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Analysis of Students' Scientific Literacy Ability in Solving HOTS-Based Chemistry Questions

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***Abstract**:* *Students' scientific literacy abilities are relatively low; apart from that, students are not yet accustomed to solving HOTS-based chemistry science literacy questions, especially in content, context, and science competency. This research aims to analyze the distribution of students' scientific literacy abilities in content, context, and competency. The instruments used are reasoned multiple-choice tests and essays. This research used quantitative descriptive research with a sample of all class XI Science students at SMA Negeri 2 Percut Sei Tuan for the 2023/2024 academic year. The results of data analysis show that the distribution of students' scientific literacy abilities in the content aspect is 71.33% in the content domain in the medium category, the procedural domain 57.11%, and the epistemic domain 56.99% in the low category. The distribution in the context aspect of the health domain was 66.08% in the medium category; the natural resources domain is 48.25%, and the environmental domain is 42.66%, which is in the deficient category. Moreover, the distribution in the domain competency aspect of explaining scientific phenomena is 55.13% in the low category; the domain of evaluating and designing investigations is 44.64%, and the domain of interpreting data and evidence scientifically is 46.68% in the deficient category.*

***Keywords**:* *scientific literacy; HOTS; content; context; competency*

INTRODUCTION

Scientific and technological literacy increased during the Independent Curriculum era. Declared that one of the skills that students need to have after learning about chemistry is the ability to apply the material to solve pertinent problems and modify chemical ideas—particularly the idea of reaction rates—to actual, life-related scenarios (Purba et al., 2024). Thus, the definition of scientific literacy is as follows: scientific literacy is the ability to recognize questions, find new information, explain scientific phenomena and make fact-based decisions, understand the nature of science, be aware of how science and technology affect the natural world , intellectual, and cultural environments, and have the motivation to become involved in and care about science-related issues (Jahro et al., 2024). Additionally, the development of group interaction skills, self-improvement via communicative methods, and the ability to show comprehensive thinking and effectively communicate ideas in social science problems all need scientific literacy (Pulungan & Simamora, 2024).

A person's scientific literacy ability is related to higher-order thinking skills (HOTS). HOTS is learning intended to prepare the 21st-century generation to have skills and abilities such as creativity, communication, critical thinking and problem-solving, and thinking processes that involve in-depth understanding as well as critical thought (Munthe & Suyanti, 2024). In December 2019 a student ability survey conducted by PISA (Programme for International Student Assesment) stated that Indonesia is a country that ranks 72nd out of 77 countries. During the survey conducted by PISA, Indonesia is always ranked in the last 10 (Az-Zahra & Darmana, 2024). The analysis's findings demonstrate that the majority of Indonesian students possess a limited understanding of science, which they can only use in certain circumstances.

Stating that a number of factors, such as teacher-centered learning, lack of positive attitudes towards science education, and a number of skills that respondents (students) dislike in terms of content, methods, and context, all contribute to the low level of scientific literacy of Indonesian students. Students cannot apply content to real-life situations because they tend to remember information more than understand it. Students are not forced to utilize reasoning while asking questions since the questions they are asked in school do not take the form of analytical inquiries. As a result, they are not used to reasoning and critical thinking (Fuadi et al., 2020).

Chemistry as a branch of science requires the presentation of facts obtained not only based on theory, but can also be applied in the learning process so that students can construct new knowledge (Hutabarat & Sinaga, 2024). One of the chemical materials studied in class XI SMA is acids and bases. The topic of acids and bases is conceptual, calculating and abstract, so effective learning strategies are needed so that they can provide experience and practice that can develop the development of students' competencies (Pardosi & Situmorang, 2024). This material is widely used daily and involves students' scientific literacy skills. Apart from that, the acid-base material meets the science content criteria, namely being relevant to real situations and contextual, so that it can measure the competencies measured by PISA (Sari et al., 2022). An overview of students' scientific literacy skills in responding to questions will be provided via a valid and reliable student scientific literacy assessment based on chemistry.

Based on the results of data analysis carried out by (Putri et al., 2022) entitled “Analysis Of Scientific Literacy Capability Of Chemistry Education Students At Tanjungpura University”, it demonstrates how proficient students are in scientific literacy, with an average of 39.62% in content knowledge and 26.38% in procedural knowledge and 23.33% in epistemic knowledge and competent in identifying scientific questions, as well as 26.38% in procedural knowledge and competent in explaining scientific phenomena. The results of the research (Latip et al., 2022) entitled Analysis of Students' Scientific Literacy Ability in Aspects of Science Competency in Introductory Physical Chemistry Lectures show: 1) Of the students who participated in the first part of the indicator of describing scientific phenomena, 14.71% understood, 44.12% somewhat understood, and 41.8% did not understand. In contrast, 52.94% of students in the indicator describing scientific phenomena part 2 category understood, 29.41% understood somewhat, and 17.65% did not grasp. 2) Of the students, 32.35% fell into the understanding group, 20.59% into the somewhat understood category, and 47.06% into the not understanding category when it came to planning and designing scientific research. 3) 61.76% of students in the indicator of evaluating data and scientific evidence part 1 were in the understanding group, 14.71% were in the somewhat understood category, and 23.53% were in the not understanding category. In contrast, 82.35% of respondents in the section 2 indication of analyzing data and scientific evidence understood, 5.88% understood somewhat, and 11.76% did not understand. These findings demonstrate the variability of students' scientific literacy skills across all indicators of scientific proficiency.

Based on the description above, there is an urgency for researchers to study research on scientific literacy abilities in the aspects of content, context, and competency for all class XI students. Given that no research has been conducted on the examination of scientific literacy skills in terms of competency, context, and content at SMA 2 Percut Sei Tuan, the problem formulation in this research is: how is the distribution of scientific literacy abilities in the content, context, and competency aspects of students in solving HOTS-based questions in Acid and Base material in Class XI Science at SMA Negeri 2 Percut Sei Tuan?

LITERATURE REVIEW

Literally, scientific literacy consists of two words: literatus, which means literacy, and scientia, which means having knowledge. Indonesia is one of the countries that participated in a literacy study conducted by the Program for International Student Assessment (PISA). However, based on the results of the PISA study, which is routinely carried out every three years, it was found that Indonesia's scientific literacy skills are still very low, as in Table 1.

Table 1. Indonesian science literacy values based on PISA study results

Year	Indonesian Average Value	Score Average PISA
2000	393	500
2003	395	500
2006	393	500
2009	383	500
2012	382	500
2015	403	500
2018	396	500

Source : (Yusmar & Fadilah, 2023)

Table 1 shows that students' literacy abilities have decreased every year. In the 2021 PISA (Program for International Student Assessment) scientific literacy assessment, Indonesian students received an average score of 383 and an average international score of 485, which is still far from the global average. This data shows that Indonesian students have very low scientific literacy, and the scores obtained have decreased from 2018 to 2021, with a score of 396 in 2018 and a score of 383 in 2021.

Scientific literacy was assessed through a Program for International Student Assessment (PISA) study from the Organization for Economic Cooperation and Development (OECD), where this research focused on the following aspects:

1. Aspects of the Science Context

According to the PISA assessment, the context domain includes personal, local/national, and global domains. The science context aspect includes issues regarding health, natural resources, the environment, dangers, science, and technology (Sutrisna, 2021). Table 2 explains the science context aspect.

Table 2. Aspects of the science context

Domain	Indicator
Personal	Know the important role of chemical knowledge in explaining everyday phenomena.
Local/National	Linking chemical innovation and social processes in responding to chemical issues.
Global	Uses chemical understanding to make decisions related to chemical issues.

2. Aspects of Science Content

The essential ideas required to comprehend natural events and alterations to the environment brought about by human activity are referred to as science content (Nofiana & Julianto, 2018). Table 3 explains these domains.

Table 3. Aspects of science content

Domain	Indicator
Content	• Explain factual knowledge. • Explain conceptual knowledge.
Procedural	• Plan experiments to prove chemical theories. • Able to identify issues to investigate.
Epistemic	• Explaining epistemic knowledge. • Using experimental results to explain a phenomenon.

3. Aspects of Science Competency

In the field of scientific competency, students must understand a number of fundamental ideas in order to understand changes brought about by human activity as well as some natural events. The definition of student processes is based on the student's capacity to apply scientific knowledge and comprehension, including the capacity to find, analyze, and apply scientific evidence (Sumarni et al., 2021). Table 4 displays the domains in the scientific competency element.

Table 4. Aspects of science competency

Domain	Indicator
Ability to Explain Scientific Phenomena	• Remembers and applies appropriate scientific knowledge. • Identify, use and create models of explanation and representation. • Make and justify correct predictions.
Evaluating and Designing Scientific Inquiry	• Identify questions explored in a scientific study. • Explain and evaluate how scientists ensure the reliability of data and the objectivity and generalisability of explanations.
Interpret Data and Evidence Scientifically	• Analyze and interpret data and draw appropriate conclusions. • Identify assumptions, evidence and reasoning in science-related texts. • Evaluate scientific arguments and evidence from various sources

METHODS

This research will be carried out at SMA Negeri 2 Percut Sei Tuan from March to May 2023/2024 academic year. This type of research uses descriptive qualitative methods, which aim to describe students' scientific literacy abilities in solving HOTS-based chemistry questions regarding content, context, and science competency. The sampling technique used in this research is total sampling, where the number of samples is the same as the population, which consists of four classes totalling 143.

The instruments used consist of reasoned multiple choice and essays by finding percentages in descriptive form. Meanwhile, if the student answers correctly, they will get a score of 4; if they answer something other than a total score but the concept is correct, they will get a score of 0 if they don't respond or answer incorrectly. The formula used is as follows:

$$N = \frac{\text{Score obtained}}{\text{Total score}} \text{ x } 100\%$$

From the results of the calculations, the formula above will produce a number in the form of a percentage. Criteria for scientific literacy abilities can be seen in Table 5.

Table 5. Criteria for scientific literacy ability

Intervals (%)	Criteria
86-100	Very high
76-85	High
60-75	Currently
55-59	Low
≤ 54	Very low

RESULT AND DISCUSSION

This research analyses students' scientific literacy abilities in content, context and competency. After the empirical test is completed, the next step is to evaluate the student's level of scientific literacy with the tools created. The results of students' scientific literacy level tests in solving HOTS-based chemistry questions are as follows:

1. Distribution of Science Content Aspects

The content or knowledge element is an understanding of the facts, concepts and hypotheses that constitute the basis of scientific knowledge. According to (Sutrisna, 2021), the fact that scientific literacy abilities are still below the average PISA completion score suggests that Indonesian students still struggle to comprehend science, particularly the applications of the information they have learned in daily life. Figure 1 shows the percentage of students' scientific literacy skills based on topic element indicators.

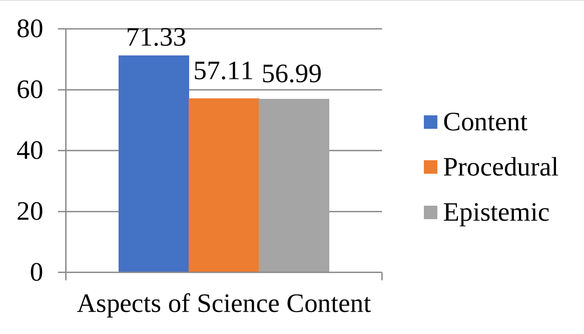

Figure 1. Content aspects of scientific literacy ability

According to the image above, the average percentage value of the results of scientific literacy abilities based on science content in the procedural domain is 57.11%, which is in the medium category; in the content domain, it is 71.33%, which is in the medium category; and in the epistemic domain, it is 56.99%, which is in the low category.

Based on the results of the scientific literacy test answers obtained by students in the content domain, they are classified as medium criteria. This is because students with content knowledge do not understand the writing of phases in chemical reactions from science content in question number 2. Apart from that, students cannot still provide reasons for analyzing the properties of solid acids, weak acids, strong bases, and weak bases based on science content. On question number 1.

The findings of the content domain analysis show that students are still unable to recognize questions that already exist, therefore their responses are not yet applicable to everyday situations. Students' understanding is still confined to the content delivered by the teacher. The questions that students usually work on are only questions that require rote knowledge obtained from textbook sources, so students are less able to build knowledge (Yusmar & Fadilah, 2023).

The procedural domain is classified as low. This is because students do not understand the calculation of the mass of a substance from the science content in question number 14. Also, students still experience difficulties calculating pH and pOH in science content in question 13. The results of students' calculations prove this. The division of square roots is incorrect, so the pH and pOH results obtained do not match the options. Students also do not understand how to determine pH trajectories from science content.

Based on the procedural domain questions tested on students, students' answers did not explore knowledge in identifying experimental variables, and students' scientific literacy skills in procedural knowledge were still not honed in calculations based on experimental data. The low aspect of procedural knowledge is caused by students rarely carrying out practical activities. According to (Jahro et al., 2021), practicum activities play an important role in chemistry learning because practicum activities are a means of carrying out scientific work, applying Science Process Skills (SPS), and developing Critical Thinking Skills (CTS), which are related to scientific literacy and curriculum. Apart from that, the practical implementation is expected to provide proof of the truth of the theory or concept that students have studied so that the theory or concept becomes more meaningful in their cognitive structure.

Based on the results of students' answers in the epistemic knowledge domain, students lacked understanding of theory so that the percentage obtained was also low. In questions number 9 and 16 which are part of the epistemic indicators regarding the material of calculating pH and pOH and relating the properties of a compound, however the answers given by students do not relate the calculation of pH and pOH to the nature of acids and bases and in question number 16 it is related to the analysis of the concept of acids and bases. According to experts, many students are confused by the choice regarding acid-base properties instead of the acid-base concept according to Bronsted-Lowry. Therefore, experts believe that pupils at SMA Negeri 2 Percut Sei Tuan lack epistemic knowledge in that they are less accurate in relating mathematical results to compound qualities and in understanding the idea of acids and bases.

Epistemic knowledge is the lowest percentage in the science content aspect. In the epistemic knowledge question, students' answers could not provide arguments accompanied by scientific reasons, so students' abilities in epistemic knowledge were still in the inferior category. This is because students are not yet accustomed to making hypotheses and drawing conclusions that support a scientific approach. Students should be accustomed to experimenting, not just theories, so they can study an event's aims and objectives, get a scientific explanation, and try to find a solution. According to (Rohmah & Hidayati, 2021), understanding the purposes served by scientific questions, observations, hypotheses, and arguments is a component of epistemic knowledge.

In line with the above, stated that there are many reasons why students' knowledge is still low. To improve students' science abilities by carrying out efficient activities. The facts obtained in the field differ significantly from the chemistry learning that should be carried out in school (Sari et al., 2022). Students' inability in the content aspect shows that they have not communicated their findings in writing. In actuality, the idea that knowledge is only a body of facts that has to be committed to memory still dominates education. Most students learn topics by heart and struggle to apply what they have learned to novel contexts.

2. Distribution of Science Context Aspects

The scientific context aspect is a dimension of scientific literacy that includes an understanding of situations related to the application of science in everyday life. It is used as material for applying processes and understanding scientific concepts. Figure 2 presents the percentage of students' scientific literacy abilities based on content aspect indicators.

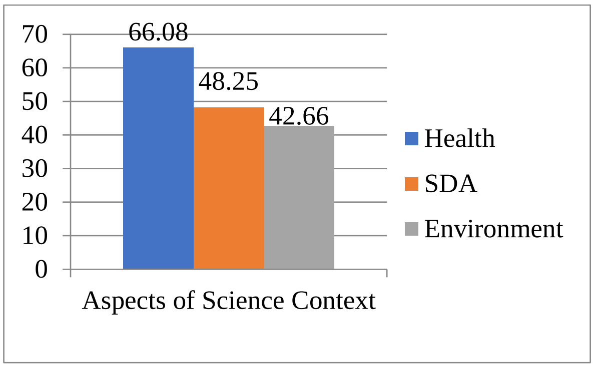

Figure 2. Context aspects of scientific literacy ability

Based on Figure 2, the average percentage value is 66.08% in the health domain and is classified as medium category. The average percentage value in the natural resource domain is 48.25%, classified as very low. And in the environmental domain, the average percentage value of 42.66% is meagre. This happens because most students answering the questions given are not able to connect the questions with the concept of acid-base knowledge they have; there are still many students who do not master sufficient vocabulary to answer questions, as seen from the students' short answers, students are still lacking in identifying questions students who rewrite the questions again. The literacy ability of students' scientific context aspects of the overall answers with the highest average value is the health domain, and the lowest is the environmental domain.

Regarding health issues, students' abilities in context aspects are classified as moderate. This is due to the inability to connect questions regarding the concept of acids and bases and health problems shown in question number 4. The short answers given by students show that students do not have sufficient vocabulary to answer questions and cannot identify problems related to the impact of carbonated drinks. The questions given and the student's answers do not have a close relationship because students in their daily learning do not directly observe the contents of carbonated drinks, so students lack interest in reading about diseases caused by carbonated drinks. According to research (Nofiana & Julianto, 2018) states that learning that links concepts with applicable contexts and is close to students' lives can make it easier for students to understand the concepts being studied so that memory for those concepts tends to be easy to remember and not easy to forget.

Students cannot be involved in acids and bases with natural resources, so they are categorized as very low. This is because students cannot answer questions about prevention methods and appropriate solutions regarding the impacts of acid rain on natural resources. They were shown in question number 12. Based on the answers given by students, their understanding still shows misconceptions; namely, the answers given are dissimilar to answers related to acids and bases in the agricultural context. This is because students still tend to use memorization methods when studying without understanding the concepts of the acid-base material. Students who can answer could be because the option they answered was correct. Still, the reason given was not accurate, or the information obtained regarding prevention caused by acid rain was not only received from books but could also be from books or the internet.

In the environmental domain, it is classified as a deficient category. This is because teachers rarely use the surrounding environment to increase students' knowledge of acid-base material. Students are not yet able to analyze the properties of detergent compounds and relate them to their function in daily life, as shown in question number 8. According to the responses provided, kids still don't seem to understand how detergents work with acids and bases, which they may utilize in daily life. This is likely because learning in schools is rarely done by direct observation. The research results (Huryah et al., 2019) determined that one of the things contributing to pupils' inadequate scientific literacy abilities is their unfamiliarity with working on analytical questions.

The low achievements obtained by students indicate that learning has not been linked to context. In learning the concepts, the teacher does not link them to the students' real daily lives. Low achievement of the context aspect also shows that students are less familiar with the context. Hence, they have difficulty connecting it with the content, so students cannot apply science in life, which is the basis for applying processes and understanding scientific concepts. The research results (Yuriza et al., 2018) determined that students' scientific literacy and higher-order thinking abilities (HOTS) are positively correlated; this implies that as students' thinking abilities grow, so will their literacy.

3. Distribution of Science Competency Aspects

A component of scientific literacy called competency refers to students' capacity to draw conclusions from scientific data (Sutrisna, 2021). Figure 3 shows the percentage of students' scientific literacy skills based on topic element indicators.

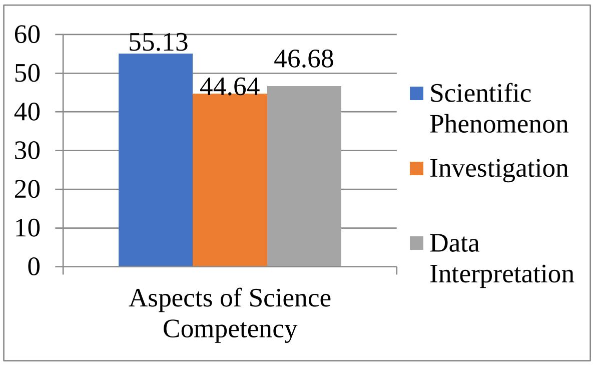

Figure 3. Scientific literacy ability aspects of competency

With an average percentage value of 55.13% in the area of describing scientific phenomena, the findings of scientific literacy abilities based on scientific competence fall into the poor group, as shown in Figure 4.3. It falls into the extremely low category when it comes to assessing and planning investigations, with an average percentage value of 44.64%. Furthermore, with an average percentage value of 46.68% in the area of scientific data and evidence interpretation, it falls into the extremely poor category.

Students performed poorly when it came to scientifically interpreting occurrences, according to the answers they provided on the scientific literacy test.

According to test findings for question number 5, some respondents were less successful in proving that shampoo is alkaline. Apart from that, in question number 7, students were less able to analyze the strength of the base based on the form of soap. In question number 18, students did not understand much about studying the nature of acids and bases and the strength of acids and bases based on scientific phenomena and interpreting substances that act as acids and bases and were unable to explain the concept of acids and bases, according to experts.

Students' scientific literacy skills in terms of competence in explaining scientific phenomena are relatively low, even though many students still answer the questions incorrectly. When working on questions, many students still use memory and memorize them. In contrast, the questions prepared follow the criteria of PISA, which require reasoning. Analysis therein, according to (Sutrisna, 2021), shows that this causes students to be unable to develop their thinking understanding. Apart from that, many students still find it difficult to relate science to the phenomena around them. This agrees with (Permatasari & Fitriza, 2019) in his research, who said that many students in Indonesia cannot relate the scientific knowledge they learn to phenomena that exist in the world because they don't gain the experience to relate to them. Students' understanding of acid-base material is still low because Chemistry teachers still completely use textbooks; this is confirmed by Stake & Easily (Fuadi et al., 2020), stating that textbooks are used by 90% of all teachers and 90% of the time allocated to learning. Students' hearts are not truly touched by information that solely depends on expertise from textbooks or texts, making it difficult for them to appreciate the material in real-world circumstances. One reason why students read questions in the form of lengthy texts so slowly is that they have little interest in reading.

When it comes to assessing and formulating scientific inquiries, it is ranked quite low. This is because students are less able to investigate the mass of science content and cannot provide appropriate reasons regarding the chosen option, as shown in question 11. Meanwhile, in question number 15, students are less able to design an investigation about a product from acid. And base, which explains the difference between soap products using soap using NaOH and KOH. Based on this, the achievement of competency in evaluating and designing scientific investigations is still meagre, namely a percentage of 44.64%. This student competency ability is caused by the use of models in learning, which makes students unable to develop, design and evaluate a scientific investigation. In line with research by (Sumarra et al., 2020), students will be passive in class during lessons if they rarely carry out investigations or practicums, and chemistry subjects will be considered theoretical lessons and only memorize them.

In the area of analyzing data and scientific evidence, this is still rather low. This is due to the fact that, as demonstrated by question number 10, students are unable to respond to inquiries about data analysis and inference from pre-existing issues. Students can comprehend an acid-base puzzle relating to weak bases in question number 17. The ability to interpret scientific data and evidence is still meagre because many students do not understand the questions presented, which makes many students unable to answer what is correct in the questions and form the questions are made in the form of reasoned multiple choices, which makes it difficult for students to express their critical thinking. Students cannot understand how to interpret data in chemistry lessons, especially in acid-base material.

Mastery of scientific literacy abilities is impacted by numerous aspects, including the science learning methodology or method utilized by teachers in developing learning ideas. Science process skills are thought to be developed via learning that can pique students' interest in the subjects they are studying and motivate them to solve the issues that the instructor presents. These abilities are a component of the scientific literacy competency factor. The practical method, which builds knowledge ideas by following the phases of the scientific method, is a teaching strategy appropriate for science classes. Understanding the nature of science is another aspect of scientific literacy, and it is related to scientific inquiry abilities such as planning experiments, gathering and evaluating data, and formulating conclusions based on empirical evidence (Niate & Djulia, 2022).

CONCLUSION

Students' scientific literacy abilities in the content aspect were 71.33% in the content domain in the medium category, 57.11% in the procedural domain, and 56.99% in the epistemic domain in the low category. The distribution in the context aspect of the health domain was 66.08% in the medium category; the natural resources domain is 48.25%, and the environmental domain is 42.66%, which is included in the poor category. Meanwhile, the distribution of domain competency aspects explaining scientific phenomena was 55.13% in the low category; the realm of assessment and investigation design was 44.64%, and the realm of scientific interpretation of data and evidence was 46.68% in the poor category. Thus, it can be said that there is still a relatively low distribution of students' scientific literacy skills in terms of content, context, and ability. In order to influence students' scientific literacy skills, it is believed that more study would be able to create learning techniques that are relevant to various components of scientific literacy.

REFERENCE

Az-Zahra, S. A., & Darmana, A. (2024). The Relationship of Religiosity with Students' Critical Thinking Skills on the Subject of Stoichiometry. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *5*(2), 163. https://doi.org/10.24114/jipk.v5i2.56227

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Sains Peserta Didik. *Jurnal Ilmiah Profesi Pendidikan*, *5*(2), 108–116. https://doi.org/https://doi.org/10.29303/jipp.v5i2.122

Huryah, F., Sumarmin, R., & Effendi, J. (2019). Analisis Capaian Literasi Sains Biologi Siswa Sma Kelas X Sekota Padang. *Jurnal Eksakta Pendidikan (Jep)*, *1*(2), 72–79. https://doi.org/10.24036/jep.v1i2.70

Hutabarat, C. M., & Sinaga, M. (2024). Implementation of an Integrated Guided Inquiry Learning Model in Generic Science Skills to Improve HOTS. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *6*(1), 59. https://doi.org/10.24114/jipk.v6i1.56467

Jahro, I. S., Darmana, A., & Sutiani, A. (2021). The Effectiveness of KAPRA Learning Model on Buffer Solution to improve Students' Critical Thinking Skills. *JTK (Jurnal Tadris Kimiya)*, *6*(1), 92–103. https://doi.org/https://doi.org/10.15575/jtk.v6i1.12495

Jahro, I. S., Sutiani, A., Suryani, S., & Nugraha, A. W. (2024). Improving Students' HOTs-Literacy Abilities Through Making Summaries at The End of Learning. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *6*(1), 153. https://doi.org/10.24114/jipk.v6i1.57484

Latip, A., Rahmaniar, A. R., Nuraini, N. L., & Intan, A. (2022). Analisis Kemampuan Literasi Sains Mahasiswa Pada Aspek Kompetensi Sains dalam Perkuliahan Pengenalan Kimia Fisika. *PSEJ (Pancasakti Science Education Journal)*, *7*(2), 68–75.

https://doi.org/10.24905/psej.v7i2.129

Munthe, S. P., & Suyanti, R. D. (2024). The Impact of the PBL Models Helping iSpring Presenters on Student HOTS Literacy on Reaction Rate. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *5*(2), 148. https://doi.org/10.24114/jipk.v5i2.56378

Niate, M., & Djulia, E. (2022). Profil Kemampuan Literasi Sains Kelas X pada Aspek Kompetensi Materi Vertebrata. *Biologi Edukasi: Jurnal Ilmiah Pendidikan Biologi*, *14*(2), 33–41. https://doi.org/10.24815/jbe.v14i2.29859

Nofiana, M., & Julianto, T. (2018). Upaya Peningkatan Literasi Sains Siswa Melalui Pembelajaran Berbasis Keunggulan Lokal. *Biosfer : Jurnal Tadris Biologi*, *9*(1), 24–35. https://doi.org/10.24042/biosf.v9i1.2876

Pardosi, I., & Situmorang, M. (2024). Implementation PhET Virtual Laboratory-Based Learning Media to Increase Learning Outcomes on Teaching of Acid-Base. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *6*(1), 111. https://doi.org/10.24114/jipk.v6i1.57330

Permatasari, P., & Fitriza, Z. (2019). Analisis Literasi Sains Siswa Madrasah Aliyah pada Aspek Konten, Konteks, dan Kompetensi Materi Larutan Penyangga. *EduKimia*, *1*(1), 53–59. https://doi.org/10.24036/ekj.v1i1.104087

Pulungan, E. N., & Simamora, K. F. (2024). Influence of Canva Media Based on Guided Inquiry Model on Students' Critical Thinking Ability and Chemical Literacy. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *6*(1), 100. https://doi.org/10.24114/jipk.v6i1.57379

Purba, M. I., Syahputra, R. A., Purba, J., Sutiani, A., & Silitonga, P. M. (2024). Analysis of Students' Learning Outcomes and Scientific Literacy Activities Using Guided Inquiry and Discovery Learning Models. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *5*(2), 102. https://doi.org/10.24114/jipk.v5i2.55908

Putri, T. R., Masriani, M., Rasmawan, R., Hairida, H., & Erlina, E. (2022). Analisis Kemampuan Literasi Sains Mahasiswa Pendidikan Kimia di Universitas Tanjungpura. *Jurnal IPA & Pembelajaran IPA*, *6*(2), 164–179. https://doi.org/10.24815/jipi.v6i2.25460

Rohmah, I. L., & Hidayati, S. N. (2021). Analisis literasi sains peserta didik SMPN 1 Gresik. *PENSA: E-Jurnal Pendidikan Sains*, *9*(3), 363–369. https://ejournal.unesa.ac.id/index.php/pensa

Sari, E. R., Haryadi S, E. F., & Lestari, N. (2022). Pembelajaran Kontekstual Untuk Melatih Kemampuan Literasi Sains Siswa. *QUANTUM: Jurnal Pembelajaran IPA Dan Aplikasinya*, *2*(1), 1–4. https://doi.org/10.46368/qjpia.v2i1.551

Sumarni, R., Soesilawati, S. A., & Sanjaya, Y. (2021). Science Literacy and Students' Mastery of Concept After Learning The Excretion System uses Scientific Literacy-Based Practicum Guidelines. *Assimilation: Indonesian Journal of Biology Educaton*, *4*(1), 32–36. https://doi.org/https://doi.org/10.17509/aijbe. v4i1.34824

Sumarra, M. Y., Wulan, A. R., & Nuraeni, E. (2020). Analisis Penggunaan Tes

Tertulis tentang Keterampilan Mengevaluasi dan Merancang Penyelidikan Ilmiah pada Matapelajaran IPA-Biologi SMP. *Jurnal Penelitian Pendidikan*, 20(1), 279–293. https://doi.org/10.17509/jpp.v20i2.24477

Sutrisna, N. (2021). Analisis kemampuan literasi sains peserta didik SMA di Kota Sungai Penuh. *Jurnal Inovasi Penelitian*, 1(12), 2683–2693. https://doi.org/https://dx.doi.org/10.47492/jip.v1i12.530

Yuriza, P. E., Adisyahputra, A., & Sigit, D. V. (2018). Hubungan Antara Kemampuan Berpikir Tingkat Tinggi dan Tingkat Kecerdasan dengan Kemampuan. *Biosfer*, *11*(1), 13–20. https://doi.org/http://dx.doi.org/10.24036/jep.v1i2.70

Yusmar, F., & Fadilah, R. E. (2023). Analisis Rendahnya Literasi Sains Peserta Didik Indonesia: Hasil Pisa Dan Faktor Penyebab. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *13*(1), 11–19. https://doi.org/10.24929/lensa.v13i1.283