Analysis on the science literacy ability of vocational school physics teacher using NOSLiT indicators

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Abstract. Professional Physics teacher must be able to manage science learning process by associating science itself with the daily life. At first the teacher must have competency in the ability of science literacy. The target of this research is vocational school Physics teachers for the purpose to describe their ability on science literacy. This research is a survey research using test method. The test instrument is The NOSLiT by Wenning. Research results are: 1) Scientific Nomenclature : 38.46 %, 2) Basic experimental and observational abilities : 38.46 %, 3) Rules of scientific evidence : 0%, 4) Postulate science: 15.38%, 5) scientific disposition: 7.69%. Conclusion: The result of each indicator shows that the ability of science literacy of vocational school Physics teachers has not met the expectations yet. It's can be used as the reflection for education experts to improve their science literacy ability so that can be applied to the learning process that directly or indirectly will have an impact on improving the students’ science literacy.

1. Introduction
One of the keys to success in improving the quality of education lies in teachers, who are integrated into the planning and learning processes in the school. The teacher is a central point in the effort to improve the quality of education. One of the changes in the effort to improve the quality of education changes are by changing the curriculum, the methods of learning, as well as the facilities and infrastructure.

The challenge of the 21st century is marked by the rapid development of technology applied in various life in society. Permenikbud number 20 of 2016 on competency standards of primary and secondary education graduates contains efforts to realize national education objectives in accordance with article 2 of Law No. 20 of 2003 states that a qualified graduate qualification profile is required in the competency standards of graduates. In article 35 of Law No. 20 of 2003 states that the competency standard of graduates is a qualification of graduate ability that includes the attitude, knowledge, and skills of learners that must be fulfilled or achieved from an education at primary and secondary education level. It becomes the duty and responsibility of the teacher as the center of education in the school.

In the above issue of permendikbud number 22 of 2016 on the standard of primary and secondary education process in the chapter of learning implementation states that teachers must be role models for learners to be honest, discipline, responsible, caring (gotong royong, cooperation, peaceful) polite, responsive, and proactive, and show attitude as part of the solution to various problems in interacting effectively with the social and natural environment and in placing themselves as a reflection of the nation in the association of the nation. Teachers are required to be part of the solution to the various problems
among learners including in achieving learning outcomes in the form of increased literacy skills of students.

1.1. The essence of science and the role of teacher in science learning
Science is a knowledge that the truth has been tested empirically through scientific methods. (Toharudin, U et all, 2011). Physics is a part of natural science that is considered difficult for learners. In science learning provides opportunities for learners to continue to potentially develop their potential optimally, both from the cognitive, affective, and psychomotor. In reporting the results of science activities learners in demands have sufficient language skills in order to complement, enrich, and provide convenience to understand the content of science itself. This is where the role of teachers is needed, teachers are required to have more ability about science literacy in the learners.

Being a teacher in this century is not easy. Such as rapid changes in times of teacher's force to continue about learn how to improve their professional qualities. Besides faced with rapid demand of the era, teachers are also faced with various characteristics of challenging learner to be handled wisely. Printing learners with competent learning outcomes to be in use in various situations takes the effort of teachers in the learning process.

1.2 Science Literacy and NOSLiT
Paul De Hart Hurt was the first person used the term science literacy. According to Hurt, science literacy means the act of understanding science and applying it to the needs of society. Toharudin [3] research on science literacy has been going on for a long time, one of the institutions that conduct science literacy study is PISA. The research conducted to explain about the unsatisfactory of results on the ability of science literacy learners Indonesia. It gives an idea that the learning process in Indonesia is low stage.

Wenning states that science literacy as a multidimensional ability that learners must possess. These capabilities include knowledge, skills, dispositions, good relationships between science and technology-society, and the history and the nature of science. The learning process should pay attention to aspects of knowledge (vocabulary, facts and concepts), logical processes (skilled and intellectual), dispositions (attitude and behavior), good relationships between science-technology-society, history and the nature of science [5]. These aspects should be included in the learning program that teachers do in the classroom as the provision of students plunge into the life of society.

Nature of Scientific Literacy Test (NOSLiT) is an assessment instrument consisting of 35 instruments that is developed by Wenning that consist of several frameworks as follows 1) scientific nomenclature, 2) Basic experimental and observational abilities, 3) Rules of scientific evidence, 4) Postulate science, 5) scientific dispositions, 6) Misconceptions. The six framework are intended to determine the ability learners in senior high school. Individuals who literate on science are those who have knowledge of the six NOSLiT frameworks that is develope by Wenning [6].

1.3. Relevant Research
Probosari [9] in her research Dampak Inkuiri Berjenjang terhadap Dimensi Literasi Sains Calon Guru Biologi stated that one of the root of the problems identified in terms of the low ability of science literacy possessed by students is proven by: 1). Difficult to interpret data and explain causal relationships in reproduction process in plants, 2). Weak ability to read and extract literature content with language that is easy to understand. 3). The limited ability of students to express arguments in the form of writing because students are not accustomed to connect information in the literature in answering the problem.

Rokhmah [5] in her research entitled Analisis Kemampuan Literasi Sains Siswa Kelas X MBI Amanatul Ummah Menggunakan Instrument NOSLiT states that the percentage of science literacy ability of learners successively from the lowest to the highest is observational ability and basic experiment 26.39%, postulate scientific 40.28%, scientific nomenclature 47.22%, scientecific disposition 48.72%. This acquisition can be caused by several factors such as the lack of ability of teachers in managing learning that can simulate the ability of science literacy learner to be able to find
the concept independently and conduct investigative activities that hone the cognitive knowledge of learner.

Inzannah in her research entitled Pengembangan Perangkat Pembelajaran Berbasis Kurikulum 2013 untuk Melatih Literasi Sains Siswa SMP states that The learning material is practical in learning process. Average score of all activities in learning implementation is 3.6 with very good category. The learning material is also effective to try skill of student’s science literacy until 4th levels. Students involve in learning process actively and give positive response in those learning. The conclusion of this research is science learning material based on curriculum 2013 in fluids pressure and it application in daily life matter can be used to try science literacy of students in class VIII Junior High School properly.

The research conducted by Marten Masoka under the title of Exploration Study of qualification and teacher competence of biology smp-sma as the basis of education quality improvement program stated that research result on the study of professional competence of biology teacher of SMP and SMA Bintuni Bay District gave information that the level of competency IPA / Biology teacher professionals in junior high school / high school in Bintuni are included in the category of sedanf of the expected competency score.

Given the importance of the teacher's role in learning, the writer tries to examine the literacy ability of physics teacher smk to know the description of the science literacy ability possessed by the smk physics teacher especially the smk teacher in the district of Wonogiri.

2. Research method
This research is a survey research using test method. The test instrument that is used by the writer is a test instrument is taken from the science literacy. This test instrument is developed by Wenning. The NOSLiT science literacy test indicator consists of six indicators, but in this research only takes five NOSLiT indicators as follows, namely scientific naming, basic experimental and observational skills, scientific proof rules, scientific postulates, and scientific dispositions. The test consists of 10 science literacy questions from the NOSLiT instrument. Data analysis that is used by the writer is descriptive statistics, data analysis is done by counting the number of teachers who answered correctly and divide it by the maximum number of correct answers and multiplied hundred percent.

2.1. Research goals
Target of the survey in this research is the teachers of Vocational Physics who are members of the Community MGMP Physics of Vocational School Expertise Field Technology and Engineering, which consists of 10 teachers from various Vocational School in Wonogiri Regency.

2.2. The lattice of test questions based on the NOSLiT indicator
In this research the researchers used ten items based on Wenning that is taken from the test questions, which consists of 5 kinds of indicators. The distribution of science literacy with the NOSLiT indicator is presented in Table 1.

| No | Indicators                              | Number of Question |
|----|----------------------------------------|--------------------|
| 1  | Scientific Nomenclature                | 1, 3               |
| 2  | Basic experimental and observational abilities | 2, 4               |
| 3  | Rules of scientific evidence           | 6, 8               |
| 4  | Postulate science                      | 7, 10              |
| 5  | Scientific Dispositions                | 5, 9               |
3. Result and discussion
The data that is found by the correct answer of the teacher on five indicators given the value of 1 and the wrong answer the teacher is given a value of 0. The correct answer on each indicators is summed and devide by the maximum number of correct answers all indicators multiplied hundred percent.
Results science literacy teachers skills are presented in graphic 1.

Science Literacy Test Result of Vocational School Teachers

![Figure 1. Graph of percentage of science literacy test of vocational school teachers.](image)

In figure 1 it can be seen that the teacher with the lowest science literacy ability is on the scientific proof rule indicators of 0%. In this third indicators is represented about the number 6 and 8. Both of these questions state that the causal relationship and the filling of a scientific claim. None of the teachers answered correctly.

The indicator of science literacy that in the fourth stage of the low score is the the rules of scientific evidence which is represented by questions 6 and 8 in 0%. There is no one of the teachers who answered the 6 and 8 questions correctly. It can be analyzed that the teachers does not or rarely do the laboratory learning in their learning process. The teachers does not practice to made the learners as the center in learning process. So, the scientific creativity of the teachers has not been channeled properly.

The second state of the low is the scientific disposition of 7.70%. In this fifth indicators is represented about the number 5 and 9. The scientific disposition identifies the attitude that scientists must process in studying science. The attitudes that must have by the teacher are curiosity and skepticism, objective and not dogmatic, creative and logical, be honest and trust worthy. Based on the test result, the ability of teachers is still low to improve the attitude of seeking to find of the new things and demand appropriate evidence and to able to demonstrate intellectual integrity and avoid personal bias. The literacy skill of the science teacher on this third incators still low and showed that creativity and logical of teacher is far of the average.

The third stage of the low score that has 15.38% percentage is the fourth namely postulate science. In this fourth indicators is represented about the number 7 and 10. Postulate science is the first assumption about science executed. The postulate of science contains of the assumption that all the laws of science are universal and not local, there is consistency in the course of science in the terms of time and place, science does not provide absolute certainty and science is not personal matter involving the interests of scientists themselves. In this indicator the teachers have begun to understanding about how science is run. But, not all of the teachers have competency on this indicator.
The highest attainable teacher at the scientific nomenclature and Basic experimental and observational abilities each other be the similar 38.46%. In this first and second indicators are represented about the number 1, 3 and 2, 4. These two indicators derive the same gain, in the scientific nomenclature of science literacy relating to languages commonly used in science such as assumptions, laws, facts, empirical, principles, hypotheses. Teachers are familiar with the languages of science even though the result obtained from this survey have not shown satisfactory result. This can be the teachers are less frequent in using inquiry learning and laboratory-centered learning. While the Basic experimental and observational abilities indicators are the skills to be raised in this indicator are the skills found in scientific method such as generalizing principles through induction, explaining and predicting, observing and collecting data, drawing conclusions from evidence. Teachers are not proficient in translating scientific methods fluently this is because teachers are still doing teacher centered learning, so the inquiry skills of teachers have not been used properly.

As the comparison of this research is the research done by [5,9]. They state that teachers’ and students’ ability of scientific literacy are still under expectation. Teachers’ ability of scientific literacy is evidenced by a research by [9] which takes sample of prospective Biology teachers in UNS. The result of her research shows they have difficulties in interpreting data and explain its causal, weak ability in reading and extracting the content of the literature using simple language. Their limited ability to express arguments in the form of writing because they are not accustomed to connect information in the literature in answering the problem. It shows that their ability of scientific literacy is still low in some areas, so it needs to be improved to produce teachers with higher ability of scientific literacy. Thus, will create students’ ability of scientific literacy as expected.

In addition, Rokhmah [5] in her research says that the acquisition in average percentage of her students’ ability of scientific literacy is still below 50%. This acquisition could be caused by some factors, such as lack of students-centered learning process, observation activities to find the concept independently, pre-knowledge of teachers about science literacy. In conclusion, it is obvious to improve students’ ability of scientific literacy is needed teachers with skillful capabilities in scientific literacy.

4. Conclusion
The percentage of literacy science abilities vocational physics teacher in district Wonogiri from low to highest is Rules of scientific evidence 0%, Scientific Dispositions 7.70%, Postulate science 15.38 % and Scientific Nomenclature and Basic experimental and observational abilities 38.46%.

This acquisition is caused by several factors, among which teachers still apply teacher-centered learning, the lack of teachers processing the learning process using inquiry learning and laboratory methods. Lack of early knowledge of teachers about science literacy. The results of this study is expected to be a consideration and learning materials for teachers, especially physics teachers in district Wonogiri to further improve the ability of scientific literacy that can be used to improve the ability of science literacy learners as well. This research is expected to inspire the researchers as a benchmark research.

Acknowledgment

References
[1] Wenning C J 2006 J. Phy. Teach. Educ. 3 3
[2] Wenning C J 2007 J. Phy. Teach. Educ. 4 21
[3] Toharudin U et all 2011 Membangun Literasi Sains Peserta Didik. (Bandung : Humaniora)
[4] Holbrook J, Rannikmae M 2009 Int. J. Environ. Sci. Educ 4 275
[5] Rokhmah A 2017 Analisis Kemampuan Literasi Sains Siswa Kelas X MBI Amanatul Ummah
[6] Intan 2015 *Pengembangan Assesment Nature of Science Literacy Test (NOSLiT) untuk mengukur Literasi Siswa SMA* (Surakarta : Universitas Negeri Sebelas Maret)

[7] BSNP-Indonesia 2016 *Permendikbud No 22 tahun 2016 tentang Standar Proses Pendidikan Dasar dan Menengah* (Jakarta : Kementrian Pendidikan dan Kebudayaan Republik Indonesia)

[8] Republik Indonesia 2003 *Undang-Undang No 20 Tahun 2003 tentang Sistem Pendidikan Nasional* (Jakarta : Sekretariat Negara)

[9] Probosari M R 2016 *Dampak Inkuiri Berjenjang terhadap Dimensi Literasi Sains Calon Guru Biologi* ISSN:2528-5742 Proceeding Biology Eduction Conference (Surakarta : Universitas Negeri Sebelas Maret)