



The Effect of Reading Literacy Ability of Prospective Chemistry Teachers on Chemistry Learning Achievement

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Authors' contributions

This work was carried out in collaboration between both authors. Author SFA designed the research and collected data. Author NIS processed the data. In addition, this study was also supported by a research assistant. Both authors read and approved the final manuscript.

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ABSTRACT

Reading literacy is an important basic skill for academic success in all disciplines, especially in science. Chemistry is one of the fields of science, so it is very important that prospective chemistry teachers have reading literacy skills for academic success in chemistry and chemistry lessons. Because later these prospective chemistry teachers, after completing their studies at the University will directly teach and educate high school students in schools in Indonesia. The aim of this study was to measure the correlation between reading literacy and learning achievement. The study used a correlational method to measure the relationship between reading ability and student achievement. The sample used in this study was 30 chemistry education students from 2019 to 2022. The instruments used in the study were reading literacy instruments, student achievement instruments, and interview instruments. In the validity and reliability test, a value of (0.90) was obtained, which means the instrument is valid and reliable. Reading literacy affects learning achievement (sig.<0.05). Students who have good reading skills will have an impact on student learning achievement patients.

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Keywords: Reading literacy; chemistry learning achievement.

1. INTRODUCTION

In the context of today's educational world, reading literacy and digital literacy skills are becoming increasingly important, especially in today's rapidly developing digital information age. The ability to access, understand and evaluate information quickly and effectively through text is becoming increasingly important in both academic and professional settings. Therefore, it is important for student teachers to improve their reading literacy skills in order to better face the challenges of the academic and professional world.

In other words, reading literacy is an essential foundational skill for academic success in all disciplines, especially in science (Dromsky & Turkan, 2015). In academia (science), students must be able to understand complex texts, such as textbooks, scientific journals and research articles to gain a good understanding of the concepts and principles in science. In addition, reading literacy is said to be very important because it is used to absorb information in the academic world (Mustapha & Mokhtar, 2017), especially in the field of science such as chemistry.

Students with good reading literacy skills can access more information resources and can understand subject matter more effectively which in turn improves student academic performance (Briks, 2016). Students who have reading literacy skills will be able to have critical thinking skills. Students who have critical thinking skills will be able to read situations well (De-La-Peña & Luque-Rojas, 2021). However, students' reading literacy skills are often inadequate, especially among freshmen and students who come from backgrounds that lack adequate reading and literacy skills (DeBoer, 2011). This limitation can lead to difficulties in understanding science-related reading materials, which in turn can have a negative impact on students' academic performance (Kang et al., 2019).

Apart from the direct impact on academic performance, good reading literacy also provides long-term benefits for students. Students who have good reading literacy skills tend to have higher confidence in understanding subject matter, better critical thinking and analytical

skills. In addition, good reading literacy skills can also help students explore in the digital world, students will look for more complex topics in the field of science as well as topics related to their field in the digital world to improve their abilities. Students who have good reading literacy skills will have the ability to use digital / internet as material to improve aspects of creativity, innovation to support life skills in the 21st century (Martin, 2022). Reading literacy can improve students' skills (Kim et al., 2020).

2. MATERIALS AND METHODS

2.1 Time and Location

This research was conducted at Universitas Kristen Indonesia, Chemistry Education Study Program, Faculty of Teacher Training and Education. This research will be conducted at the beginning of the 2023 academic year.

2.2 Sampling

The sample used in this study were all FKIP UKI Chemistry Education students starting from Class 2022 to Class 2019 students.

2.3 Methods

The method used in this research is the correlational method. The correlational research method is used to examine the effect of chemistry students' reading literacy skills on chemistry learning achievement of chemistry students or prospective chemistry teachers.

2.4 Research Design

This research was conducted using a quantitative approach using correlational studies/research. The data obtained from this study will be used to see the effect of chemical reading literacy skills on the chemistry learning achievement of Chemistry Education students of FKIP UKI or prospective chemistry teachers.

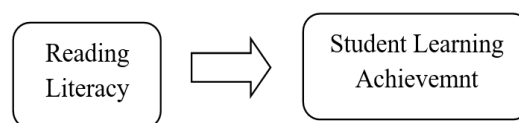


Fig. 1. Research design

2.5 Research Aspects Parameter

Table 1. Student literacy aspects

Skor	Level	Kriteria
4	Strong	a. Interpret questions, statements or graphs carefully b. Determine the most important arguments in the form of both reasons and claims c. Carefully analyze and assess points of view d. Draw conclusions that are guaranteed not to be erroneous (misleading) e. Thoroughly justify procedures and results by outlining reasons and assumptions f. Follow well where the evidence and reasoning leads
3	Accepted	a. Accurately interpret evidence, statements, graphs, questions b. Clearly articulate analysis and evaluation through alternative points of view c. Draw conclusions that are guaranteed not to be erroneous (misleading) d. Justify procedures and results by outlining reasons and assumptions e. Following well where the evidence and reasoning leads
2	Rejected	a. Misinterpreting questions and statements or graphs b. Failure to specify the argument clearly c. Omitting and evaluating not in a clear alternative point of view d. Draws wrong conclusions e. Justifying procedures and results without elaborating reasons f. Disregarding reasons or evidence in favor of personal views
1	Weak	a. Presenting interpretations that deviate from the statement or question as well as the graph or interpretations that deviate from the assumptions or evidence. b. Unsuccessfully identifying the hasty nature of rejecting arguments that are otherwise strong and relevant c. Neglecting or inadequately evaluating clear alternative viewpoints d. Giving opinions using weak or erroneous or unwarranted viewpoints e. Not justifying procedures and results and without elaborating based on prejudice f. Shows reticence in expressing reasons

Table 2. Student learning achievement

Level	Skor	Kriteria
Very poor	<20	Did not answer all questions correctly
poor	21 - 40	Can only write the known of all the questions given
Simply	41 - 60	There are some correct answers
Good	61 - 80	Reached 50% correct answers
Excellent	>81	Achieved more than 50% of the given questions are answered correctly and appropriately

2.6 Research Procedure

The research was conducted in three stages, namely: (1) research preparation stage; (2) research implementation stage; (3) final stage. In outline, the activities carried out are as follows:

2.6.1 Research preparation stage

Some of the activities carried out at the preparation stage include:

- a) Instrument development

- b) Making reading literacy instruments, interviews, observations, questionnaires / questionnaires

- c) Instrument validation
- d) Instrument improvement/revision
- e) Determining research subjects

2.6.2 Research implementation stage (conducting research)

Activities carried out in the implementation of research include:

- a) Implementation of research

- b) Distribution of instruments
- c) Observation
- d) Reflection

2.6.3 Final stage

- a) Collecting research data
- b) Processing the research data
- c) Discussion of research findings
- d) Making conclusions and suggestions based on the research results
- e) Preparation of research reports

3. RESULTS AND DISCUSSION

Reading is one of the important aspects that students need to master because reading is the basis for learning subjects in all sciences (Rintaningrum, 2019). Reading literacy refers to understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals and to develop one's knowledge and potential (OECD, 2019). Research that has been conducted by taking samples of Chemistry Education students at Universitas Kristen Indonesia through distributing instruments to respondents. In addition to distributing instruments, the research was also carried out by observing the learning process in class, as well as interviews with lecturers and students.

The results of the data collection that has been carried out obtained data (see Fig. 2) that the average value of student reading literacy is 35.8. With the lowest score of 28 and the highest score of 43, with a range of 15 points. The maximum value in the reading literacy measurement is 103 points. This shows that students' reading literacy scores are still very low, below the median score of the reading literacy instrument. This reading literacy ability is closely related to students' reading habits in their daily lives. The scores also show the low reading habits of the students and the lack of diversity in the sources of reading materials.

The reading literacy scores measured describe students' reading habits, literature used in learning, reading materials read, the use of related facilities in stimulating reading literacy, lecturer strategies in stimulating students to improve reading literacy, the formation of reading ecosystems, formulating problems from reading texts, measuring students' global insights, the ability to examine scientific articles, the ability to correlate knowledge with reading materials, and the ability to make decisions in problem solving.

In terms of sources of reading materials used by students, students read or get the most information from social media such as blogs, some blogs are less credible or not based on the results of scientific studies, so in terms of scientific validity cannot be measured (Fig. 3). In addition, the most reading material is from online comics such as manga, or novels. The use of textbooks or scientific journals is very low.

The importance of using scientifically based reading materials so that the credibility of the information can be accounted for. Scientifically based reading materials will shape the cognitive and critical level of students more than reading materials that are not scientific or not based on the results of research studies. Information that has no scientific basis is very vulnerable to containing hoax elements. Hoax news has a huge impact on people's reading literacy skills which will have an impact on the level of knowledge and vulnerability of decision making (Nabila et al., 2022). Developed countries have good habituation, one of which is the use of reading materials, people are happy to read books, journals, or information that has clear credibility. So that developed societies have very good critical thinking skills and have the ability to make the right decisions because the sources of reading material used are credible, so that when getting information the community will check the information obtained (Verhoeven et al., 2024).

Students who have good literacy intelligence will be able to sort out information well, besides that students will have a good initial scientific foundation. In Bloom's taxonomy, the main capital in learning is the willingness to read, because by reading someone will be able to recognize and know a knowledge. This is the basic level in Bloom's taxonomy. High literacy skills will be able to place students in a good level of knowledge. Students who have good literacy skills will make the best use of the information resources they have and enrich the information with other reading materials (Binks & Vale, 2016). Students who have good reading skills will allocate more time for reading than other students, and students who have good literacy skills will prepare for learning as well as possible.

In this context, it can be said that reading is a difficult and complex process that requires many cognitive skills (Adams, 1990). Therefore, it can be said that there are many factors that influence students' acquisition of reading skills and

successful performance of them (Esmer & Günes, 2019; Linnakyla et al., 2004). Reading literacy is an important academic skill in the era of globalization that is indispensable for success in most learning processes and competing in the global era (Kern, 2018). So that someone who can read and write is said to have reading literacy (Bormuth, 1973).

Literacy is the ability to read and write without error, the point is that literacy is defined as the capacity to read and write at a level that enables a person to understand and utilize written communication in print and digital formats (Kanniainen et al., 2019). So it can be defined that reading literacy is a form of ability to understand and use forms of written language

that are required by society and valued by individuals (Miles & Huberman, 1994). So it can be said that reading various textual styles can help readers better understand the outside world and themselves. Maroco (2021) reading literacy consists of broader abilities that enable readers to engage with written material offered in one or more books for specific purposes. The term reading literacy used in PISA refers to a variety of cognitive skills ranging from basic decoding to sophisticated vocabulary and grammar understanding. So it can be said that reading literacy is the ability to understand texts and respond to them effectively. Kanniainen et al., (2019) says that reading comprehension indicates a higher level of literacy.

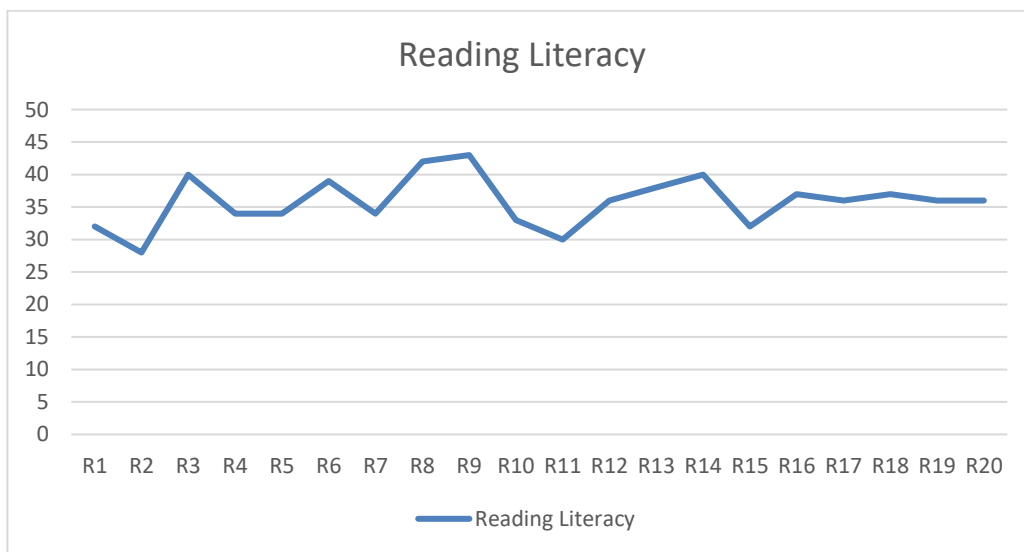


Fig. 2. Reading literacy score

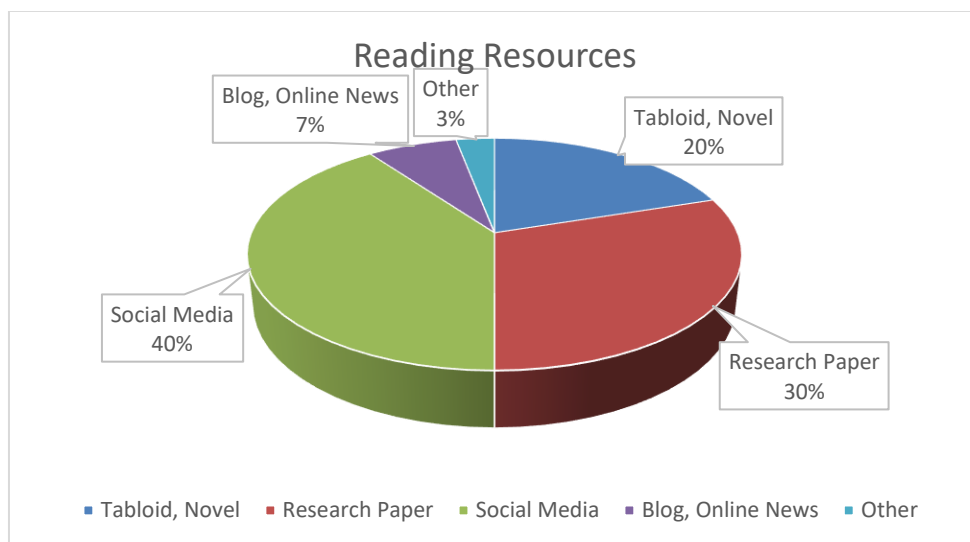


Fig. 3. Learning resources

Table 3. Data and correlation test

Mean of Reading Literacy	Mean of Student Achievement	Normality Test	Homogeneity Test	Pearson Test	Sig. Pearson Test
35.80	9.65	0.200	0.397	0.790	0.032

Achievement in reading comprehension is influenced by various factors, namely, reading fluency, text structure information, cognitive and metacognitive strategy knowledge, vocabulary, motivation and prior knowledge (Kendeou & Van Den Broek, 2007; Ozuru et al., 2009). Achievement factors in such a difficult and multidimensional process also involve socioeconomic and family conditions, school type, reading habits, learning strategies, and participation in preschool education (OECD, 2019). So it can be said that parents' participation in literacy activities in their children's preschool education as well as parents' educational status is one of the determining factors.

Students' achievement in reading is very important in terms of demonstrating their skills in other academic domains. If students' reading literacy levels are low, it generally means difficulty in acquiring some other skills in most cases (Geske & Ozola, 2008). To be successful in science and math, readers must first read and understand texts and symbols well and interpret what they read. Rindermann & Baumeister, (2015) emphasized that it is crucial to consider reading performance when interpreting student achievement. Sahin & Yaykiran, (2016) found that reading comprehension is a significant predictor of math and science achievement. Fuentes, (1998) argues that math and reading go hand in hand. In other words, students need to improve their reading so that they can improve their achievement.

Reading literacy is seen as very important to improve performance as well as improve students' academic achievement because reading is an essential skill for students' academic achievement. Arellano, (2013) states that students who have critical reading skills in their academic studies can involve extrapolating meaning from context, identifying meaning incorporated into the text and can gather general knowledge. However, literacy is still debated regarding critical, appreciative and inferential reading literacy. Adams, (2007) stated that there is no significant difference in reading ability between male and female students.

Students' reading skills will contribute significantly to their development in other academic skills such as math and science (Kuyucu & Tahsin, 2020). The fact that science and mathematics performance are closely related to reading comprehension, so science reading skills are an important issue that should be emphasized in this study.

Learning achievement can be defined as the achievement of expected results from a learning activity such as tests, exams or assignments (Briggs et al., 2012). Learning achievement covers various aspects, including cognitive aspects, affective aspects and psychomotor aspects. The cognitive aspect is the ability of students to understand the concepts and facts taught in learning, the affective aspect covers the feelings and attitudes of students in dealing with learning activities while the psychomotor aspect is the ability of students to perform physical activities or skills related to learning (Huitt & Hummel, (2006); Krathwohl et al., (1973); Marzano & Kendall, (2008).

In literacy studies, students who have good literacy will be able to have good achievement as well (Verhoeven et al., 2024). Academic achievement is closely related to student knowledge. Knowledge has several levels, but the basis of knowledge or cognitive is recognizing, knowing, and understanding. To reach this level, students must be able to have good reading skills and reading habits. The formation of a good learning ecosystem and good commitment and interest in learning will maximize student cognition (Dromsky & Turkan, 2015). The research conducted focuses on how the relationship between reading literacy and student achievement. Research that has been conducted in 2024 obtained the following data and correlation tests.

Measurement of reading literacy using literacy instruments that contain habituation and reading ecosystems from students. In addition, the measurement of reading literacy is carried out with a literacy ability test. For the measurement of learning achievement is done with a questionnaire, and supported by student achievement index scores and interviews. The

results of the data obtained were converted and then processed by testing normality, homogeneity, and Pearson test, obtained the average reading literacy score with a value of 35.80 with a conversion of Good. The average value of student learning achievement with a value of 9.65 with a conversion of Very Good.

In the normality and homogeneity tests, the categories are normal (sig.>p) and homogeneous (sig.>p). Pearson test obtained a positive value of 0.790 and sig.<p. Data management refers to the existence of a positive correlation between student reading literacy and learning achievement, which means that reading literacy affects learning achievement. The Pearson value is converted into a strong category which means that learning achievement is influenced by literacy skills. Very high literacy skills will have an impact on improving learning achievement. Students to be able to get learning achievement must have good cognitive abilities. Good cognition must be constructed through good learning as well. Good student cognition can be formed through reading habits, good reading habits will have an impact on high interest in learning. Learning achievement has many components but the main foundation in learning is reading. So that students who have good reading habits will correlate with a good level of knowledge as well (Mustapha & Mukhtar, 2017).

In addition, classroom learning also determines the formation of reading habits. Lecturers must be able to create a good reading ecosystem, so that students will be stimulated to read textbooks or review journal literature. Appropriate learning strategies in reading will be able to improve student learning abilities, for example through assignments related to the study of journal articles, or conducting systematic article literature reviews so that students' reading, conceptualizing, and critical thinking skills can be formed. If the ecosystem and habituation have been formed, it will stimulate good student learning abilities and have an impact on high learning achievement (Kern et al., 2018).

It is not easy to build or improve students' reading skills. However, the most important point is how students are aware and motivated to read independently, so that reading culture becomes a habit (Baron & Mangen, 2021). While we know that the basic capital in learning is reading. Of course, students who are rich in reading materials will have different thinking skills, one of

which is in criticizing a phenomenon (Oficina et al., 2023). Students who have reading literacy skills will correlate with critical thinking skills. Critical students will be able to read situations well, be able to realize their abilities, and be able to develop potential (Cabrera et al., 2021).

The reading literacy skills of chemistry teacher candidates must always be improved and become an important concern at the university. Prospective teachers who have good reading literacy skills will also have an impact on learning achievement, prospective teacher students will have broad insights so that they will be able to have good self-confidence as capital when becoming a teacher. The strategies used by lecturers to students are expected to be applied to learning in schools later.

4. CONCLUSION

Research that has been conducted by measuring learning achievement and reading literacy of prospective chemistry teacher students. Research that uses instruments in the form of questionnaires and test instruments with good category results. In the study, it was found that student reading literacy affects learning achievement as evidenced by the Pearson correlation value of 0.790 in the strong category.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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Details of the AI usage are given below:

1. Consensus for literature
2. Preplexity for literature

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Adams, J., Khan, H. T., Raeside, R., & White, D. (2007). Literature review and critical reading. In *Research methods for graduate business and social science students* (pp. 48-78). SAGE Publications India.
- Arellano, M. 1987. Computing Robust Standard Errors for Within-groups Estimators. *Oxford bulletin of Economics and Statistics*, Vol. 49, No.4, h. 431–434.
- Baron, N., & Mangen, A. (2021). Doing the reading: The decline of long long-form reading in higher education. *Poetics Today*, 42, 253-279. <https://doi.org/10.1215/03335372-8883248>
- Binks, J., & Vale, C. (2016). The relationship between literacy and science attainment in high school. *Journal of Research in Science Teaching*, 53(3).
- Briggs, D. C., Alonzo, A. C., Schwille, K., & Wilson, M. (2012). The role of assessment in a learning culture. In *Assessment and teaching of 21st century skills* (pp. 17-41).
- Bormuth, H. (1973). Defining and assessing literacy. *Reading Research Quarterly*, 1, 10-12.
- Cabrera-Pommiez, M., Lara-Inostroza, F., & Puga-Larraín, J. (2021). Assessing academic reading in students entering higher education.
- DeBoer, G. E. (2011). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching*, 48(4).
- De-La-Peña, C., & Luque-Rojas, M. (2021). Levels of reading comprehension in higher education: Systematic review and meta-analysis. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.712901>
- Dromsky, M., & Turkan, S. (2015). The impact of literacy on science achievement: A meta-analysis. *Educational Research Review*, 16.
- Esmer, Baris, and Gunes, Ahmed Muhlih. (2019). The Usage of Meaning Identification Technique in Measuring Reading Comprehension Skills. *International Electronic Journal of Elementary Education*, 11 (4): 413-420.
- Fuentes, M., Mag R, J., Pozas, C.R.R., Pariente, J.P., and Corma, A., 1998, Cyclization Of Citronellal To Isopulegol By Zeolite Catalysis, *Appl. Catal*, 47(2), 367-374.
- Geske, Andrejs, and Antra Ozola. (2008) . Factors influencing reading literacy at the primary school level. *Problems of education in the 21st Century*.
- Huitt, W., & Hummel, J. (2006). An overview of the conative domain. *Education Psychology Interactive*. Valdosta, GA: Valdosta State University.
- Kang, H. S., Lee, J. E., & Choi, I. (2019). Science literacy as a predictor of science achievement: A longitudinal study. *International Journal of Science Education*, 41(2).
- Kanniainen, L., Kiili, C., Tolvanen, A., Aro, M., & Leppänen, P. H. (2019). Literacy skills and online research and comprehension: Struggling readers face difficulties online. *Reading and Writing*, 32(9), 2201-2222.
- Koyuncu, İ., & Firat, T. (2020). Investigating reading literacy in PISA 2018 assessment. *International Electronic Journal of Elementary Education*, 13(2), 263–275. <https://doi.org/10.26822/iejee.2021.189>
- Kendeou, P., & van den Broek, P. (2007). The effects of prior knowledge and text structure on comprehension processes during reading of scientific texts. *Memory & Cognition*, 35(7), 1567–1577.
- Kern, D., Bean, R. M., Swan Dagen, A., DeVries, B., Dodge, A., Goatley, V., ... Walker-Dalhouse, D. (2018). Preparing reading/literacy specialists to meet changes and challenges: International Literacy Association's Standards 2017. *Literacy Research and Instruction*, 57(3), 209-231.
- Kim, Y., Lee, H., & Zuilkowski, S. (2020). Impact of literacy interventions on reading skills in low- and middle-income countries: A meta-analysis. *Child Development*. <https://doi.org/10.1111/cdev.13204>
- Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1973). *Taxonomy of educational objectives: The classification of educational goals. Handbook II: Affective domain*. David McKay.
- Linnakyla", P., Malin, A., & Taube, K. (2004). Factors behind low reading literacy achievement. *Scandinavian Journal of Educational Research*, 48(3), 231–249. <https://doi.org/10.1080/00313830410001695718>

- Maroco, Joao. (2021). What makes a good reader? Worldwide insights from PIRLS 2016. *Reading and Writing*, 34:231–272
- Marzano, R. J., & Kendall, J. S. (2008). *The new taxonomy of educational objectives*. Corwin Press.
- B. Miles, M., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. SAGE Publications, Inc.
- Mustapha, A. B., & Mokhtar, N. F. (2017). The relationship between reading literacy and science achievement among Malaysian students. *Journal of Baltic Science Education*, 16(1).
- Nabila, Sarah, S., Rouli Manalu, & H. P. Santaosa. (2022). Hubungan tingkat kompetensi literasi digital dan intensitas konsumsi media sosial dengan tingkat kerentanan generasi milenial dalam mempercayai informasi palsu tentang Covid-19. *Interaksi Online*, 11(1).
- OECD. (2019). Programme for International Student Assessment (PISA) 2018 Result Indonesia. *Oecd 2019*, 79–79.
- Oficina, D., Letramento, N., Superior, E., Berberian, A., Bizelli, P., & Cruz, P. (2023). Literacy workshop in higher education: Students' view of their writing and reading conditions.
- Ozuru, Y., Dempsey, K., & Mcnamara, D. S. (2009). Prior knowledge , reading skill , and text cohesion in the comprehension of science texts. *Learning and Instruction*, 19(3), 228–242.
- Rindermann, Heiner, & Baumeister, Antonia E. E. (2015). Validating the Interpretations of PISA and TIMSS Tasks: A Rating Study. *International Journal of Testing*, Vol. 15: (1), p1-22.
- Rintaningrum, R. (2019). Explaining the important contribution of reading literacy to the country's generations: Indonesian's perspectives. *International Journal of Innovation, Creativity and Change*, 5(3).
- Şahin, Akbaşı, and M. Sahin, & Yaykiran, Z. (2016). The Effect of Reading Comprehension on the Performance in Science and Mathematics. *Journal of Education and Practice*, 7(16), 108-121.
- Verhoeven, L., Nag, S., Perfetti, C., & Pugh, K. (2024). *Global variation in literacy development*. Cambridge University Press.

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