

Analysis of Students Science Literacy Competencies Based on Coastal Wisdom Use Moodle's -Learning During Covid 19 Pandemic

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ABSTRACT

The distance learning system during the Covid-19 pandemic brought students closer to exploring scientific knowledge information around them, such as local wisdom in coastal areas. This study aims to determine the level of scientific literacy competence of students towards coastal wisdom based on three indicators, namely, explain phenomena scientifically, evaluate and design scientific inquiry, interpret data and evidence scientifically. This research used the descriptive quantitative method. Data were collected from 65 junior high school students in Gresik-East Java as a sample through the purposive sampling technique. This research instrument used multiple-choice questions on scientific literacy tests based on coastal wisdom that has been validated and accessed through Moodle E-Learning. The results showed that the average score of each science literacy competency was in the moderate category for aspects of explain phenomena scientifically, evaluate and design scientific inquiry had been achieved 37.30% and 57.29%. While the aspect of data interpretation and scientific evidence reached a percentage of 72.25% with a good category. The study showed that the distance learning system using open-source Moodle e-learning has a positive effect on students' ability to improve science literacy based on coastal wisdom.

Keywords: *scientific literacy, coastal wisdom, distance learning, Moodle's e-learning.*

1. INTRODUCTION

The development of 21st-century life provides challenges for the world of education. A variety of information is widely spread and technology is developing rapidly, so it requires a fast and appropriate response [1]. The education system is expected to be able to adapt to any changes while maintaining religious values and national character. Since March 2020, Indonesia has experienced the Covid 19 pandemic and has spread globally to all countries in the world. The Covid-19 pandemic has an impact on interventions on health to human death. Many countries in the world have taken policies by closing schools and choosing to facilitate education through distance learning [2] or school from home in Indonesia [3].

The Covid-19 pandemic has presented its challenges for teachers to overcome educational problems by innovating online learning [4]. Teachers are increasingly adaptive and understand the characteristics of students in distance learning. The widespread flow of information, technological sophistication, and the availability of various learning platforms provide opportunities for teachers to increase creativity in facilitating student learning in

the 21st century [5]. One of the technology platforms used to facilitate distance learning K12 and higher education is Moodle open-source learning [6]. The Moodle platform is used in online learning and to measure scientific literacy skills because it has more complete facilities such as providing media features for learning and distribution of teaching materials, facilitating various forms of learning assessment, and facilitating communication media services between teachers, students, and other users [6]. There are about 18 features that can be developed through Moodle including Assignment, Chat, URL, Quiz, Glossary, Feedback, Folder, Book, Forum and others.

The role of information technology in the distance learning process during the Covid 19 pandemic has an important position in social life. Information is not seen as knowledge that is owned individually. However, it has a global dimension as the consumption of information by the international community is assisted by technology [7]. According to [8] states that the convergence of technology and the flow of globalization will have a major impact on people's knowledge. This is a challenge for the world of education in providing students with the importance of literacy skills [9], sensitivity to the environment, and love of national culture [10]. Thus, it is expected

that students have high adaptability to change, are selective about information, and can contribute positively to social life.

Currently, scientific literacy is an important issue of education in Indonesia, especially with the new education policy on the National Assessment which includes aspects of literacy, numeracy, and character [11]. According to Paul de Hurt, the person who proposed the term scientific literacy defines scientific literacy as a person's ability to understand science and be able to apply it directly in social life [12]. This shows that students who have scientific literacy competence will be able to solve real problems in their daily lives by applying the science content they learn. In addition, a literate generation can also explain a natural phenomenon, understand the characteristics of science and draw conclusions based on facts, have an awareness of the importance of science and technology in shaping nature, intellectually, culturally, and actively participate in and care about issues related to science [13]. The results of mapping the scientific literacy competencies of Indonesian students based on the results of the Program for International Student Assessment (PISA) in 2015, Indonesia ranks 64th out of 72 participating countries in the world with a science score of 403 from the OECD average of 493 [13]. The 2018 PISA results show that the average value of Indonesian science has fallen again by an average of 396 from the international average score of 500, placing Indonesia in 74th place out of 79 participating countries [14].

Various Natural Science learning topics are considered to contain multi-dimensional information and there have been many kinds of research on student scientific literacy such as on the topic of climate change [15], global warming [16], healthy and food [17], eco-literacy, and others. The topic becomes an issue in the community and the information presented further stimulates scientific literacy competence not only for students but will provide great benefits if it is built on a community basis [18]. Gresik district is a coastal area bordering the Java Sea and the Madura Strait which has very good local wisdom potential. In this study, an analysis of students' scientific literacy competencies will be carried out on the topic of coastal local wisdom during distance learning using the Moodle E-Learning platform.

2. METHODS

This research is classified as a descriptive quantitative that aims to describe students' scientific literacy skills based on coastal wisdom using the Moodle e-learning platform. This study was carried out in March-April 2021 during Study from Home (SFH) due to the Covid 19 pandemic. This study was conducted in a private junior high school in Gresik Regency, East Java, Indonesia. The subjects of this

study were 65 students of a private school in Gresik Regency, East Java-Indonesia. They consist of 29 male students (44,62%) and 36 female students (55,38%). They were selected through random sampling. The composition of participants is almost evenly distributed by number or gender. In addition, participants have different academic abilities. Participants were tested for their scientific literacy skills using the Coastal Wisdom Science Literacy Test (CWSL) instrument which was constructed from indicators from PISA 2015. This instrument is used by students through Learning Management System (LMS) used Moodles e-learning platform. The test of the validity of the Coastal wisdom science literacy (CWSL) test instrument was declared valid at the significance level ($\alpha = 0.05$) for every 12 items tested. The CWSL instrument has also been tested for reliability using SPSS 25. The results of the analysis show that the estimation of Chronbach's Alpha reliability is 0.597 (r Table = 0.2441) which is classified as a good category. This indicates that the CWSL instrument can be used to collect data.

This research method used quantitative descriptive which can provide information of data about students' scientific literacy competence [19]. The results of the analysis of students' scientific literacy skills are presented by calculating the number of scores obtained by students and divided by the maximum number of scores and multiplied by 100 percent. This study also presents the average score of student achievement on the three scientific literacy indicators of the 2015 PISA framework explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. Data on students' scientific literacy competence were also analyzed and presented based on gender differences.

3. RESULTS AND DISCUSSION

Scientific literacy skills need to be continuously cultivated and trained for students. Students who have good scientific literacy competence are expected to be able to understand, discover the values of life and have a commitment to apply them in real life [20], [21], [10]. So that students have a mindset, behavior, and character who care and are responsible for themselves, society, and their environment. This research will present the achievement of students' scientific literacy competence based on coastal wisdom, analysis of student performance based on scientific literacy indicators, and gender differences. For the achievement of students' scientific literacy competence as measured through the Coastal Wisdom Science Literacy (CWSL) test instrument, it is shown in Table 1.

Table 1. Student’s performance science literacy

Score of CWSL Test	Frequency (f)	Percentage
0-20	2	3,08%
21-40	10	15,38%
41-60	27	41,54%
61-80	19	29,23%
81-100	7	10,77%

Table 1 data shows that 19 students (29.23%) have scientific literacy competence in the good category and 7 students (10.77%) in the very good category. Meanwhile, as many as 10 students (15.38%) have scientific literacy skills in enough category and 2 students (3.08%) need intensive assistance for their scientific literacy skills. Determination of the criteria for achieving scientific literacy achievement cites [16] as stated in Table 2.

Table 2. The category of scientific literacy achievement

Percentage	Category
81% - 100%	Very good
61% - 80%	Good
41% - 60%	Fair
21% - 40%	Enough
0% - 20%	Poor

The results of statistical tests on the distribution of students' scientific literacy scores based on coastal wisdom can be seen in Table 3. Overall the data shows that scientific literacy skills are in the fair category and close to the good category with an average value (mean) of 56,12 with a standard deviation of 19,05. Based on the results of statistical tests, the value of the mode is 58.33. So it can be stated that most of the students who have scientific literacy skills based on the coastal wisdom of junior high school students during distance learning are closer to the good-very good category. This indicates that the topic of coastal wisdom material has an attraction for some students during distance learning due to the Covid 19 pandemic. Although competence in scientific literacy indicators needs to be improved.

Table 3. Descriptive statistical value data of students' scientific literacy

Mean	Median	Mode	Standard Deviation
56,12	55,69	58,33	19,05

The integration of the topic of coastal wisdom into the concept of the material makes science learning different and meaningful. The learning implementation process can be integrated into the concept of human interaction with the ecosystem. This learning has certain characteristics by providing space for students to explore various information about the potential of the area around them. The learning process becomes deeper and wider, not only related to scientific concepts. They can have multidimensional competence by understanding material concepts in an integrated manner with a variety of interesting information that is close to their lives. In the end, the online learning process through the Moodle platform became more interesting, challenging, and varied [22], [23]. The integration of coastal wisdom materials into online learning is also intended to increase civic literacy for Generation Z [21]. The potential of coastal wisdom as local wisdom of the Gresik area can provide positive value in schools and communities to foster character and achieve national revolution [24] so it needs to be grown and trained from an early age. In fact, according to science learning through coastal wisdom, is part of the effort to achieve education sustainable development (ESD).

According to the Organization for Economic Co-operation and Development (OECD), scientific literacy skills contain two aspects, namely scientific knowledge and scientific skills. Someone who has good scientific knowledge if they can understand the characteristics of science can relate one concept to another well and can apply their knowledge in solving life problems. While students with good scientific skills can identify scientific phenomena scientifically, are skilled in designing scientific investigations, and can interpret data based on evidence so that they can conclude. Someone with good scientific literacy skills will have an awareness of how science and technology can shape the environment, intellectually, and culture, as well as a willingness to be involved and concerned with issues related to science. In PISA (Programme for International Student Assessment study), formulating scientific literacy competence includes three indicators, namely explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and evidence scientifically [14]. In this study, students' scientific

literacy competencies based on gender differences can be seen in the Table 4.

Table 4. Gender difference student science literacy competence

Indicator of science literacy	Student Gender		Average
	Male	Female	
Explain phenomena scientifically (C1)	33,6	41,0	37,3
Evaluate and design scientific inquiry (C2)	50,0	64,6	57,3
interpret data and evidence scientifically (C3)	68,1	76,4	72,2

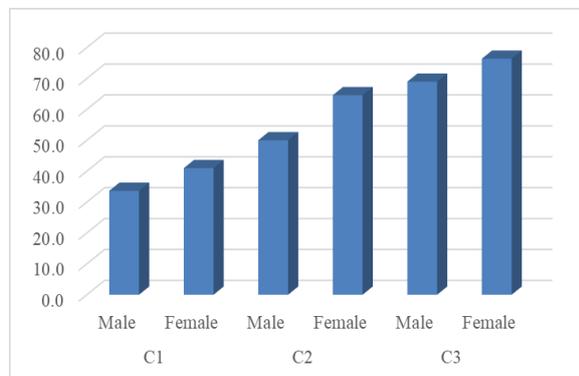


Figure 1 Profile of scientific literacy competence based on gender differences.

Based on Table 4, it can be seen that the scientific literacy ability of male students in the context of coastal wisdom is slightly lower than female students. The average value of science literacy competence for male students is 50.57 and female students are 60.65 in the moderate category. Female students have good mastery in various aspects such as understanding and finding scientific concepts from the information or phenomena presented, designing an investigation, scientific research, finding scientific evidence, designing scientific investigations, and

communicating data and conclusions. Meanwhile, male students can conclude. The excellence of female students in mastering scientific literacy also applies in various countries, age groups, survey periods, and study programs consistently [25].

Figure 1 shows that both male and female students have the same profile on scientific literacy skills, namely the ability to interpret scientific data and evidence (C3) which is more prominent than the ability to design a scientific inquiry (C2). Meanwhile, in distance learning, the skills to find information and explain scientific phenomena are low (C1). This shows that in scientific literacy competence, the ability to read and absorb information is an important factor in providing support for online learning [26]. The results of the same study conducted by Shaffer [27] on PISA results show that basic reading skills are very low so that it affects the competence to analyze observational data and understanding contextual knowledge. The hobby of reading is one of the factors that support the achievement of scientific literacy, especially in C1. This is as the results of research conducted by Hardinata [16] which found that male and female students at the age of about 15 years had different scientific literacy abilities in each country. Generally, male students are proficient in mathematics, while female students have better reading abilities and endurance. Based on figure 1, the involvement of female students was seen to be better than that of male students in distance learning. Meanwhile, male students have a better self-concept than females. The male students tend to have better experience and skills in digital learning and can overcome any obstacles that occur during the use of Moodle e-learning. Thus, when looking at the profile in figure 1, it can be seen that the literacy skills of both male and female do not have significant differences in each indicator. So that gender differences are not the main factor in achieving junior high school students' scientific literacy performance.

The highest scientific literacy competence is in the indicator of interpreting data and scientific evidence (C3), where male students get a score of 68.10 and girls 76.39 in the good category. This shows that students' ability to analyze and evaluate data, convey claims and arguments in various representations well in online learning through Moodle. In addition, they have a good ability to draw the right scientific conclusions. This condition is in line with the characteristics of generation Z where this junior high school student aged 13-15 years is unique in carrying out his life. They belong to Generation Z who are closely related to the digital world [16]. They like graphic visuals and are quick to decide the data presented. So, with the ability to evaluate data, they can reflect their knowledge into real-life and can provide problem-solving for themselves, society, and their environment.

4. CONCLUSION

Based on the results of this study, it can be concluded that the scientific literacy ability of junior high school students towards coastal wisdom using Moodle e-learning is in the moderate category. Gender differences do not have a significant influence on the scientific literacy ability of coastal wisdom during distance learning during the COVID-19 pandemic. Analysis of students' scientific literacy abilities based on three scientific literacy indicators adopted from the OECD shows that male and female students have almost the same competence. For the achievement of the indicators of interpreting data and evidence scientifically with good categories. While the indicators explain phenomena scientifically and design scientific inquiry in the fair (enough good) category. This condition reveals that students' skills in finding scientific concepts from information or phenomena need to be continuously trained and also students' abilities in designing scientific investigations. The distance learning system using open-source Moodle e-learning has a positive effect on students' ability to find patterns and relationships from scientific data visualization, make evidence-based decisions and enable them to be communicated to others. With the transition to the digital learning era, further research is needed for strategies to increase scientific literacy that is tailored to the characteristics of this digital native generation.

AUTHORS' CONTRIBUTIONS

Anis Shofatun: conceived and planned the experiment, wrote the manuscript with input from all authors. Rudiana Agustini: Review manuscript and supervised the project; and Yuni Sri Rahayu: Data analysis and review the manuscript.

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REFERENCES

- [1] S. Sarwi, E. Ellianawati, Grounding Physics and Its Learning for Building Global Wisdom in the 21st Century, *Journal of Physics: Conference Series*, 1171(1) (2019). URL: <https://iopscience.iop.org/article/10.1088/1742-6596/1171/1/012001/meta>
- [2] Abuhammad, Barriers to Distance Learning During The COVID-19 Outbreak: A Qualitative Review from Parents' Perspective. *Heliyon*, 6 (11), 1–5 (2020) 7-42. DOI: <https://doi.org/10.1016/j.heliyon.2020.e05482>
- [3] Sekertaris Jendral Kementerian Pendidikan dan Kebudayaan, 2020.
- [4] A. Abidah, H.N. Hidaayatullaah, R.M. Simamora, D. Fehabutar, L. Mutakinati, The Impact of Covid-19 to Indonesian Education and its Relation to The Philosophy of "Merdeka Belajar", *Studies in Philosophy of Science and Education*, 1(1) (2020) 38-49. URL: <https://scie-journal.com/index.php/SiPoSE/article/view/9>
- [5] N.H. Al-Kumaim, A.K. Alhazmi, F. Mohammed, N.A. Gazem, M.S. Shabbir, Y. Fazea, Exploring The Impact of The COVID-19 Pandemic on University Students' Learning Life: An Integrated Conceptual Motivational Model for Sustainable and Healthy Online Learning, *Sustainability* 13(5) (2021) 2546. DOI: <https://doi.org/10.3390/su13052546>
- [6] L. Pagán, A. Medina, the acceptance of moodle learning management system in higher institution during covid-19 pandemic, *Proceedings of INTED2021 Conference*, 8 (2021) URL: https://www.researchgate.net/profile/Liz-Pagan/publication/349991995_THE_ACCEPTANCE_OF_MOODLE_LEARNING_MANAGEMENT_SYSTEM_IN_HIGHER_INSTITUTION_DURING_COVID-19_PANDEMIC/links/604a6f52299bf1f5d840d284/THE-ACCEPTANCE-OF-MOODLE-LEARNING-MANAGEMENT-SYSTEM-IN-HIGHER-INSTITUTION-DURING-COVID-19-PANDEMIC.pdf
- [7] I. Schiff, How Information Literate Are Junior and Senior Class Biology Students?, *Research in Science Education* 50(2) (2020) 773-789 DOI: <https://doi.org/10.1007/s11165-018-9710-2>
- [8] R.S. Malik, Educational Challenges in 21st Century and Sustainable Development, *Journal of Sustainable Development Education and Research* 2(1) (2018) 9-20 DOI: <https://doi.org/10.17509/jsder.v2i1.12266>
- [9] A. Chalkiadaki, A Systematic Literature Review of 21st Century Skills and Competencies in Primary Education, *International Journal of Instruction* 11(3) (2018) 1-16 URL: <https://eric.ed.gov/?id=EJ1183407>

- [10] V. Milenkova, V. Lendzhova, Digital Citizenship and Digital Literacy in the Conditions of Social Crisis, *Computers* 10(4) (2021) 40. DOI: <https://doi.org/10.3390/computers10040040>
- [11] Kemdikbud, Edaran Tentang Pencegahan Wabah COVID-19 di Lingkungan Satuan Pendidikan Seluruh Indonesia, Kemdikbud RI, 2020.
- [12] Wasis, Y.R. Rahayu, T. Sunarti, S. Indana, HoTs dan Literasi Sains, 2020 URL: https://scholar.google.com/citations?view_op=view_citation&hl=id&user=sHNNH2zcAAAAJ&sortby=pubdate&authuser=4&citation_for_view=sHNNH2zcAAAAJ:YsrPvIHIBpEC
- [13] OECD, *Education at a Glance 2016: OECD Indicators*, OECD Publishing, 2016.
- [14] OECD, *Education at a Glance 2019: OECD Indicators*, OECD Publishing, 2019.
- [15] V.H. Kaya, D. Elster, German Students' Environmental Literacy in Science Education Based on PISA Data. *Science Education International*, 29(2) (2018) DOI: <https://doi.org/10.3390/su11061581>
- [16] A. Hardinata, R.E. Putri, A. Permanasari, Gender Difference and Scientific Literacy Level of Secondary Student: A Study on Global Warming Theme, *Journal of Physics: Conference Series*, 1157(2) (2019) DOI: <https://doi.org/10.1088/1742-6596/1157/2/022016>
- [17] S. Themistokleous, L. Avraamidou, Vrasidas, Mobile Games for Negotiated-Play and Decision-Making in Health Literacy, *Eurasia Journal of Mathematics, Science and Technology Education* 16(9) (2020). URL: <https://eric.ed.gov/?id=EJ1272175>
- [18] C.E. Snow, K.A. Dibner, *Science literacy: Concepts, Contexts, and Consequences*, The National Academic Press, 2016.
- [19] J.R. Fraenkel, N.E. Wallen, H.H. Hyun, *How to Design and Evaluate Research in Education*, Mc Graw-Hill, 2011.
- [20] J. Holbrook, M. Rannikmae, The Meaning of Scientific Literacy, *International Journal of Environmental and Science Education* 4(3) (2009) 275-288. URL: <https://eric.ed.gov/?id=ej884397>
- [21] S.E. Atmojo, B.D. Lukitoaji, T. Muhtarom, Improving Science Literation and Citizen Literation Through Thematic Learning Based on Ethnoscience, *Journal of Physics: Conference Series*, 1823(1) (2021) URL: <https://doi.org/10.1088/1742-6596/1823/1/012001>
- [22] E. Risdianto, M.J. Dinissjah, Nirwana, M Kristiawan, The Effect of Ethno Science-Based Direct Instruction Learning Model in Physics Learning on Students' Critical Thinking Skill, *Universal Journal of Educational Research* 8(2) (2020) 611-615 DOI: <https://doi.org/10.13189/ujer.2020.080233>
- [23] W. Widodo, E. Sudibyo, Suryanti, D.A.P, Inzanah, B. Setiawan, The eEffectiveness of Gadget-Based Interactive Multimedia in Improving Generation Z's Scientific Literacy, *Jurnal Pendidikan IPA Indonesia* 9 (2) (2020) 248-256 DOI: <https://doi.org/10.15294/jpii.v9i2.23208>
- [24] S.R. Abubakar, W. A. S. Uke, Integration of Local Wisdom Coastal Communities in Early Childhood Education Learning, *Ilkogretim Online* 20(1) (2021) 922-929. DOI: <https://doi.org/10.17051/ilkonline.2021.01.88>
- [25] M.L. Kristiyasari, S. Yamtinah, S.B. Utomo, Ashadi, N.Y. Indriyanti, Gender Differences in Students' Science Literacy Towards Learning on Integrated Science Subject, *Journal of Physics: Conference Series*, 1097 (1) (2018) DOI: <https://doi.org/10.1088/1742-6596/1097/1/012002>
- [26] S. Korlat, L. Kollmayer, J. Holzer, M. Luftenegger, E.R. Pelikan, B. Schober, C. Spiel, Gender Differences in Digital Learning During COVID-19: Competence Beliefs, Intrinsic Value, Learning Engagement, and Perceived Teacher Support, *Frontiers in Psychology*, 12 (2021) 849. DOI: <https://doi.org/10.3389/fpsyg.2021.637776>
- [27] J.F. Shaffer, F. Ferguson, K. Denaro, Use of The Test of Scientific Literacy Skills Reveals that Fundamental Literacy is An Important Contributor to Scientific Literacy, *CBE—Life Sciences Education* 18 (3) (2019) DOI: <https://doi.org/10.1187/cbe.18-12-0238>