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Profile of Junior High School Students' Scientific Literacy

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ABSTRACT

Objective: This research is a preliminary study that aims to describe the scientific literacy skills of junior high school students based on tests using questions with indicators of scientific literacy skills, according to PISA. **Method:** This research was quantitative descriptive analysis research that used 20 questions with indicators of scientific literacy skills to measure the level of students' scientific literacy skills. Data were collected using a purposive sampling technique to obtain a sample of 102 students from 3 schools in Banjarmasin. **Findings:** Based on the research results obtained from 102 students, 11 had scientific literacy skills at level 5 or with good criteria. Then, 29 students are at the level of scientific literacy skill level 4 with enough criteria. Furthermore, 37 students are at the level of scientific literacy skills level 3 with deficient criteria. Moreover, 25 students are still at the level of scientific literacy skills level 2 with low criteria. Based on the results of this study, it is necessary to have follow-up efforts and more attention from related teachers to focus more on developing students' scientific literacy skills in the future. **Novelty:** The research novelty was to explain each level of scientific literacy ability that students reach. Hopefully, these things will be more helpful for further research, because the data that is presented is not just about the percentage of the quantity number. However, it is already explained in more detail.

INTRODUCTION

The rapid development of science and technology in the 21st century requires humans to be more challenged to adapt in all areas of life. Education in the 21st century aims to train students to become individuals who are responsive and ready to adapt to various changes that occur on an ongoing basis (Sutrisna, 2021). Developments in the world related to technology and education are becoming faster and more complex. The faster this development aims to improve the quality of modern society. In the tough challenges that will be faced, there needs to be a paradigm shift in the education system to facilitate students in developing themselves to face every aspect of global life (Gultepe & Kilic, 2015).

Science education is essential in preparing individuals to face the times and achieve the competencies needed in various situations and conditions (Rini et al., 2020). Scientific literacy skills are one of the competencies in science education (Widowati, 2017). Scientific literacy skills are essential skills that must be trained to answer various challenges in the industrial era 4.0, especially in learning science which can interact directly with the phenomena of everyday life (Subekti et al., 2018; Ahmad, 2018). Science skills themselves are a factor that influences the competitiveness of students to face the latest information technology era, which causes competition between individuals to become more stringent (Ibda, 2018). This is also inseparable because scientific literacy skills can affect individual decision-making, participation, and one's productivity (Jamaluddin et al., 2018; Sharma & Buxton, 2015).

According to PISA, scientific literacy skills are the ability to use scientific information, identify scientific questions, and interpret evidence based on data inferences to conclude (OECD, 2019). Based on the latest PISA results, the scientific literacy abilities of students in Indonesia from 2006-2018 have always fluctuated, while the assessment conducted by PISA is carried out once every three years. The highest recorded score achieved by Indonesia in the PISA assessment occurred in 2015, with a score of 403, and was ranked 62 out of 69 participants. However, this score was still below the average score set by PISA, namely, 500. Based on the latest assessment in In 2018, Indonesia obtained a score of 396 and was ranked 71st out of 79 participants (OECD, 2019). Based on the data, there has been a decline in Indonesia's score from 2015 to 2018.

The scientific literacy skills of students in Indonesia still need to improve if we look at the data obtained from PISA. The factor that causes this to happen is that science learning in Indonesia is still too focused on mastering the learning materials, and it is still rare to emphasize the connection between science learning in schools and phenomena that occur in daily life (Argina, 2017; Chasanah et al., 2022). This is also coupled with the fact that there are still many science teachers who do not know how to create and develop questions with scientific literacy indicators as used by PISA, so they cannot practice similar questions to students (Sunandar et al., 2022; Widyasarai & Haryanto, 2022). On this issue, teachers should also be able to be more active in developing their abilities, where this is a challenge in itself to give more attention to the development of students' scientific literacy skills (Jufri, 2018; Sholahuddin et al., 2021).

The need for more awareness and attention from science teachers to develop and improve the quality of their abilities as an asset to develop students' scientific literacy skills in the future. These cannot be separated because they are connected (Jamaluddin et al., 2018; Fernandez, 2018). The teacher's scientific literacy skills to bring up scientific literacy-based learning are very much needed to develop scientific literacy because how can the teachers train the students to become literate if they still did not literate (Asyhari, 2017; Budiarti & Tanta, 2022). Science teachers are also expected to be able to measure students' scientific literacy skills regularly (Utami et al., 2022). In addition to knowing the level of students' scientific literacy skills, this is also useful for knowing the quality of learning that has been held so that the teacher concerned can also make plans ahead to make the learning process becomes way better than before (Rubini, 2016; Putra et al., 2016; Arrohman et al., 2022). This is reinforced by Kusumastuti (2019), who states that to improve scientific literacy skills, more meaningful scientific literacy learning is needed to achieve the expected learning objectives.

The recent research that was conducted to describe the student's scientific literacy level still shows that the students' scientific literacy level still needs to be higher and needs more attention for further research. Nopriadi et al. (2022), in their research in State SHS 1 and State SHS 2 Pujut, state that 51,46% of 103 students needed more scientific literacy. Meanwhile, Palennari et al. (2022) also found that there are still many students with very low scientific literacy. Based on their data from 272 students, 94 students still need to improve. Based on the instrument used, the students had a higher percentage of answering correctly questions explaining phenomena scientifically indicator, than the question about evaluating and designing scientific investigations and interpreting data and scientific evidence (Saputro, 2022; Bagasta et al., 2018).

Through the problems discussed above, scientific literacy skills in Indonesia must be given more attention and improvement in the future. To improve this, accurate and

relevant data is also needed to support the development of these literacy skills. Nevertheless, according to the recent preliminary research mentioned above, they mainly described the student's scientific literacy only by grouping them into students who met the minimum completeness criteria or those who did not meet those minimum completeness criteria or by using the percentage. The author thinks it will be more helpful if the research about student scientific literacy is grouped based on students' levels. Based on this, the author wants to know the level of scientific literacy skills of grade 8 junior high school students in Banjarmasin. For the novelty of this research, the author will focus on describing the students' scientific literacy level in more detail using the scientific literacy level from PISA. Hopefully, in the end, the data presented can be used to research further to determine the treatment used to practice and develop students' scientific literacy. This research can also be used to reflect on the learning process going on so far.

RESEARCH METHOD

This preliminary research describes the findings in the analysis process that took place during the research without conducting hypothesis testing. Preliminary research is made to find the information researchers need to examine the problem appropriately. This study did not use any treatment, such as a control or experimental class. The results of this study will be used as material for consideration for further research objectives to improve the scientific literacy skills of junior high school students (Applebaum et al., 2018). This method intends to help develop the quality of further learning by developing effective learning designs to improve students' scientific literacy (Saraswati et al., 2021).

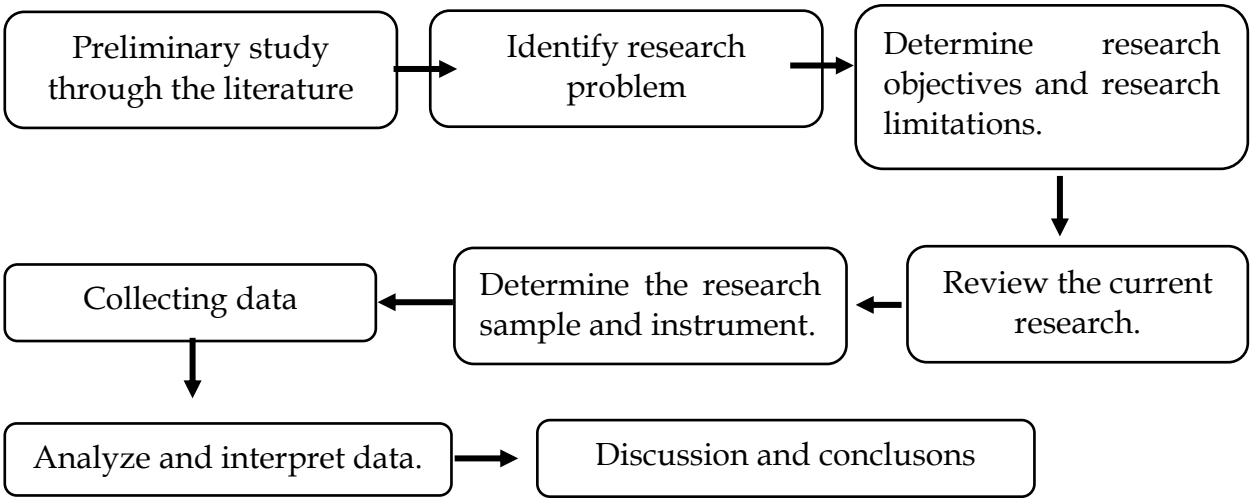

Figure 1. The research flowchart.

This study used a purposive sampling technique to obtain the necessary data, while this sampling technique is a sampling technique with specific considerations (Sugiyono, 2017). The samples in this study were 102 students of grade 8 junior high school who came from 3 classes from different schools. In this study, there were three schools, namely State JHS 2 Banjarmasin, State JHS 5 Banjarmasin, and State JHS 6 Banjarmasin, where from each school, there was a sample of 34 students.

This study uses scientific literacy questions to measure students' scientific literacy skills. The questions used are made based on PISA scientific literacy indicators, namely

1) explaining phenomena scientifically, 2) evaluating and designing scientific investigations, and 3) interpreting data and evidence scientifically (OECD, 2016). The questions used are 20, which consist of 4 different discussion topics adapted to the context of PISA scientific literacy and the science curriculum at school. The questions used have also been adjusted to the scope mentioned by PISA, namely personal, local/national, and global (OECD, 2016). The students who were sampled in this study were those who had studied these topics. The data obtained is then analyzed to determine the score and level of students' scientific literacy skills.

Analysis of scientific literacy tests is used to determine scores and levels of students' scientific literacy skills, which are measured by 1) giving value or score to each question with a different level. The value score is adapted from PISA, then 2) Determine the achievement score for each level using the scoring formula as follows:

$$Score = \sum \frac{Bi\ x\ bi}{St}\ x\ 100\%$$

Description:
B_i= the number of items answered correctly
b_i= the value of each item (adapted from PISA)
S_t= theoretical score

(Pravitasari et al., 2015)

By converting the scores contained in PISA and the research results obtained, the following range of scores and levels of scientific literacy skills of the 20 questions can be seen in Table 1.

Table 1. Students' scientific literacy level criteria.

Score Range	Scientific Literacy Level	Criteria
93.0 – 100.0	6	Very Good
73.0 – 92.0	5	Good
55.0 – 72.0	4	Enough
40.0 – 54.0	3	Deficient
14.0 – 39.0	2	Low
7.0 – 13.0	1a	Very Low
1.0 – 6.0	1b	Very Low

After calculating the score to determine the category of students' scientific literacy level, then assess each student's answer sheet. After that, proceed with determining the level of scientific literacy skills students have achieved using the Table 1. Each level has different abilities. To make the data more detailed, the author will use the PISA's explanation of each level's abilities to determine the limitations of students' abilities at each level.

RESULTS AND DISCUSSION

Results

This study used 20 essay questions that were designed based on indicators of PISA scientific literacy skills, namely 1) explaining phenomena scientifically, 2) evaluating or designing scientific investigations, and 3) interpreting data and evidence scientifically (OECD, 2016). Then, the student's answers were analyzed to determine their level of scientific literacy skills. Students will get a score of 5 if the answer is entirely correct, 2.5 if only partially correct, and 0 if the answer is incorrect or does not answer.

Based on the research results obtained from data from the three schools, results were found related to the level of scientific literacy skills. A few students still had scientific literacy skills in the suitable criteria. In contrast, the rest still had levels of scientific literacy skills classified as sufficient, lacking, to low, according to the criteria in Table 1. The recapitulation regarding student scores from the results of the scientific literacy tests that have been carried out can be seen in Table 2.

Table 2. The Recapitulation data from 102 students' scientific literacy test.

Category Score	Score
Highest Score	82.5
Lowest Score	25.0
Average Score	50.5

Based on the recapitulation results of the scores obtained, it is known that the highest score obtained from all students is 82.5. Then the lowest score obtained is 25.00, and the average score obtained from all students is 50.5. The next step is to determine the level of students' scientific literacy skills. The scores obtained by students are then grouped based on the score ranges in Table 1. Based on the grouping results, the results are shown in Figure 1.

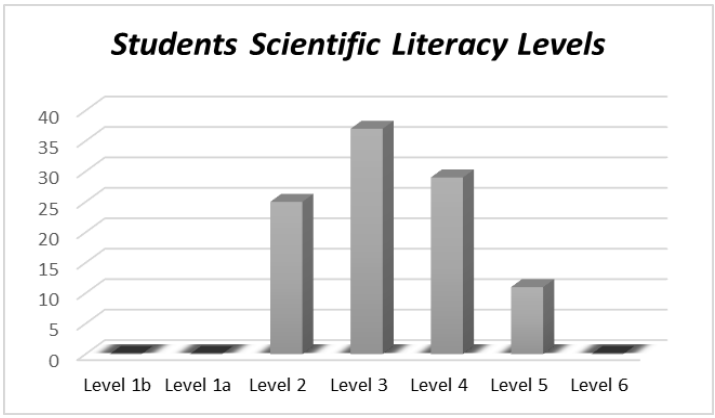

Figure 2. Students' scientific literacy levels.

Based on the results of grouping students based on their level of scientific literacy skills, as shown in the Figure 2, it is known that 25 students are still at level 2, then 37 students are still at level 3, then 29 students are at level 4. Meanwhile, only 11 students were at level 5 or good criteria. Based on the data obtained, students' scientific literacy skills in the three schools still need various efforts to improve them. To make it more detailed, we can use the description of each scientific literacy level's abilities from PISA.

Discussion

From the results after grouping the student's scientific literacy levels, we can find more details about the student's scientific literacy. PISA already explains students' scientific literacy abilities, specifically at each level. It can be used to determine the limitations of students' abilities at each level. It can be seen in Table 3.

Table 3. PISA description on each scientific literacy level.

Scientific Literacy Level	Description
Level 1b	Students can use basic or everyday scientific knowledge to recognize familiar aspects or simple phenomena at this level. They can identify simple patterns in data, recognize basic scientific terms and follow explicit instructions to carry out scientific procedures.
Level 1a	At this level, students can use primary procedural content or knowledge in everyday life to recognize or identify explanations of simple scientific phenomena.
Level 2	At this level, students can utilize everyday content and basic procedural knowledge to identify and explain scientifically, interpret data, and identify questions being discussed in a simple design.
Level 3	At this level, students can utilize content knowledge that is quite complex to identify or build relevant explanations about phenomena in less familiar or more complex situations.
Level 4	At this level, students can use complex content knowledge to build explanations of events and phenomena that are less familiar.
Level 5	At this level, students can use abstract scientific ideas or concepts to explain unknown and complex phenomena, events, and processes that involve more causal relationships.
Level 6	At this level, students can draw on interrelated scientific ideas and concepts from the physical, life, and earth sciences and use content, procedural, and epistemic knowledge to offer explanatory hypotheses of new scientific phenomena, events, and processes or to make predictions.

(OECD, 2016)

PISA explains that at level 2, students can utilize everyday content knowledge and basic procedural knowledge to identify and explain scientifically, interpret data, and identify questions being discussed in a simple design (OECD, 2016). Research findings show that 25 students are still at level 2, 37 students are still at level 3, and 29 students are at level 4. Meanwhile, only 11 students are at level 5 or good criteria. This aligns with the findings obtained based on students' answers at that level, where they can already explain phenomena scientifically and identify questions in a simple experimental design.

The students must still build their knowledge to explain the phenomena or problems stated in the question (Rohmah & Hidayati, 2021; Mellyzar et al., 2022). Even so, students at this level still need help to answer questions with more complex phenomena. For example, this research can be seen when they are asked to explain the phenomena of solar and lunar tides due to the earth and moon's revolution and rotation motion. The other example from further research can be seen when the students are asked to explain basic terms and concepts of science in daily life (Selamet et al., 2021; Yanti et al., 2020).

Meanwhile, at level 3, PISA explains that at this level, students can utilize content knowledge that is quite complex to identify or build relevant explanations about phenomena in less familiar or more complex situations (OECD, 2016). This is related to the following data obtained from students at this level, where they can already use various concepts to build an explanation or argument relevant to the problem (Subaidah et al., 2019). In this research, it can be seen when the students are asked to

explain a problem related to environmental pollution caused by coal mining activities. In the other research example, the students are asked to explain fluid dynamics (Sabrina et al., 2021).

Furthermore, at level 4, PISA explains that students at this level can use complex content knowledge to build explanations of events and phenomena that are less familiar (OECD, 2016). Based on the results obtained from this research on students at this level, when they are asked to make an explanation or argument from phenomena that are rarely encountered in everyday life, they can already use these concepts to construct an explanation of phenomena or events that they rarely encountered before. In this research, it can be seen when they are asked to explain the questions related to technology used in the field of astronomy or questions related to environmentally friendly technology. Nevertheless, students at this level still had difficulty using their explanation to conclude the phenomena or problems in daily life that they are still not familiar with that involve causal effects on it (Harlina et al., 2020), another example of a question that can involve causal effects such as to identify the transmission of covid-19 & explanation about the ways to avoid covid-19 in pandemic era (Purnomo et al., 2021).

At level 5, PISA explains that students at this level can use abstract scientific ideas or concepts to explain unknown and complex phenomena, events, and processes that involve more causal relationships (OECD, 2016). Since there are not many students who are at this level, there is a big difference between them when answering questions that require them to evaluate information to provide an argument in building an explanation or when they are asked to interpret data from graphics or other information there is much causal effect in it (Mijaya et al., 2019). Data from the use of non-environmentally friendly technology in everyday life can affect the future condition of the earth, for example, in other research, such as how to deal with the people who suffered COVID-19 or interpret the valid sources of information about covid-19 (Purnomo et al., 2021). Examples in this research, such as graphic data related to carbon gas emissions and their impact on global warming, then the data related to the planet's distance from the sun affects the time of revolution and surface temperature. The student at the high level also needs to practice consistently to maintain their levels. If it is not, then it can be caused them to get lower levels in the future (Maulina et al., 2022; Subaidah et al., 2019; Yanti et al., 2020).

Based on the findings in this study, the scientific literacy skills of students from these three schools require efforts to improve so that they can become better in the future. The findings also explain that various factors can cause the students' low scientific literacy skills. According to research conducted by (Saraswati, 2021; Merta et al., 2020; Andriani et al., 2021), one of the factors that can cause this to happen is textbooks that need to be more optimal to train students' scientific literacy skills. Moreover, students also feel that textbooks are less attractive (Suprapto et al., 2022). This was reinforced by Dhitareka et al. (2022) in their research, explaining that Indonesian science textbooks have a lot of science learning material. However, in terms of the quality of the content, it still needs to be improved.

According to Kelana & Pratama (2019), to train students' scientific literacy, teaching materials are needed that meet the characteristics of indicators of scientific literacy-based teaching materials. Pursitasari et al. (2020) state the characteristics of literacy-based teaching materials, which contain four indicators of scientific literacy-based teaching materials according to Chiapetta et al. (1991), namely 1) science as the body of knowledge, 2) science as a way of investigating, 3) science as a way of thinking, and 4)

the interaction of science, technology, and society, is effective for improving students' scientific literacy skills.

Teaching materials and students must be trained using scientific literacy-based questions to develop their scientific literacy skills. The current problem is that the average scientific literacy skills of Indonesian students are low based on PISA results because they have never been trained with questions similar to these PISA questions (Hasasiyah et al., 2019). One of the efforts to improve students' scientific literacy skills is by getting them used to answering questions based on scientific literacy. The more familiar they are with these types of questions, the more honed their ability to understand and interpret questions with these indicators of scientific literacy (Arrohman et al., 2022). Because of this, science teachers need to understand how to create and develop questions based on indicators of scientific literacy before being able to train them on their students (Azizah et al., 2022).

However, learning models are crucial in education. The use of learning models presented by the teacher during the learning process can also affect students' scientific literacy skills (Agustina et al., 2020; Lestari et al., 2021). Scientific literacy skills, according to PISA, require three types of scientific knowledge, namely in the form of personal, local, and global contexts (Fakhriyah et al., 2017; Utami et al., 2022). So it is necessary to have learning that can connect scientific problems, such as identifying, analyzing, and making conclusions on phenomena that occur in everyday life to be able to improve students' scientific literacy skills (Winarni, 2019; Alvina et al., 2022; Budiarti & Tanta, 2022). Contextual learning is one way that can train students to develop their scientific literacy skills, where learning can raise various science contexts as well as issues or problems that exist in the surrounding environment. In this way, students can be trained to connect classroom learning and everyday phenomena to produce more meaningful learning (Shohib, 2021; Wasis et al., 2020; Hafizah & Nurhaliza, 2021).

CONCLUSION

Fundamental finding: Based on research data obtained at State JHS 2, State JHS 5, and State JHS 6 Banjarmasin, it can be concluded that students' scientific literacy skills still need to improve. This can be seen from 102 students. Only 11 students have scientific literacy skills at level 5 and reach the minimum completeness criteria (75). Meanwhile, the rest of the students still need improvement in their scientific literacy to reach those criteria. **Implication:** Several factors can cause students' literacy skills to be low, such as the textbooks used do not facilitate students' need for content based on indicators of scientific literacy. Then, students have never been trained to answer questions with scientific literacy indicators as used by PISA. This causes them to be unfamiliar with similar questions, so they still need help. As well as the selection of learning models can also affect the level of scientific literacy skills of these students. There needs to be attention in the future to improve students' scientific literacy skills. This is also a challenge for future researchers to be able to participate directly in this effort. **Limitation:** This research is limited only to describing the scientific literacy skills of junior high school students based on tests using questions with indicators of scientific literacy skills according to PISA on each level that students reach. **Further Research:** For further research, this research findings can be beneficial to the other author to determine the treatment that must be done for facilitating the students to develop their scientific literacy and to train them to get better scores.

REFERENCES

Agustina, I. R., Andinasari, A., & Lia, L. (2020). Kemampuan literasi sains pada materi zat melalui model pembelajaran inkuiri terbimbing berbantuan multimedia. *JPF: Jurnal Pendidikan Fisika, 8*(1), 1-10. http://doi.org/10.24127/jpf.v8i1.2491

Ahmad, I. (2018). *Proses pembelajaran digital dalam era revolusi industri 4.0*. Kemenristek Dikti.

Alvina, S., Mellyzar, M., Zahara, S. R., Masrina, M., & Afrianti, S. (2022). The influence of POGIL and MFI models on science literacy and science process skills for junior high school. *Jurnal Penelitian Pendidikan IPA, 8*(4), 2201-2209. https://doi.org/10.29303/jppipa.v8i4.2121

Andriani, S., Sukarmin, S., & Masykuri, M. (2021). Development of electronic modules (e-modules) based on guided inquiry on temperature and heat materials to improve students' science literacy. *Jurnal Penelitian Pendidikan IPA, 7*, 281-287. https://doi.org/10.29303/jppipa.v7iSpecialIssue.1234

Appelbaum, M., Cooper, H., Kline, R. B., Mayo-wilson, E., Nezu, A. M., Rao, S. M., & Clinic, C. (2018). Journal article reporting standards for quantitative research in psychology: The APA publications and communications board task force report. *American Psychologist, 73*(1), 3-25. https://doi.org/10.1037/amp0000191

Argina, W. A., Delsi, M., Nur, I., & Setiawan, R. (2017). Indonesian PISA result: What factors and what should be fixed. *The 1st Education and Language International Conference Proceedings Center for International Language Development of Unissula*, 69-79.

Arrohman, D. A., Wahyuni, A. L. E., Wilujeng, I., & Suyanta, S. (2022). Implementasi penggunaan LKPD pencemaran air berbasis STEM dan model learning cycle 6E terhadap kemampuan literasi sains. *Jurnal Pendidikan Sains Indonesia*, *10*(2), 279-293. https://doi.org/10.24815/jpsi.v10i2.23584

Asyhari, A. (2017). Literasi sains berbasis nilai-nilai islam dan budaya indonesia. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni, 6*(1), 137-148. https://doi.org/10.24042/jipfalbiruni.v6i1.1584

Azizah, N., Suryanti, S., & Suprapto, N. (2022). Apollo and comet media design to practice science literacy for elementary school students. *Al-Ishlah: Jurnal Pendidikan*, *14*(2), 2019-2030. http://dx.doi.org/10.35445/alishlah.v14i2.2146

Bagasta, A. R., Rahmawati, D., Wahyuni, I. P., & Prayitno, B. A. (2018). Profil kemampuan literasi sains peserta didik di salah satu SMA negeri kota sragen. *Pedagogia: Jurnal Pendidikan*, *7*(2), 121-129. https://doi.org/10.21070/pedagogia.v7i2.1551

Budiarti, I. S., & Tanta, T. (2022). Analysis of students' scientific literacy of newton's law and motion system in living things. *Jurnal Pendidikan Sains Indonesia, 9*(1), 36-51. http://dx.doi.org/10.24815/jpsi.v9i1.18470

Chasanah, N., Widodo, W., & Suprapto, N. (2022). Pengembangan instrumen asesmen literasi sains untuk mendeskripsikan profil peserta didik. *PENDIPA Journal of Science Education*, *6*(2), 474-483. https://doi.org/10.33369/pendipa.6.2.474-483

Chiappetta, E. L., Fillman, D. A., & Sethna, G. H. (1991). A method to quantify major themes of scientific literacy in science textbooks. *Journal of Research Science Teaching*, *28*(8), 713–725. https://doi.org/10.1002/tea.3660280808

Dhitareka, P. H., Hidayat, A., & Siahaan, P. (2022). Comparison of nature of science profile in indonesia, malaysia, and singapore secondary science textbooks: Case of electricity lesson. *Jurnal Penelitian Pendidikan IPA*, *8*(5), 2299–2306. https://doi.org/10.29303/jppipa.v8i5.1878

Fakhriyah, F., Masfuah, S., Roysa, M., Rusilowati, A., & Rahayu, E. S. (2017). Students' science literacy in the aspect of content science. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 81–87. https://doi.org/10.15294/jpii.v6i1.7245

Fernández, M. B. (2018). Framing teacher education: Conceptions of teaching, teacher education, and justice in chilean national policies. *Education Policy Analysis Archives*, *26*(34), 1-37. http://dx.doi.org/10.14507/epaa.26.2806

Gultepe, N., & Kilic, Z. (2015). Effect of scientific argumentation on the development of scientific process skills in the context of teaching chemistry. *International Journal of Environmental and Science Education, 10*(1), 111-132. http://doi.org/10.12973/ijese.2015.234a

Hafizah, E., & Nurhaliza, S. (2021). Implementasi problem based learning (PBL) terhadap kemampuan literasi sains siswa. *Quantum: Jurnal Inovasi Pendidikan Sains, 12*(1), 1-11. https://doi.org/10.20527/quantum.v12i1.9497

Harlina, H., Ramlawati, R., & Rusli, M. A. (2020). Deskripsi kemampuan literasi sains peserta didik kelas IX SMPN 3 makassar. *Jurnal IPA Terpadu*, *3*(2), 96-107. https://doi.org/10.35580/ipaterpadu.v3i2.12320

Hasasiyah, S. H., Hutomo, B. A., Subali, B., & Marwoto, P. (2019). Analisis kemampuan literasi sains siswa SMP pada materi sirkulasi darah. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 5-11. https://doi.org/10.29303/jppipa.v6i1.193

Ibda, H. (2018). Penguatan literasi baru pada guru madrasah ibtidaiyah dalam menjawab tantangan era revolusi industri 4.0. *JRTIE: Journal of Research and Thought of Islamic Education*, *1*(1), 1-21. https://doi.org/10.24260/jrtie.v1i1.1064

Imanda, R., Zahara, S. R., & Alvina, S. (2022). Development of assessment sheet for measuring students' scientific literacy level in the era of revolution 4.0. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1096–1101. https://doi.org/10.29303/jppipa.v8i3.1169

Jamaluddin, J., Jufri, A. W., Ramdhani, A., & Azizah, A. (2019). Profil literasi sains dan keterampilan berpikir kritis pendidikan IPA SMP. *Jurnal Penelitian Pendidikan IPA (JPPIPA), 5*(1), 120-131. https://doi.org/10.29303/jppipa.v5i1.185

Jufri, A. W. (2018). Peningkatan kompetensi guru IPA kota mataram dalam memfasilitasi penguasaan keterampilan abad ke 21 siswa SMP. *Jurnal Pengabdian Magister Pendidikan IPA, 1*(1), 1-6. https://doi.org/10.29303/jpmpi.v1i1.207

Kelana, J. B., & Pratama, D. F. (2019). *Bahan ajar IPA berbasis literasi sains*. Lekkas.

Kusumastuti, F. A., Rombot, O., & Ariesta, F. W. (2019). The effect of stem integration on primary school students' scientific literacy. *International Journal of Scientific and Technology Research*, *8*(12), 1551–1553.

Lestari, S., Indrowati, M., & Sari, D. P. (2021). Pengaruh model pembelajaran PLGI terhadap kompetensi literasi sains ditinjau dari kemampuan akademik. *Jurnal Inovasi Pendidikan IPA*, *7*(1), 61-73. http://dx.doi.org/10.21831/jipi.v7i1.29845

Maulina, D., Widyastuti, W., Maulina, H., & Mayasari, S. (2022). Kajian faktor intrinsik dan kemampuan literasi sains siswa SMP di kota banda lampung. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *12*(1), 1-8. https://doi.org/10.24929/lensa.v12i1.201

Mellyzar, M., Zahara, S. R., & Alvina, S. (2022). Literasi sains dalam pembelajaran sains siswa SMP. *Pendekar: Jurnal Pendidikan Berkarakter, 5*(2), 119-124. https://doi.org/10.31764/pendekar.v5i2.10097

Merta, I. W., Artayasa, I. P., Kusmiyati, K., Lestari, N., & Setiadi, D. (2020). Profil literasi sains dan model pembelajaran dapat meningkatkan kemampuan literasi sains. *Jurnal PIJAR MIPA*, *15*(3), 223-228. http://doi.org/10.29303/jpm.v15i3.1889

Mijaya, N. P. A. P., Sudiatmika, A. A. I. A. R., & Slamet, K. (2019). Profile literasi sains siswa SMP melalui model pembelajaran levels of inquiry. *Jurnal Pendidikan dan Pembelajaran Sains Indonesia*, *2*(2), 161-171. https://doi.org/10.23887/jppsi.v2i2.19385

Nopriadi, M. N., Andayani, Y., & Hadisaputra, S. (2022). Analisis literasi sains peserta didik melalui pendekatan etnopedagogi pada pembelajaran kimia. *Journal of Classroom Action Research, 4*(3), 98-102. https://doi.org/10.29303/jcar.v4i3.2669

OECD. (2016). *PISA 2015 results in focus: What 15-year-olds know and what they can do with what they know*. Columbia University.

OECD. (2019). *PISA 2018 results in focus: What 15-year-olds know and what they can do with what they know*. Columbia University.

Palennari, M., Safitri, A. N., & Arifin, A. N. (2022). Profil keterampilan literasi sains peserta didik di SMA negeri kabupaten pinrang. *Jurnal Nalar Pendidikan, 10*(1), 8-14. https://doi.org/10.26858/jnp.v10i1.33114

Pravitasari, O. T., Widodo, W., & Purnomo, T. (2015). Pengembangan media pembelajaran blog berorientasi literasi sains pada sub materi perpindahan kalor. *PENSA: E-jurnal Pendidikan Sains, 3*(3), 1-15.

Purnomo, A. B., Sudibyo, E., Budiyanto, M., Sari, D. A. P., & Sabtiawan, W. B. (2021). Scientific literacy of COVID-19 in the first year pandemic: Design and development test. *Jurnal Penelitian Pendidikan IPA, 6*(1), 48-55. https://doi.org/10.26740/jppipa.v6n1.p48-55

Pursitasari, D. I., Ardianto, D., Kurniasih, S., & Hidayat, I. (2020). How to develop teaching material to promote student's scientific literacy through blended learning at junior high school. *Journal of Education and Practice*, *11*(17), 46-55. https://doi.org/10.7176/JEP/11-17-05

Putra, M. I. S., Widodo, W., & Jatmiko, B. (2016). The development of guided inquiry science learning materials to improve science literacy skills of prospective MI teachers. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 83-93. https://doi.org/10.15294/jpii.v5i1.5794

Rini, C. P., Hartantri, S. D., & Amaliyah, A. (2021). Analisis kemampuan literasi sains pada aspek kompetensi mahasiswa PGSD FKIP universitas muhammadiyah tangerang. *Jurnal Pendidikan Dasar Nusantara, 6*(2), 166-179. https://doi.org/10.29407/jpdn.v6i2.15320a

Rohmah, I. L., & Hidayati S. N. (2021). Analisis literasi sains peserta didik SMPN 1 gresik. *PENSA E-Jurnal Pendidikan Sains*, *9*(3), 363-369.

Rubini, B., Ardianto, D., Pursitasari, I. D., & Permana, I. (2016). Identify scientific literacy from the science teachers' perspective. *Jurnal Pendidikan IPA Indonesia, 5*(2), 299–303. https://doi.org/10.15294/jpii.v5i2.7689

Sabrina, F., Rachmadiarti, F., & Sunarti, T. (2021). Analysis of scientific literacy of senior high school students on fluid dynamics. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *11*(1), 40–51. https://doi.org/10.26740/jpps.v11n1.p40-51

Saputro, V. C. E. (2022). Analisis kemampuan literasi sains biologi peserta didik madrasah aliyah jabal noer sidoarjo. *ALLIMNA: Jurnal Pendidikan Profesi Guru, 1*(2), 21-34. https://doi.org/10.30762/allimna.v1i2.696

Saraswati, Y., Indana, S., & Sudibyo, E. (2021). Science literacy profile of junior high school students based on knowledge, competences, cognitive, and context aspects. *International Journal of Recent Educational Research (IJORER), 2*(3), 329-341. https://doi.org/10.46245/ijorer.v2i3.118

Selamet, K., Sarini, P., & Suardana, I. N. (2021). Literasi sains awal calon guru pada bidang IPA berkonteks isu-isu sosiosaintifik. *Jurna IPA Terpadu, 5*(1), 42-53. https://doi.org/10.35580/ipaterpadu.v5i1.22702

Sharma, A., & Buxton, C. A. (2015). Human-nature relationships in school science: A critical discourse analysis of a middle-grade science textbook. *Science Education*, *99*(2), 260–281. https://doi.org/10.1002/sce.21147

Shohib, M., Rahayu, S., Wasis, W., & Hariyono, E. (2021). Scientific literacy ability of junior high school students on static electricity and electricity in living things. *IJORER: International Journal of Recent Educational Research, 2*(6), 700-708. https://doi.org/10.46245/ijorer.v2i6.170

Sholahuddin, A., Susilowati, A., Prahani, B. K., & Erman, E. (2021). Using a cognitive style-based learning strategy to improve students' environmental knowledge and scientific literacy. *International Journal of Instruction*, *14*(4), 792-808. https://doi.org/10.29333/iji.2021.14445a

Subaidah, T., Muharrami, L. K., Rosidi, I., & Ahied, M. (2019). Analisis kemampuan literasi sains pada aspek konteks dan knowledge menggunakan cooperative problem solving (CPS) dengan strategi heuristik. *Natural Science Education Research*, *2*(2), 113-122. https://doi.org/10.21107/nser.v2i2.6238

Subekti, H., Taufiq, M., Susilo, H., Ibrohim, I., & Suwono, H. (2018). Mengembangkan literasi informasi melalui belajar berbasis kehidupan terintegrasi STEM untuk menyiapkan calon guru sains dalam menghadapi era revolusi industri 4.0: Review literatur. *Education and Human Development Journal*, *3*(1), 81–90. http://dx.doi.org/10.33086/ehdj.v3i1.90

Sugiyono, S. (2017). *Metode penelitian kuantitatif, kualitatif, R & D*. Alfabeta

Sunandar, A., Srihanaty, S., & Rahayu, H. M. (2022). Scientific literacy skills of state high school students in singkawang city. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 767–772. https://doi.org/10.29303/jppipa.v8i2.1350

Suprapto, N., Tafauliyati, T., & Yanti, V. K. (2022). Development of e-book with flip PDF professional based on scientific literacy. *TEM Journal*, *11*(2), 851-855. http://dx.doi.org/10.18421/TEM112-44

Sutrisna, N. (2021). Analisis kemampuan literasi sains peserta didik SMA di kota sungai penuh. *Jurnal Inovasi Penelitianitian, 1*(12), 2683-2694. https://doi.org/10.47492/jip.v1i12.530

Utami, S. H. A., Marwoto, P., & Sumarni, W. (2022). Analisis kemampuan literasi sains pada siswa sekolah dasar ditinjau dari aspek konten, proses, dan konteks sains. *Jurnal Pendidikan Sains Indonesia*, *10*(2), 380-390. https://doi.org/10.24815/jpsi.v10i2.23802

Wasis, W., Rahayu, S. Y., Sunarti, T., & Indana, S. (2020). *HOTs dan literasi sains: Konsep, pembelajaran, dan penilaiannya.* Kun Fayakun.

Widowati, A., Widodo, E., & Anjarsari, P. (2017). The development of scientific literacy through nature of science (NoS) within inquiry based learning approach. *IOP Conference Series: Journal of Physics, 909*, 1-7. https://doi.org/10.1088/1742-6596/909/1/012067

Widyasari, A., & Haryanto, H. (2022). Analysis of students' initial scientific literacy of science in elementary school teacher education student. *Jurnal Inovasi Pendidikan IPA*, *8*(1), 57-66. http://dx.doi.org/10.21831/jipi.v8i1.41667

Winarni, E. W., Hambali, D., & Purwandari, E. P. (2020). Analysis of language and scientific literacy skills for 4th-grade elementary school students through discovery learning and ICT media. *International Journal of Instruction*, *13*(2), 213–222. https://doi.org/10.29333/iji.2020.13215a

Yanti, R., Prihatin, T., & Khumaedi, K. (2020). Analisis kemampuan literasi sains ditinjau dari kebiasaan membaca, motivasi belajar, dan prestasi belajar. *INKUIRI: Jurnal Pendidikan IPA, 9*(2), 147-155. https://doi.org/10.20961/inkuiri.v9i2.27422

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