



Correlation Study Between Scientific Literacy and Environmental Literacy of Jambi City High School Students in the Subject of Physics

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Abstract

This research aims to look at the relationship between scientific literacy and environmental literacy of high school (SMA) students so that it can be determined whether learning physics by integrating the environment is suitable to be implemented in supporting the goals of the independent curriculum, namely mastering literacy and numeracy. The research sample consisted of 294 *students* of class X, and XI. The research method used in this research is an associative quantitative approach with a correlation-based research design. Quantitative analysis was carried out using SPSS software to carry out descriptive analysis, test normality, test linearity, and carry out correlation analysis. The results of this research show that there is a relationship between scientific literacy and environmental literacy in high school students in physics subjects. This can be seen from the hypothesis test using the Pearson correlation test, which produces a value (r) of 0.704 and shows a significance value of 0.000 which is less than 0.05

Keywords: Science Literacy, Environmental Literacy, Physics, Correlation

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INTRODUCTION

Physics learning in the 21st-century education era is a period of educational transformation that is integrated with rapidly developing technology. Technological developments in the 21st century are also caused by developments in physics. Physics is a crucial science that is the basis for every field of study, including biology, medicine, chemistry, astronomy, and engineering. So that basic physics subjects are the key to enabling technological advances that will help each individual to understand events that occur around them and find solutions to the problems they face. Physics is a part of natural science that describes systematic efforts to build and organize knowledge in the form of explanations that can be verified and can predict natural phenomena.

Physics is one of the high school subjects with the Basic Competency of "Presenting ideas/ideas for solving problems of limited energy resources, alternative energy, and their impact on life". This competency cannot be achieved without integrating natural phenomena as objects in physics learning as guidance and development of environmental education. (Desnita, 2015).

The independent curriculum is one of the breakthroughs in the world of Indonesian education in the 21st century which gives students the freedom to learn and search for talents independently and emphasizes literacy and numeracy skills as a measure of student learning outcomes (Yayuk et al., 2023). The school literacy movement is one of the important Merdeka Belajar programs and needs to be improved in

educational units because literacy skills are basic abilities that can influence the success of a person's life.

Achieving scientific literacy in 21st-century education is the ability of students to solve existing problems by collaborating in thinking scientifically, in other words, the ability to use science in the context of everyday life. Apart from that, environmental literacy is also one of the literacies that need to be improved in implementing the independent curriculum. It is not enough for students to only know the environment, they must also have a responsive attitude and provide solutions to issues in the environment.

Scientific literacy skills are an aspect that students must master because they are one of the important pillars in the development of science and technology and help improve the quality of effective physics learning in the era of science and modern technology. Students need to have scientific literacy so that they not only understand science as a concept but can also apply science in real life.

Indonesia is one of the countries with a low scientific literacy ranking, which is confirmed by the results of the PISA (*Program for International Student Assessment*) survey in 2018 which shows that the achievement of scientific literacy abilities of high school students in Indonesia, which was participated by 79 countries, Indonesia experienced a drastic decline by occupying 70th place with an average student scientific literacy score of 396 below the PISA average score, namely 500. This shows that there is a gap in how education is treated (Narut et al, 2019).

Students need to have an understanding of environmental literacy from an early age so that they can identify and provide solutions to environmental issues. This will encourage students to consistently prevent damage to the environment and try to repair the negative impacts that arise, remembering that the environment is a place for human life to live.

Environmental literacy must be possessed by students to instill awareness in each individual in protecting the earth and caring for the environment. However, the environmental literacy of high school students is still relatively low as evidenced by research conducted in 15 countries such as Brazil, Chile, Croatia, Dominican Republic, Georgia, Germany, Hong Kong, Ireland, Italy, Korea, Macau, Malta, Mexico, Panama and Portugal stated that some of their students were not at all interested in studying environmental issues that were linked to scientific literacy.

Competition in the world of education requires students to have good scientific literacy skills balanced with environmental literacy skills. Because the environment is included in one of the five applications of science and technology in which there is a PISA science assessment context with detailed categories, environmental quality, environmentally friendly actions, use and disposal of materials and equipment, waste disposal, environmental impacts of biodiversity, ecological sustainability, pollution control, production, and soil/biomass loss.

Education that focuses on the environment has a very significant role in the lives of every individual, including students. Through environmental education, environmental conservation values can be instilled, which has the potential to change a person's view of nature and the environment. This allows a deeper understanding of the importance of protecting the environment, which is reflected in everyday actions and behavior. Apart from that, environment-based education also plays a role in forming and improving the scientific literacy abilities of high school students.

Research from 25 countries shows that students who have a low level of environmental awareness have a low level of scientific literacy, and vice versa, students who have a high level of environmental awareness also have a high level of scientific literacy (Alivernini & Manganelli, 2015). Based on this description, it is important to carry

out this research to determine the relationship between scientific literacy and environmental literacy of high school students in Jambi City in physics subjects.

METHODS

The research method applied in this research is a quantitative approach with an associative and correlational research design. Associative quantitative research aims to explore the relationship between two or more variables. Correlational design is a step in quantitative-based research that is used by researchers to measure the level of relationship between two or more variables by utilizing correlation statistical analysis methods.

Researchers chose a sample of 294 class X and IX students in classes X and XI at SMAN 5, SMAN 10, and SMAN 11, Jambi City. This research uses a sampling technique based on *cluster sampling*. *Cluster sampling* (region selection) is used when the population or data source to be studied is very broad, such as the population of a country, province, or district.

The instrument that will be used in this research is a questionnaire sheet accompanied by a score, with each statement given the answer options provided. The data in this research uses a *Likert scale* in preparing the questionnaire. Data collection techniques will be collected through the use of a questionnaire, which will be given to respondents containing statements accompanied by scoring. The aspects to be studied are scientific literacy and environmental literacy.

Product-moment correlation test to determine the research objective, namely knowing the relationship between two variables. scientific literacy (X) as the independent variable and environmental literacy as the dependent variable (Y).

Table 1. Scientific Literacy Interval

Category	Criteria
Tall	$X > 59$
Currently	36 – 59
Low	$X < 36$

Table 2. Environmental Literacy Interval

Category	Criteria
Tall	$X > 121$
Currently	73 – 121
Low	$X < 73$

Table 3. Interpretation of Correlation Coefficients

Positive	Negative	Interpretation
0.90 – 1.00	-0.90 – -1.00	Perfect correlation
0.70 – 0.90	-0.70 – -0.90	Strong correlation
0.50 – 0.70	-0.50 – -0.70	Moderate correlation
0.30 – 0.50	-0.30 – -0.50	Weak correlation
0.00 – 0.30	-0.00 – -0.30	No correlation

RESULTS & DISCUSSION

Results

Analysis of high school students' scientific literacy and environmental literacy skills in physics material under the theme "lightning" can be seen in Table 4 and Table 5.

Table 4. Student Scientific Literacy Results

Criteria	Category	Mean	Minimum	Maximum	Standard Deviation	Frequency	%f
X > 59	Tall					183	62
36 – 59	Currently	51.63	19	72	9,857	104	35
X < 36	Low					7	3

Based on Table 4 obtained from 294 respondents, shows that students' scientific literacy is in the high category. The results of scientific literacy skills obtained from the analysis process using the SPSS application were, as many as 183 students obtained the high category with the highest percentage of 62%, scientific literacy in the medium category was obtained by 104 students with a percentage of 35% and scientific literacy in the low category was obtained by 7 students. with the lowest percentage of 3%.

Table 5. Student Environmental Literacy Results

Criteria	Category	Mean	Minimum	Maximum	Standard Deviation	Frequency	%f
X > 121	Tall					50	17
73 – 121	Currently	127.2	40	160	22,379	236	80
X < 73	Low	6				8	3

Based on Table 5 obtained from 294 respondents, shows that students' environmental literacy is in the medium category. The results of environmental literacy skills obtained from the analysis process using the SPSS application were, as many as 50 students obtained the high category with a percentage of 17%, environmental literacy in the medium category was obtained by 236 students with the highest percentage of 80% and environmental literacy in the low category was obtained by 8 students with the lowest percentage were 3%.

Table 6. One-Sample Kolmogorov-Smirnov Normality Test Using SPSS 21

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residuals
N		294
Normal Parameters ^{a, b}	Mean	.0000000
	Std. Deviation	15.90163051
Most Extreme Differences	Absolute	,077
	Positive	,077
	Negative	-.072
Kolmogorov-Smirnov Z		1,315
Asymp. Sig. (2-tailed)		,063

a. Test distribution is Normal.

b. Calculated from data.

Next, the data was analyzed to determine the relationship between two variables, namely the relationship between scientific literacy and environmental literacy using the Pearson correlation test. Before the correlation test, the data was tested for normality and linearity first. The normality test is used to determine whether the sample comes from a normally distributed population or not. The technique used to test data for normality is the Kolmogorov-Smirnov test. Based on the results of the normality test, it is known that the significance value is $0.063 > 0.05$. It can be concluded that the data values are normally distributed.

Table 7. Linearity Test with SPSS 21

ANOVA Table			Sum of Squares	df	Mean Square	F	Sig.
		(Combined)	15847.985	42	377,333	2,997	,000
Environmental Literacy * Scientific Literacy	Between Groups	Linearity	9199.768	1	9199.768	73,072	,000
		Deviation from Linearity	6648.217	41	162.152	1,288	.125
	Within Groups		31601.036	251	125,901		
Total			47449.020	293			

The linearity test is used to assess whether the model specifications used are correct or not. Based on the results of the linearity test, it is known that the significance value of linearity deviation is 0.125, meaning the linearity value is > 0.05 . It can be concluded that there is a linear relationship between scientific literacy abilities and environmental literacy abilities.

The results of the normality and linearity tests stated that the data were homogeneous and linear so a correlation test could be carried out using Pearson correlation to see the relationship between scientific literacy abilities and environmental literacy. Hasil pengolahan data korelasi dan relationshipnya terlihat pada Tabel 8.

Table 8. Pearson Correlation Test with SPSS 21

Correlations			
		Scientific Literacy	Environmental Literacy
Scientific Literacy	Pearson Correlation	1	,704 **
	Sig. (2-tailed)		,000
	N	294	294
Environmental Literacy	Pearson Correlation	,704 **	1
	Sig. (2-tailed)	,000	
	N	294	294

** . Correlation is significant at the 0.01 level (2-tailed).

Table 9. Relationship between Science Literacy and Students' Environmental Literacy

Variable	Scientific Literacy		Environmental Literacy	
	r	Sig.(2-tailed)	r	Sig.(2-tailed)
Scientific Literacy	1	0,000	0.704	0,000
Environmental Literacy	0.704		1	

Based on Table 9, the significance value of 0.000 is smaller than 0.05, which means there is a relationship between students' scientific literacy and environmental literacy. Meanwhile, the Pearson correlation value is 0.704, meaning there is a strong relationship between scientific literacy and environmental literacy. The Pearson correlation value is positive, which means that if scientific literacy increases, environmental literacy will also increase.

Discussion

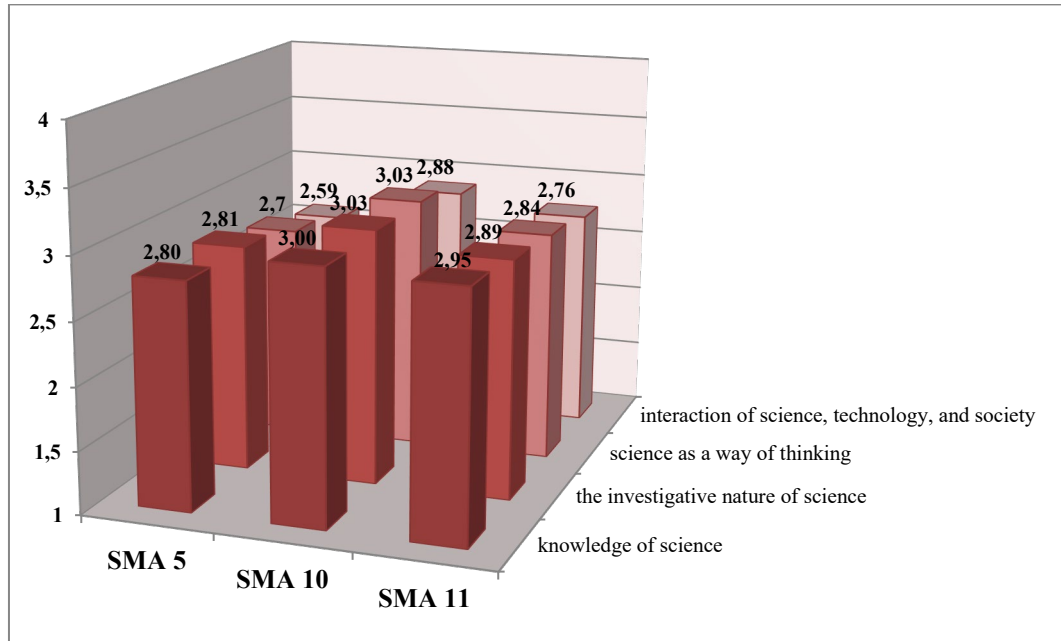


Figure 1. Graph of Scientific Literacy Indicators

The results of the scientific literacy abilities of students at SMAN 5, SMAN 10, and SMAN 11 in Jambi City are shown in Figure 1. Scientific literacy consists of four aspects which include *the knowledge of science*, *the Investigative nature of science*, *science as a way of thinking*, and *the interaction of science, technology, and society*. Based on four indicators of scientific literacy which are summarized in 19 questionnaire statements on a Likert scale with four criteria, namely, score 1 means strongly disagree with the statement, score 2 means disagree with the statement, score 3 means agree with the statement, and score 4 means strongly agree with the statement. After conducting research, 294 students obtained the following total scores. *The knowledge of science* indicator scores are 2.80, 3.00, and 2.95. *The investigative nature of science* scores were 2.81, 3.03, and 2.89. *The science as a way of thinking* indicator scores are 2.7, 3.03, and 2.84. Meanwhile, the *interaction of science, technology, and society* indicator scores were 2.59, 2.88, and 2.76. The average value of the four aspects of scientific literacy is 2.85, which means that it is in the category of agreeing with the statement in the questionnaire instrument with the interpretation of students' scientific literacy abilities being in a good category.

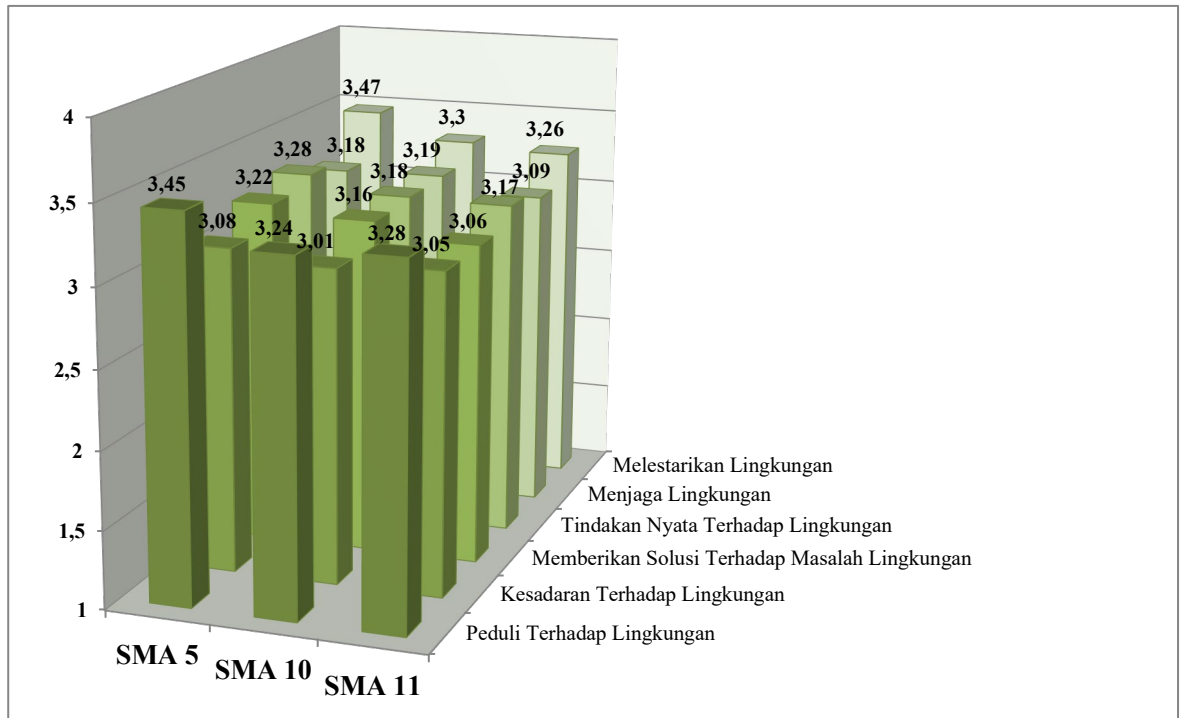


Figure 2. Graph of Environmental Literacy Indicators

The results of the environmental literacy abilities of students at SMAN 5, SMAN 10, and SMAN 11 in Jambi City are shown in Figure 2. Environmental literacy consists of six aspects which include caring for the environment, awareness of the environment, providing solutions to environmental problems, real action towards the environment, protecting the environment, and preserving the environment. Based on six indicators of environmental literacy which are summarized in 39 questionnaire statements with a Likert scale with four criteria, namely, score 1 means strongly disagree with the statement, score 2 means disagree with the statement, score 3 means agree with the statement, and score 4 means strongly agree with the statement. After conducting research, 294 students obtained the following total scores. The 'care for the environment' indicator scores are 3.45, 3.24 and 3.28. The 'environmental awareness' scores were 3.08, 3.01, and 3.05. The indicator scores for 'providing solutions to environmental problems' are 3.22, 3.16, and 3.06. The scores for the 'real action on the environment' indicator are 3.28, 3.18, and 3.17. The 'protecting the environment' indicator scores are 3.18, 3.19, and 3.09. The 'preserving the environment' indicator scores were 3.47, 3.3, and 3.26. The average value of the six aspects of environmental literacy is 3.20, which means that the category agrees with the statement in the questionnaire instrument with the interpretation of students' scientific literacy abilities in the good category.

Scientific literacy was a key focus subject in the implementation of the Program for International Student Assessment (PISA) in 2015 and 2006, which was supported by the OECD by offering the opportunity to evaluate countries' education systems and economies on an international platform. So this can be considered as an indicator of the importance of scientific literacy globally (OECD, 2016). Increasing scientific literacy through science education is a sign of developing the ability to use scientific knowledge and skills creatively to prepare oneself for everyday life and the professional career one will pursue students.

The 2018 PISA evaluation also emphasizes the application of scientific literacy and scientific knowledge in an environmental context as one of the aspects used in cognitive test questions within the scope of scientific literacy, so that the scientific literacy and environmental literacy abilities of high school students also become the goal of learning physics which is the object of Century education goals. 21 (Pratiwi et al., 2019). Physics as a real science in everyday life will discipline oneself in how to behave responsibly towards the environment. Because environmental issues are a global topic that has been of concern to all countries for many years. Thus, providing quality science education will have an impact on the country's development achievements in terms of human resources.

Competition in the world of education requires students to have good scientific literacy skills balanced with environmental literacy skills. Because the environment is included in one of the five science and technology applications in which there is a PISA science assessment context with detailed categories, environmental quality, environmentally friendly actions, use and disposal of materials and equipment, waste disposal, environmental impacts of biodiversity, ecological sustainability, pollution control, production, and soil/biomass loss.

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This research can be used as a reference for educators that in one lesson they can improve two student literacies at once, namely scientific literacy and environmental literacy, where these two literacy skills are abilities that students need in 21st-century education. Therefore, this research is relevant to It has been previously researched that if students' scientific literacy is high, students' environmental literacy will also be high. However, if students' scientific literacy is low, students' environmental literacy will also be low.

CONCLUSION

The scientific literacy and environmental literacy abilities of high school students in physics material are relatively high. The results of the Pearson correlation analysis that has been carried out show that there is a strong correlation between students' scientific literacy and environmental literacy. Students who have high scientific literacy will have high literacy abilities, and vice versa. The importance of scientific literacy and environmental literacy for high school students is that students learn by using knowledge and are actively involved in discovering concepts from phenomena that exist in the environment. After learning, students can apply the scientific knowledge gained in daily life applications, one of which is protecting and preserving the environment.

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REFERENCES

- Abaniel, A. (2021). Enhanced conceptual understanding, 21st-century skills, and learning attitudes through an open-inquiry learning model in physics. *Journal of Technology and Science Education*, 11 (1), 30–43. <https://doi.org/10.3926/jotse.1004>
- Alivernini, F., & Manganelli, S. (2015). Country, school, and student factors associated with extreme levels of science literacy across 25 countries. *International Journal of Science Education*, 37 (12), 1992–2012. <https://doi.org/10.1080/09500693.2015.1060648>
- Chaerunisa, R., Mahrawi, & Mariningsih, P. (2023). Development of an e-module for making liquid organic fertilizer (POC) based on SETS (Science, Environment, Technology, Society) to increase environmental literacy in the concept of environmental change for class X SMA. *Journal of Biological Pedagogy (JPB)*, 01 (02), 94–107.
- Cohen, L., Manion, L., & Morrison, K. (2007). Research methods in education. In *Routledge Taylor & Francis Group*. <https://doi.org/10.4324/9781315158501-17>
- Creswell, J. W. (2015). Qualitative research & research design. In *Learning Library* (Vol. 94, Issue 4). SAGE.
- D.E., H., W, W., & S.G., J. (2003). Applied statistics for the behavioral sciences (5th edition). In *Houghton Mifflin*. Houghton Mifflin.
- Desnita. (2015). Hidden environmental curriculum in renewable energy material for high school physics. *Journal of Physics Education Research & Development*, 1 (2), 7–12. <https://doi.org/doi.org/10.21009/1.01202>
- Enterprise, J. (2014). *SPSS for Beginners (Indonesian Edition)*. Elex Media Komputindo.
- Holbrook, J., & Rannikmae, M. (2009). The meaning of scientific literacy. *International Journal of Environmental & Science Education*, 4 (3), 275–288. <http://www.ijese.com/>
- Hollweg, KS, Taylor, JR, Bybee, RW, Marcinkowski, TJ, &... (2011). Developing a framework for assessing environmental literacy. In *North American Association for Environmental Education (NAAEE)*.
- Irmawanty, & Luliyana. (2022). The relationship between naturalist intelligence and environmental literacy of class XI students at SMAN 5 Barru. *Hybrid: Journal of Science Education and Learning*, 1 (2), 19–29. <https://etdci.org/journal/hybrid/article/view/738>
- Malik, A., & Chusni, M. (2018). Introduction to educational statistics. In *CV Budi Utama*. Deepublish.
- Mifidah, L., & Asyhari, A. (2023). The influence of learning cycle 5E based on local problems on students' environmental literacy in the independent curriculum material on environmental change and preservation for class X SMA NU Al Ma'ruf Kudus. *Journal of Educational Integration and Development*, 3 (1), 54–70.
- Muliaman, A., Sakdiah, H., Ginting, FW, Sabrin, N., & Zahara. (2022). Analysis of students' employability skills and scientific literacy through authentic self-assessment in the Merdeka curriculum at North Aceh High School. *JPF (Physics Education Journal) UIN Alauddin Makassar*, 11 (1), 24–32. <https://doi.org/10.24252/jpf.v11i1.34010>
- Narut et al, YF (2019). Students' scientific literacy in science learning in Indonesia 1 1.2. *Journal of Elementary Education Innovation*, 3, 61–69.
- Nunez, M. B., & Clores, M. A. (2017). Environmental literacy of K–10 student completers. *International Journal of Environmental and Science Education*, 12 (5), 1195–1215. <http://creativecommons.org/licenses/by/4.0/>

- Nurhasanah, N., Jumadi, J., Herliandry, LD, Zahra, M., & Suban, ME (2020). Development of scientific literacy research in physics learning in Indonesia. *Education Science*, 12 (1), 38–46. <https://doi.org/10.15408/es.v12i1.14148>
- OECD. (2016). *Education at a Glance 2016: OECD Indicators* (Issue December). <http://www.oecd-ilibrary.org/docserver/download/eag-2007-summary.pdf?expires=1450309401&id=en&accname=guest&checksum=8ECF2407785157EC8F65BDED3FAC43C4>
- OECD. (2019a). Indonesia education at a glance. In *OECD: Country Notes*. Education at a Glance Database. <https://www.oecd.org/education/education-at-a-glance/>
- OECD. (2019b). Education in Indonesia is learning from the results of PISA 2018. *Educational Assessment Center Balitbang KEMENDIKBUD*, 021, 1–206. <http://repository.kemdikbud.go.id/id/eprint/16742>
- OECD. (2019c). *PISA for Development Assessment and Analytical Framework*. OECD Publishing. <https://doi.org/https://doi.org/10.1787/b25efab8-en>
- Oral, I., & Erkilic, M. (2022). Investigating the 21st-century skills of undergraduate students: physics success, attitude, and perception. *Journal of Turkish Science Education*, 19 (1), 288–305. <https://doi.org/10.36681/tused.2022.122>
- Ozkan, UB (2021). Interest in environmental issues as a determinant of Science Literacy: a multinational review with artificial neural network analysis. *FIRE: Forum for International Research in Education*, 7 (1), 115–131. <https://doi.org/10.32865/fire202171232>
- Minister of Education and Culture Regulation. (2018). Regulation of the Minister of Education and Culture of the Republic of Indonesia number 37 of 2018. In *a copy of the Attachment to the Minister of Education and Culture's Regulation*.
- Pratiwi, SN, Cari, C., & Aminah, NS (2019). 21st century science learning with students' scientific literacy. *Journal of Physics Materials and Learning (JMPF)*, 9 (1), 34–42.
- Rusli, IA (2023). The role of implementing freedom of learning in improving students' literacy abilities. *Proceedings of the PSSH National Seminar (Education, Science, Technology, Social and Law)*, 2, 1–9.
- Sugiyono. (2016). Statistics for research. In *Statics For Research* (Vol. 12).
- Sutrisna, N. (2021). Analysis of the science literacy abilities of high school students in Sungai Banyak city. *Journal of Research Innovation*, 1 (12), 2683–2694. <https://stp-mataram.e-journal.id/JIP/article/view/530>
- Yayuk, E., Restian, A., & Ekowati, DW (2023). Numeracy literacy in the independent curriculum framework based on art education. *International Journal of Community Service Learning*, 7 (2), 228–238.