Journal of Learning Improvement and Lesson Study
Volume 3 Number 2 2023, pp, 1-6
E-ISSN: 2798-9011
DOI: 10.24036/jlils.v3i2.46
Received: June 10, 2023; Revised December 27, 2023; Accepted December 31, 2023
Availaible Online: http://jlils.ppj.unp.ac.id/index.php/

Analysis Of Science Literacy Of XI Class Students In Buffer Solution Materials

Sandy Yudha*, Murniaty Simorangkir, Nurfajriani
Universitas Negeri Medan
*Corresponding author, e-mail: sanyudha97@gmail.com

Abstract
The background of this research is that the world of education is currently intensively developing scientific literacy skills for students. This condition is the result of the rapid development of science and technology (IPTEK), so students must be able to act wisely and be able to adapt to science, environment, society, and technology. The purpose of this study was to determine the level of scientific literacy in nominal, functional, conceptual, and multidimensional aspects of class XI students on buffer solution material at State Senior High School (SMAN) 1 Binjai, Langkat Regency. This research method is a survey research, using a cross-sectional survey design. The sample in this study was taken from class XI IPA 1, totaling 30 people based on a purposive sampling technique. The research instrument used was a scientific literacy test in the form of essay questions, with indicators of scientific literacy referring to the theoretical framework. Based on the results of data analysis, it was found that the average value of students' scientific literacy abilities, nominal literacy indicators were 83.33%, functional indicators were 57.67%, conceptual indicators were 59.07%, and multidimensional indicators were 28.49%.

Keywords: Scientific literacy, Buffer solution

Introduction

Currently, the world of education is incessantly developing 21st century life skills, namely scientific literacy skills for students. This condition is the result of the rapid development of science and technology (IPTEK). The rapid development of science and technology must be balanced with the understanding of students in interacting with the development of science and technology. This means that every student must be able to act wisely and be able to adapt to science, the environment, society and technology (Situmorang, 2016).

The learning process in Permendikbud number 23 of 2016 regarding the Minimum Completeness Criteria (KKM) as a criterion for learning completeness. This is determined by the education unit which refers to graduation competency standards, where one aspect of the assessment is knowledge competency. This means that in the 2013 curriculum, it requires students to master knowledge competencies so that they can be said to be complete according to the Minimum Completeness Criteria (KKM) (Citra, 2017).

The quality of learning is influenced by school quality, curriculum, and teaching quality, so that the implementation of the 2013 Curriculum is one of the efforts to reform education and science education in particular. The low ability of students' scientific literacy is one reason that underlies the government to revise the 2006 curriculum to the 2013 curriculum (Odja, 2014). The 2013 curriculum provides reinforcement or revitalization in several aspects of the previous curriculum. The 2013 curriculum is a response to the rapid development of science, technology and information. Therefore, the 2013 curriculum provides hope for the realization of a scientifically literate society (Yudha, 2021).

Science as a basic science that plays an important role in the development of science and technology because science is always needed by society in order to form scientifically literate human resources. Science produces students who have values, attitudes, and thinking skills to produce quality students who are able to face problems. Science education has great potential to prepare quality human resources in facing the globalization era (Hermita, 2014).

The potential of science education can be seen from the ability to communicate, the ability to think, the ability to solve problems, the ability to master technology, has the ability to adapt to changes and developments in life. The process of science education can form a fully literate human being in science and technology. The science learning process produces quality students who are shown to be aware of science, have values, and high-level thinking skills which in turn give rise to human resources who can think critically, think creatively, make decisions, and solve problems.

The scientific literacy level of Indonesian students compared to other countries can be seen from the PISA (Program for International Student Assessment) study. PISA is a scientific literacy study carried out by the Organization for Economic Co-Operation and Development (OECD) and the Unesco Institute for Statistics (Wulandari 2016). PISA aims to monitor and compare the results of the education system related to the ability of 15 year old students in scientific literacy (Tomi, *et al* 2016). The assessment carried out by PISA is not only focused on the extent to which students have mastered the school curriculum, but also looks at the ability of students to use the knowledge and skills they have acquired in everyday life. The Organization for Economic Cooperation and Development (OECD) report shows that the scientific literacy ranking of Indonesian students in 2000 ranked 38th out of 41 countries, in 2003 it ranked 38th out of 40 countries, in 2006 it ranked 50th out of 57 countries, in 2009 it ranked 60th out of 65 countries, in 2012 it was 64th out of 65 countries, in 2015 it was 64th out of 72 participating countries. When compared to international averages, Indonesia's scientific literacy skills are still below average and in general the abilities of students in Indonesia are at the lowest stage of the PISA measurement scale, namely being able to explain simple concepts (Trisnowati, 2016). The assessment carried out by PISA is every three years, in which the assessment carried out by PISA is oriented towards the future (Toharuddin, 2011). in 2012 it was ranked 64th out of 65 countries, in 2015 it was ranked 64th out of 72 participating countries. When compared to international averages, Indonesia's scientific literacy skills are still below average and in general the abilities of students in Indonesia are at the lowest stage of the PISA measurement scale, namely being able to explain simple concepts (Trisnowati, 2016). The assessment carried out by PISA is every three years, in which the assessment carried out by PISA is oriented towards the future (Yudha, 2022). in 2012 it was ranked 64th out of 65 countries, in 2015 it was ranked 64th out of 72 participating countries. When compared to international averages, Indonesia's scientific literacy skills are still below average and in general the abilities of students in Indonesia are at the lowest stage of the PISA measurement scale, namely being able to explain simple concepts (Trisnowati, 2016). The assessment carried out by PISA is every three years, in which the assessment carried out by PISA is oriented towards the future [8]. Indonesian scientific literacy skills are still below average and in general the abilities of students in Indonesia are at the lowest stage of the PISA measurement scale, namely being able to explain simple concepts (Trisnowati, 2016). The assessment carried out by PISA is every three years, in which the assessment carried out by PISA is oriented towards the future (Toharuddin, 2011). Indonesia's scientific literacy skills are still below average and in general the abilities of students in Indonesia are at the lowest stage of the PISA measurement scale, namely being able to explain simple concepts (Trisnowati, 2016). The assessment carried out by PISA is every three years, in which the assessment carried out by PISA is oriented towards the future (Toharuddin, 2011).

Assessment is an important component in the learning process, including an assessment of the achievement of scientific literacy or chemical literacy. Most studies that identify chemical literacy are based on studies related to scientific literacy, as well as efforts to measure scientific literacy are highly dependent on research on scientific literacy (Rahayu, 2017). To categorize students' abilities in scientific literacy, Bybee proposes a framework consisting of four levels, namely: nominal literacy, functional literacy, conceptual literacy, and multidimensional literacy (Ardiansyah, 2016). Rodger W. Bybee in 1997 proposed a scientific literacy theoretical framework as an instrument development for assessing the level of scientific literacy of class X and class XI students.

The results of observations and interviews of researchers with one of the teachers in chemistry class XI MIPA (Mathematics and Natural Sciences), that at SMAN 1 Binjai Langkat Regency are still implementing the 2013 curriculum, and learning has implemented scientific literacy. However, learning scientific literacy is only on the aspect of conceptual knowledge, and does not refer to the theoretical framework from Bybee (1997) which consists of four dimensions namely, nominal literacy level, functional literacy, conceptual literacy, and multidimensional literacy. So that researchers are interested in analyzing students' scientific literacy based on the level of the theoretical framework.

According to Chairisa (2016), the material of the buffer solution system is one of the chemical materials that is often overlooked even though the buffer solution itself has an important role in human survival, both regarding the environment and everyday life so that the material of the buffer solution is certainly related to the meaning of scientific literacy itself. Easy buffer solution learning encourages students to make connections between the knowledge they have and its application in everyday life (Chairisa, 2016). So that the buffer solution material is very appropriate to be used to analyze students' scientific literacy using

the theoretical framework from Bybee (1997). Based on the description above, the researcher is interested in conducting research with the title "Scientific Literacy Analysis of Class XI Students on Buffer Solution Material at SMAN 1 Binjai, Langkat Regency". The purpose of this study was to determine the level of literacy skills of class XI students on buffer solution material at SMAN 1 Binjai, Langkat Regency.

Method

This research belongs to the type of survey research, with a cross-sectional survey design that is commonly used in education. In this study the researcher collected data at one time. This research was conducted in May 2023 even semester of the 2022/2023 academic year in class XI MIPA SMAN 1 Binjai, Langkat Regency. The subjects in this study were students of class XI MIPA at SMAN 1 Binjai, Langkat Regency, for the 2022/2023 academic year. The object of this research is the scientific literacy analysis of class XI students on the buffer solution material at SMAN 1 Binjai, Langkat Regency. The sampling technique used was purposive sampling. Purposive sampling is taking sample members from the population with certain considerations (Fatmawati, 2015). Selection of a group of subjects in purposive sampling, based on certain characteristics that are considered to have a close relationship with the population characteristics that have been known before (Margono, 2010). Things to consider in determining the sample in this study include; has implemented the 2013 curriculum, the learning process applies scientific literacy, as well as consideration of colloidal material, limited time, manpower, and funds so that it cannot take large and distant samples.

The data collection technique in this study consisted of (1) tests, the tests in this study were in the form of PISA scientific literacy-based essay questions, instruments that could be used to measure the dimensions of knowledge and dimensions of cognitive processes that have been put forward, namely instruments that refer to the revised Bloom's taxonomy (Nursa'adah, 2016). (2) interview, the researcher conducted a type of unstructured interview with students who had carried out the test. (3) Documentation. Documentation in this study is in the form of information documents about school profiles in the form of school conditions, number of students, as well as data that supports other research. The data analysis technique used is descriptive statistical analysis techniques, descriptive statistics are statistics whose level of work includes ways to collect, arrange or organize, process, present, and analyzing numerical data, in order to provide an orderly, concise, and clear description of a phenomenon, event or situation, so that certain meanings or meanings can be drawn. The percentage criteria for assessing students' scientific literacy abilities are summarized in Table 1.

Table 1. Criteria For The Percentage Of Students' Scientific Literacy Ability.

Average	Interpretation
80% - 100%	Very good
66% - 79%	Good
56% - 65%	Pretty good
40% - 55%	Not good
30% - 39%	Not very good

(Source: Ayuningtyas, 2015)

Results and Discussion

The results of the research conducted by researchers at SMAN 1 Binjai, Langkat Regency, by distributing test questions in the form of essay questions totaling 10 items representing each indicator, of the four indicators namely nominal literacy, functional literacy, conceptual literacy, and multidimensional literacy. After examining and processing data using Microsoft Excel, as well as assisted with manual calculations, the percentage of students' scientific literacy levels on the four indicators is shown in Table 2.

Table 2. Data On The Level Of Scientific Literacy

No	Indicator	Student Score
1	Nominal Literacy	83.33%
2	Functional Literacy	57.67%
3	Conceptual Literacy	59.07%
4	Multidimensional Literacy	28.49%
	Average	57.14%

The percentage of student scores in Table 2 is then interpreted with the percentage criteria for assessing students' scientific literacy abilities in Table 1, so that the category of students' scientific literacy level is known. The nominal literacy indicator with an average percentage obtained by students is 83.33% in the "very good" category. On the functional literacy indicator with an average percentage obtained by students of 57.67% in the "enough" category. On conceptual indicators with an average percentage of students of 59.07%, it is categorized as "enough". The multidimensional literacy indicator with an average percentage obtained by students is 28.49% in the "very poor" category. These results are in accordance with Abdul Haris Odja's research that most students for scientific literacy abilities are in the first category, namely nominal and only a small proportion at the multidimensional level (Odja, 2014). This is also supported by research conducted by Bybee in (Jack Holbrook and Miia Rannikmae, 2009), that at a nominal level students can recognize terms. But do not have a clear understanding of its meaning. At the functional level students can use scientific and technological vocabulary, but only out of context, for example on exams at school. At the conceptual level students demonstrate understanding and relationships between concepts and can use processes with meaning. At the multidimensional level students do not only have understanding. However, it has developed a science and technology perspective that includes the nature of science, the role of science and technology in personal and societal life. To see in detail the differences obtained from the research results in determining the level of scientific literacy of class XI MIPA 1 students can be seen in Figure 1 as follows.

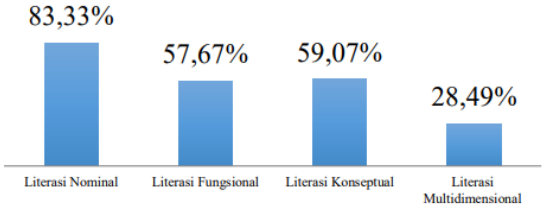

Figure 1. Overall Percentage Graph For Scientific Literacy Indicators

From Figure 1 it can be seen that the level of scientific literacy ability of class XI MIPA 1 students in colloid material is quite good. At the first level students get a score of 83.33%, the second level is 57.67%, the third level is 59.07%. At the fourth level, according to Koballa, he calls it true scientific literacy [8], class XI MIPA 1 students get a score of 28.49%. Descriptive statistical data obtained by students from various aspects including the mean, standard deviation, median, and mode obtained from the research results can be seen the differences in each indicator in Figure 2 below.

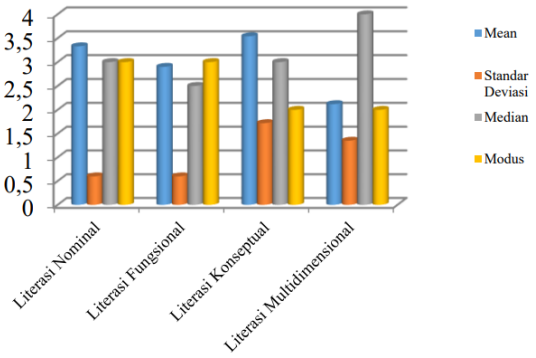

Figure 2. Graph Of Mean, Standard Deviation, Median, And Mode For Each Indicator Of Scientific Literacy

Figure 2 clearly shows the differences in the mean, standard deviation, median, and mode for each indicator of nominal literacy, functional literacy, conceptual literacy, and multidimensional literacy. In the nominal literacy indicator, the mean value is 3.33, the standard deviation value is 0.6, the median value is 3, and the mode value is 3. The functional literacy indicator has a mean value of 2.9, a standard deviation value of 0.6, the median value is 2.5, and the mode value is 3. Conceptual indicators mean value is 3.54, standard deviation value is 1.72, median value is 3, and mode value is 2. Multidimensional indicators mean value is 2.12, standard value the deviation is 1.35, the median value is 4, and the mode value is 2.

Table 3. Descriptive Statistical Data On Students' Scientific Literacy As A Whole

Indicator	Means	Standard Deviation	Median	mode	Student Score
Nominal Literacy	3,33	0.6	3	3	83.33%
Functional Literacy	2,9	0.6	2,5	3	57.67%
Conceptual Literacy	3.54	1.72	3	2	59.07%
Multidimensional Literacy	2,12	1.35	4	2	28.49%

Table 3 is descriptive statistical data for students' overall scientific literacy obtained by researchers after conducting research. Which are indicators of scientific literacy, mean, standard deviation, median, mode, and percentage of literacy skills. There are four indicators that become a reference for researchers in conducting research, including; nominal literacy, functional literacy, conceptual literacy, and multidimensional literacy.

Based on the results of the research, the researcher provides several recommendations for SMAN 1 Binjai Langkat Regency including: in literacy activities reading in the morning before studying, it is better to provide reading books about lessons, both content based and the context of the modern world (socio scientific themed books). For teachers in the field of chemistry studies, in the learning process they should use a variety of learning methods or models, and more often provide questions in chemistry learning based on PISA scientific literacy questions. For researchers who wish to follow up on research, they can use learning models or learning methods to improve students' scientific literacy abilities.

Conclusion

Based on the results of the study, the results showed that the scientific literacy ability of class XI MIPA 1 students on each achievement indicator that the average value of students' scientific literacy ability nominal literacy indicator was 83.33% in the "very good" category. The functional indicator is 57.67% in the "enough" category. The conceptual indicator is 59.07%, with the "enough" category. And the multidimensional indicator is 28.49% with the "very poor" category. The scientific literacy ability of class XI MIPA students of SMAN 1 Kampar is categorized as "sufficient", with an average percentage value of 57.14%.

References

Ardiansyah, Ahmad Ali Irfan et al. (2016). Analisis Literasi Sains Siswa Kelas XI IPA pada Materi Hukum Dasar Kimia di Jakarta Selatan. *Jurnal Kimia dan Pendidikan*. 1(2), hal.149-161.

Ayuningtyas, Rizki Samty. (2016). Profil Kompetensi Literasi Sains Siswa Berdasarkan The Programme for International Student Assesment (PISA) pada Konten Biologi (Kuasi Deskriptif Kelas IX SMP se-Kecamatan Kedaton di Bandar Lampung). *Skripsi*. Lampung: Universitas Lampung.

Chairisa, Nur et al. (2016). Perbedaan Literasi Ilmiah dan Hasil Belajar pada Materi Sistem Koloid antara Pembelajaran yang Menggunakan Model Inkuiri Terbimbing dengan Metode Ekperimen Riil dan Eksperimen Animasi. *Jurnal Inovasi Pendidikan Sains*. 7(2), hal. 156-175.

Citra, Desyrulla Affandy, et al. (2017). Penerapan Model Pembelajaran Inkuiri Terbimbing untuk Melatihkan Kemampuan Literasi Sains Siswa pada Materi Kesetimbangan Kimia Kelas XI SMAN I Manyar Gresik. *UNISA Journal of Chemistry Education*, 6(1), hal. 102- 110.

Fatmawati, Ida Nur, et al. (2015). Penerapan Levels of Inquiry untuk meningkatkan Literasi Sains Siswa SMP Tema Limbah dan Upaya Penanggulangannya. *EDUSAINS*. 7(2), hal. 151-159.

Hermita, Resty et al. (2016). Pengembangan Modul Berbasis Bounded Inquiry Laboratorium (LAB) untuk Meningkatkan Literasi Sains Dimensi Proses pada Materi Sistem Pencernaan Kelas XI. *Jurnal Inkuiri*. 5(2), hal. 94-107.

Holbrook, Jack, Miia Rannikmae. (2009). The Meaning of Scientific Literacy. *International Journal of Environmental & Scince Education*. 4(3), hal. 275-288.

Margono. (2010). *Metodologi Penelitian Pendidikan*. Jakarta: PT. Rineka Cipta.

Nursa'adah, Euis et al. (2016). Analisis Kemampuan Kognitif Mahasiswa pada Konsep Asam-Basa Menggunakan Tes Berdasarkan Taksonomi Bloom Revisi. *Jurnal Kimia dan Pendidikan*. 1(1), hal. 25-35.

Odja, Abdul Haris. (2014). Analisis Kemampuan Awal Literasi Sains Siswa pada Konsep IPA. *Seminar Nasional Kimia*, Surabaya, hal. 40-47.

Rahayu, Sri. (2017). Mengoptimalkan Aspek Literasi dalam Pembelajaran Kimia Abad 21. *Prosiding Seminar Nasional Kimia UNY 2017*. hal. 02.

Situmorang, Risya Pramana. (2016). Integrasi Literasi Sains Peserta Didik dalam Pembelajaran Sains, 32(1), hal. 49-56.

Toharuddin, Uus. (2011). *Membangun Literasi Sains Peserta Didik*. Bandung: Humaniora.

Tomi, *et al*. (2016). Kajian Kemampuan Siswa dalam Pembelajaran Kimia Ditinjau dari Literasi Sains PISA Kelas XII SMAN 1 Teluk Keramat. *Ar-Razi Jurnal Ilmiah*, 4(2), hal. 142-153.

Trisnowati, Eli. (2016). Model Keterpaduan Pembelajaran Sains dalam Kurikulum 2013. *Jurnal SPEKTR*. 2(2), hal. 20-27.

Wulandari, Nisa, et al. (2016). Analisis Kemampuan Literasi Sains pada Aspek Pengetahuan dan Kompetensi Sains Siswa SMP pada Materi Kalor. *EDUSAINS*, 8(1), hal. 66-773.

Yudha, S., Nurfajriani, N., & Silaban, R. (2022, December). Development of Android-Based Interactive Multimedia on Odd Semester Chemistry Materials for Class X SMA/MA. In *Proceedings of the 7th Annual International Seminar on Transformative Education and Educational Leadership, AISTEEL 2022, 20 September 2022, Medan, North Sumatera Province, Indonesia*.

Yudha, S., Saputra, O. A., Purwanto, R., & Nugraha, A. W. (2021). Analysis of Chemical Teaching Materials for Class X SMA / MA on The Discussion of The Role of Chemistry in Daily Life. *Jurnal Pendidikan Dan Pembelajaran Kimia*, *10*(3), 109–117. https://doi.org/10.23960/jppk.v10.i3.2021.11