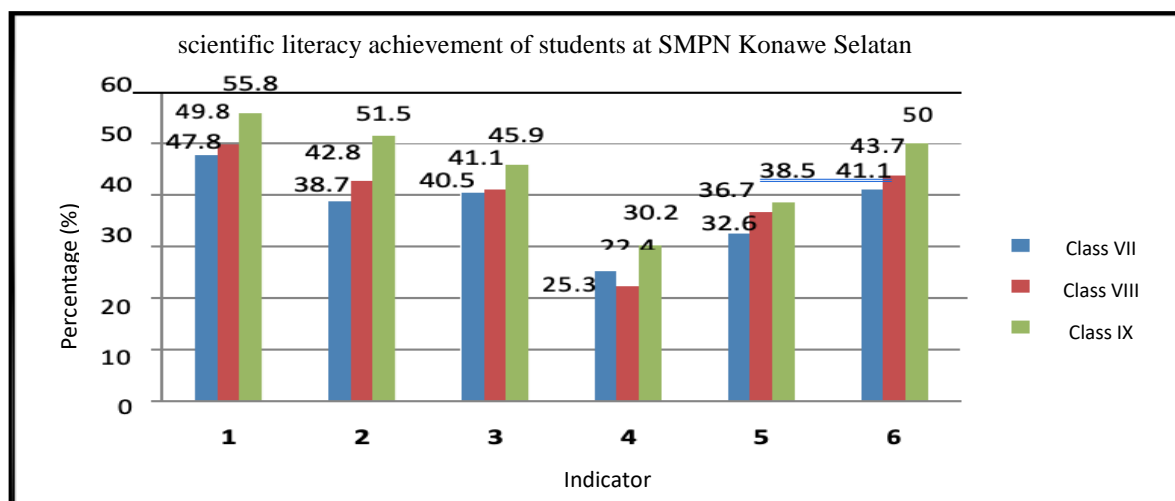

Figure 1. Achievement of Scientific Literacy of SMPN Konawe Selatan Students

Figure 1 shows that the scientific literacy achievement of the Konawe Selatan Middle School students for indicator 1 is highest in class IX at 55.8%, followed by class VIII at 49.8%, and class VII at 47.8%, for indicator 2 the scientific literacy achievements of participants the highest was in class IX at 51.5%, followed by class VIII at 42.8% and class VII at 38.7%, for indicator 3 the highest literacy achievement was in class IX at 45.9%, followed by class VIII at 41, 1% and class VII of 40.5% then the highest scientific literacy achievement of SMPN Konawe Selatan for indicator 4 is in class IX of 30.2%, followed by class VII of 25.3% and class VIII of 22.4%, for indicator 5 the highest scientific literacy achievement was in class IX

at 38.5%, followed by class VIII at 36.7%, and class VII at 32.6%, then for indicator 6 the highest scientific literacy achievement was at class IX was 50%, followed by class VIII at 43.7%, and class VII at 41.1%. Description of students' scientific literacy abilities SMPN Konawe Selatan as a whole on all NOSLiT indicators can be seen in the following Figure 2.
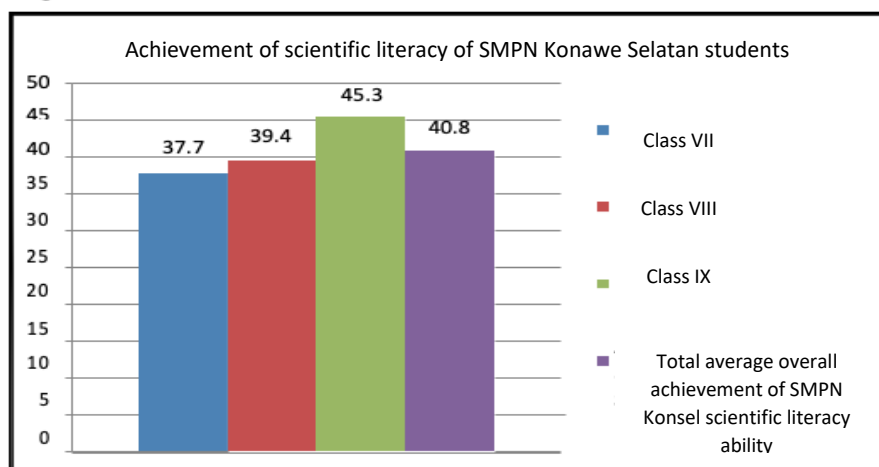

Figure 2 shows that the scientific literacy achievements of Konawe Selatan Middle School

Students for all the highest NOSLiT indicators were obtained by class IX, namely 45.3%, which was in the low category, then followed by class VIII, which was 39.4%, which was in the very low category, then the last position was obtained by class VII, which was 37.7% is very low category. The total average overall achievement of the scientific literacy abilities of Konawe Selatan Middle School students is 40.8% which is in the low category.

Based on the research data, it was found that the scientific literacy skills of Konawe Selatan Middle School students based on the NOSLiT instrument had several percentages that were not much different at each class level, where for class VII and class VIII had a total average percentage of scientific literacy ability each of 37.7% and 39.4% both of which are in the very low category, then for class IX the total average percentage of scientific literacy is 45.3% which is in the low category. Overall, the scientific literacy ability of SMPN Konawe Selatan students was obtained at 40.8%, which is in the low category. For more details, this can be seen from the description of the indicators as follows.

Indicator 1 regarding scientific naming is an indicator that measures terms commonly used to study scientific research, one of which is in practicum or other scientific activities. Scientific naming really needs to be mastered by students because it is universal. Indicator 1 consists of 7 item items, namely questions number 1, 2, 3, 4, 5, 6, and 24.

Figure 1 on indicator 1 shows that class VII has a scientific literacy achievement percentage of 47.8% and class XI is 49.8%, and class VIII is 55.8%. The highest achievement in scientific literacy skills of Konawe Selatan Middle School students in indicator 1 was obtained by class IX, however, the achievement of all grade levels on indicator 1 was in the low category. Students cannot answer questions about scientific terms correctly because students do not really know the definitions of some words even though the terms in question are terms that are very closely related to experimental activities and represent at least a concept or vocabulary, so that both the teacher and students must really understand it.

The percentage of achievement obtained on the scientific naming indicator is not much different from that obtained by Murti (2018), which is 41.87%. Students basically understand the concept of connecting science with other disciplines and are able to write scientific terms, but they often misunderstand the concept, while students who remember theory correctly and are able to explaining the concept has a limited understanding and it is difficult to connect the concept with the answer itself.

According to Wenning (2006) the scientific nomenclature listed in the NOSLiT indicator is a key word for communicating an idea. One of the scientific competencies measured in scientific literacy is identifying scientific problems which include identifying keywords for scientific investigations (Bybee, 2009).

Indicator 2 regarding the ability of process skills is an important observational and experimental skill that will be learned when science is taught and is oriented towards investigation in both teaching and laboratory methods (Wenning, 2006). Indicator 2 consists of 6 item items, namely questions number 7, 8, 9, 10, 11, and 23. Figure 2.1 on indicator 2 shows that class VII has a scientific literacy achievement percentage of 38.7% which is in the very low category, then class VIII and class IX respectively by 42.8% and 51.5% and both are in the low category.

The highest achievement in scientific literacy skills of Konawe Selatan Middle School students in indicator 2 was obtained in class IX but was still in the low category. This happens because students do not yet have good scientific literacy related to the ability to carry out practices or experiments and determine what procedures are carried out in practicums, on the other hand practicums carried out by students are only a means or facility to complete their tasks without knowing well the function of each step or procedure they perform.

The percentage of achievement on the intellectual process skills indicator by Murti 2018 only reached 44.83%, where there is some knowledge that students do not yet have, namely in differentiating observation, experimentation and recognizing laws and theory. There are several aspects that need to be improved in scientific literacy related to intellectual Process Skills indicators, namely students are able to observe, analyze, and are able to infer data (Murti, et al. 2018: Wenning, 2006) According to Wenning (2006) students can have a comprehensive understanding in science if they have experience with the scientific method. Intellectual process skills in indicator 2 are the key to observation skills and experimentation when the science being taught focuses on the intellectual process skills of scientists.

Indicator 3 is the rules of scientific evidence or the Rules of Evidence, namely indicators related to students' ability to accept evidence or facts that exist in the science process. Indicator 3 consists of 7 question items, namely question number 12, 13, 14, 15, 16, 27 and 28. Figure 4.1 on indicator 3 shows that class VII has a scientific literacy achievement percentage of 40.5% and class VIII is 41.1%, and class IX is 45.9%, the percentage of scientific literacy achievement in indicator 3 for all grade levels is in the low category. The presentation of the highest scientific literacy achievement was obtained by class IX, but it is still in the same category as class VII and VIII, which is in the low category. This condition occurs because students do not understand and realize that truth in science needs to be believed if they have received accurate or valid evidence.

The percentage of achievement on the rules of evidence indicator by Rokhmah 2017 reached 84.72%, the percentage of achievement was quite high, this happened because the phenomena presented in the questions were close to the daily activities of students and in accordance with the flow of thinking or logic that students have . The relatively large difference in percentage achievement is caused by differences in the characteristics of students based on the quality of education, the types of questions presented are still relatively new to students and students' general knowledge of science is still relatively lacking.

Indicator 4 is the Postulates of Science, namely the indicators in the NOSLiT instrument related to several assumptions that are believed and become a basis for scientific work and estimates or in other words, this postulates science indicator contains assumptions about how science works, functions as a basis for scientific work and thought under the rule of scientific evidence to determine what is acceptable or unacceptable to a certain extent. This indicator consists of the 4 question items are questions number 17, 18, 26, and 29.

Figure 2 on indicator 4 shows that class VII has a scientific literacy achievement percentage of 25.3%, class VIII SMPN Konawe is 22.4% and class IX is 30.2%. The percentage of students' scientific literacy achievement at SMPN Konawe Selatan on this indicator for all grade levels is within very low category. The highest percentage of achieving scientific literacy skills was obtained by class IX, but it is still in the same category as class VII and VIII, which is in the very low category. This happens because students do not understand at all about some of the assumptions that need to be mastered by the students themselves, namely the assumption that all scientific laws are universal so that by itself it requires students to be able to seek truth that is truly comprehensive in nature. Nature operates consistently, or even unique conditions may occur naturally, perhaps not directly observed but their existence theoretically can be inferred through reason (Wenning, 2006).

The percentage of achievement results obtained on the science postulates indicator by Murti (2018) is 48.28%. The test results show that there are some students who do not understand the eight aspects of the scientific postulates of the NOSLiT instrument. The eight aspects of the postulates are that all scientific laws are universal, consistency of time and place, no effect without natural causes, explanation without test is unacceptable in science, science does not recognize repeated observations, scientific knowledge is prolonged but tentative, and science does not has absolute certainty, and science is not a private matter related to its own problems.

Indicator 5 is scientific character or (Scientific Dispositions), which is an indicator that assesses or measures whether students already have the soul of being a good researcher, in other words, scientific character is an attitude that scientists must have in studying science. These attitudes include curiosity and skepticism, objective and not dogmatic, creative and logical, and honest and trustworthy, with this attitude it will make it easier for students to conduct research and process data. Indicator 5 consists of 5 question items, namely questions number 19, 20, 21, 22, and 25.

Figure 1 on indicator 5 shows that class VII has a scientific literacy achievement percentage of 32.6%, class VIII is 36.7% and class IX is 38.5%. Percentage of achievement of scientific literacy ability of SMPN Konawe South students on this indicator for all grade levels is in the very category low. The highest percentage of achieving scientific literacy skills was obtained by class IX, but it is still in the same category as class VII and VIII, which is in the very low category. This condition occurs because of two reasons, the first is that most students at SMPN Konawe Selatan are used to receiving learning that is presented directly by the teacher and accompanied by learning methods that seem boring, so that students feel lazy to find out or develop their own knowledge. Most students feel that the attitude that scientists must have is very complex so that it is complicated to apply in the learning process. This shows that the creativity of SMPN Konawe Selatan students to find new things is still very low and the logic of students is still far from average.

The percentage of achievement results obtained on the scientific character indicator by Murti (2018) is 27.59% in the very low category. The results of the test show that 72.41% of students are less thorough in understanding the discourse in question, so they fail to find solutions for rational explanations as characters. scientists as seen in NOSLiT-based problems. Research by Liu (2009) shows that it is not easy to change the concept of knowledge to be scientific because students and society in general do not realize that their knowledge is low in concept.

Indicator 6 is a misconception about science where this indicator assesses how far students' understanding of science is, there are still some misconceptions that students have so students are still not able to answer questions correctly. This indicator implements that the scientific method is a method that can answer problems that exist in nature and is universal. The scientific method can be used when there are questions that arise to form a problem statement. The formulation of the problem will form a temporary hypothesis or conjecture which can become a theory if it has been proven valid. A process that requires an honest and

objective attitude so that absolute truth will be formed (Wenning, 2011). This indicator consists of 6 question items, namely questions number 30, 31, 32, 33, 34, and 35.

Figure 1 on indicator 6 shows that class VII has a scientific literacy achievement percentage of 41.1%, class VIII has 43.7% and class IX has 50%. The highest percentage of scientific literacy achievement of Konawe Selatan Middle School students who achieved the highest scientific literacy ability was obtained by class XII, but it is still in the same category as class VII and VIII, which is in the low category. This condition is caused by several things, namely the first because of the cognitive knowledge of SMPN Konawe Selatan students themselves which is still low, the teacher does not master teaching materials during the learning process then the teacher's teaching method only contains lectures and writing and directly discusses mathematical formulas meaning not explaining the concept from where why can this be the way to solve it.

The percentage of achievement results obtained on the indicator of misconceptions about science by Murti (2018) is 39.66%. Common misconceptions in the NOSLiT test are made-up stories about the scientific method, general hypotheses, theories from hypotheses, knowledge based on experimentation, and the scientific method leading to absolute truth (Wenning, 2006). The test results obtained that some students still could not understand the meaning of scientific stories on the NOSLiT test so they could not determine the correct answer. These students need strategic reading skills because they affect their scientific achievement, so it can be concluded that students' reading skills help them understand scientific knowledge (Rivard, 2016). Increasing reading ability increases students' mathematical and scientific literacy (Arikan, 2016).

The acquisition of an average NOSLiT score for each indicator is generally in the low category, but there are also those that are in the very low category, for example in indicators 5, 4, and 2. This acquisition must be used as evaluation material to organize learning that facilitates good scientific literacy skills in accordance with the 2013 curriculum is to increase the understanding of the nature of science in teachers and students, and increase inquiry activities during the learning process, thus it is expected that students' scientific literacy in each indicator can increase.

The lack of scientific literacy abilities of Konawe Selatan Middle School students is apart from the lack of facilities and infrastructure, as well as the lack of inquiry activities when learning this is also caused by a lack of understanding of the nature of science by teachers which causes the teaching process to be less than optimal, one of which is characterized by learning that is mostly based on conceptual knowledge only, and in the learning process it rarely directs skills to students so that students' understanding is also not optimal . This is in line with the statement (Khalick, et al.,: 1997) that a good understanding of NoS from teachers will affect students' understanding.

According to (Wahbeh & Abd-El-Khalick, 2014), namely that the teacher's conception or understanding of the concept of NOS is a very important factor in influencing students' ideas about NOS, on this basis the understanding of NOS owned by the teacher becomes the main requirement before the teacher does learning process in the classroom.

According to Trianto (2010) in his theory of constructivism that one of the most important principles in educational psychology is that teachers do not just impart knowledge to students, but students must build their own knowledge in their minds. Teachers can facilitate this process, by giving students opportunities to invent or apply their own ideas, and teaching students to become aware and consciously use their own strategies.

Tips for developing students' scientific literacy, educators are required to be able to apply learning that originates from student activities in understanding concepts about various problems. Students need scientific literacy skills in studying problems and being able to relate scientific truths accompanied by valid evidence or information in their daily lives. This treatment aims to make students able to make very appropriate decisions about problems related to various phenomena or natural events. Learning process activities by applying

scientific literacy, students' skills will be measured by scientific knowledge and understanding, such as students' skills in finding things, interpreting, and analyzing evidence. (Zuhra, 2021).

One way to train students to be able to build their own knowledge well is to increase students' understanding of the nature of science itself. The essence of learning science is not only learning products, but also learning aspects of processes and attitudes so that students can truly understand science as a whole. Learning science is something that must be done by students, not something that is done to students. It is very important for every teacher to understand as well as possible about the learning process of students, so that they can provide guidance and provide an appropriate and harmonious learning environment for students. (Hamalik, 2010)

Efforts that can be made by educators are to increase the exploratory activities that will be carried out by the students themselves, where this exploratory activity allows students to explore a problem or problem regarding a particular phenomenon, as well as create their own ideas using higher skills, in the learning process. learning in these activities the students concerned can observe, predict, investigate, analyze and conclude the problems faced. Types of activities that can be carried out include experimental activities, observations, and literature studies. (Rokhmah, 2017).

This is in line with Hoolbrook and Rannikmae's research (2009) that scientific literacy is primarily taught with the opinion that "teaching is through or through science" not the other way around, namely science passes or goes through the teaching process. An effective teacher learning strategy for teaching NOS to students is explicit-reflective learning even though it has a different context but research suggests that this strategy is known to be effective to use (Adibelli-Sahin & Deniz, 2017).

CONCLUSION

The scientific literacy skills of the students of SMPN Konawe Selatan based on the NOSLiT instrument in class IX are still in the low category while those in class VII and class VIII are classified as very low. This can be seen by obtaining the overall average NOSLiT score for all grade levels, namely 37%, 39.4% and 45.5%, and after calculating the overall results, the average percentage of scientific literacy ability of Konawe Selatan Middle School students is in the low category, which is 40.8%.

Achievement of scientific literacy for the NOSLiT indicator of SMPN Konawe Selatan students at all grade levels obtained the highest percentage of achievement in the scientific naming aspect, then followed by the aspect of scientific misconception, and process skill ability and the lowest percentage of achievement lies in the aspect of science postulates. In general, the highest achievement for all NOSLiT indicators was obtained by class IX, followed by class VIII and class VII. The percentage achievement for class IX for indicators of scientific naming, process skills ability, and major misconceptions reached 50% and was above 50% but still this percentage is still in the low category.

RECOMMENDATION

For future researchers, it is suggested to conduct research by looking more deeply into the factors that influence the low and very low scientific literacy abilities of Konawe Selatan Middle School students. For teachers to improve students' scientific literacy skills there are 6 indicators that need to be considered, namely: (a) Scientific naming indicators related to understanding 24 vocabulary in science, the teacher is expected to be able to introduce students to scientific vocabulary related to learning the nature of science, so that students get used to knowing, remembering and understanding scientific vocabulary; (b) Indicators of process skill ability, teachers should train their students more and often provide inquiry-oriented learning and laboratory methods, so that students are accustomed and better trained to think, reason, draw the right conclusions, explain the reasons for linking a formula, read

graphs designing experiments and identifying research variables; (c) Indicators of the rule of scientific evidence, a teacher should get used to giving his students the topic of problems in learning that can only be solved based on accurate statements accompanied by scientific evidence, so that students can be trained to think factually and in accordance with scientific evidence; (d) Indicators of science postulates, teachers should train their students so that they have more ability to assume where science can operate, that is by way of more dominant students being given practicum-based learning, from which learning students are faced with problems, then students observe and then can make assumptions about how to solve the problem; (e) Indicators of scientific character, teachers should better train their students to identify some general characteristics that describe rules for scientists, by stimulating students with fun learning, so that students feel interested again and feel more curious to find other new things objectively , creative and logical. and (f) Main misconception indicators, namely to reduce misconceptions in students should teachers improve teaching methods and of course accompanied by mastery of their own teaching materials so that misconceptions that occur can be minimized or eliminated. For school principals to be able to pay attention to infrastructure or facilities that support science learning so that learning can run effectively.

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