Journal of Advanced Sciences and Mathematics Education
Volume 4, Issue 2, 61 - 70.
e_ISSN: 2798-2351
DOI: 10.58524/jasme.v4i2.363

Investigating the relationship between environmental literacy and mathematical literacy toward computer self-efficacy in secondary school

Ahmad Rozikin
SMPN 3 Palas,
INDONESIA

Suherman
University of Szeged,
HUNGARY

Farida
UIN Raden Intan Lampung,
INDONESIA

Riccardo Tasca
Slifigoi Srl,
ITALY

Article Info

Article history:

Received: April 03, 2024
Accepted: May 04, 2024
Published: Dec 15, 2024

Keywords:

Computer Self-efficacy;
Digital Competence;
Environmental Literacy;
Mathematical Literacy;
Secondary Education.

Abstract

Background: The twenty-first century has been characterised by remarkable advances in technology, information, and communication, underscoring the importance of environmental and mathematical literacy in navigating this digital age.
Aim: The study aims to investigate the influence of environmental and mathematical literacy on computer self-efficacy.
Method: This study employed a quantitative methodology within a correlational research design, with a total of 47 secondary school students participating by random sampling. Regression analysis was used to analyse the data, revealing insightful findings on the relationship between environmental and mathematical literacy and computer self-efficacy.
Results: After conducting the prerequisite checks for the regression test, it was determined that the feasibility of testing the hypothesis by the data, particularly through the regression test. In this study, the results showed that the relationship between environmental literacy and mathematical literacy with computer self-efficacy abilities is particularly significant. In fact, the study found that the combined influence of environmental and mathematical literacy on computer self-efficacy is stronger than its individual effects, suggesting a synergistic relationship between these types of literacy. Furthermore, mathematical literacy emerged with the highest average score of 62.070, followed by environmental literacy and computer self-efficacy abilities, which received average scores of 54.875 and 55.953, respectively.
Conclusion: In summary, the study underscores the significant positive impact on the relationship between environmental and mathematical literacy on computer self-efficacy among secondary school students. By improving environmental and mathematical literacy, educators and researchers can empower students with the skills and competencies necessary to navigate the digital landscape with confidence and proficiency.

To cite this article: Rozikin, A., Suherman, S., Farida, F. & Tazca, R. (2024). Investigating the relationship between environmental literacy and mathematical literacy toward computer self-efficacy in secondary school. *Journal of Advanced Sciences and Mathematics Education, 4*(2), 61 - 70. https://doi.org/10.58524/jasme.v4i2.363

INTRODUCTION

The twenty-first century has been characterised by advances in technology, information and communication. The impact of advances in technology, information and communication can be beneficial to the world of education (Suherman et al., 2020), it has the potential to significantly benefit education, indicating the crucial role that education plays in human life. Therefore, education is a fundamental need that must be met in the life of the nation and the state to develop knowledge-equipped human resources (Cooper et al., 2017; Erbay et al., 2021). The ever-accelerating pace of

* **Corresponding author:**
Suherman, University of Szeged, HUNGARY
suherman@edu.u-szeged.hu

change in the field of education requires educators and students to place a premium on literacy skills and to maximise their capacity for processing and understanding information (Nurwidodo et al., 2020; Widyastuti et al., 2020). Literacy aims to develop potential, solve problems in a variety of contexts, and participate in society through reading, writing, listening, and speaking (Damaianti et al., 2020). As a core component of education, literacy equips individuals with critical skills to navigate their world, including environmental and mathematical literacy, which are essential for addressing real-world challenges and fostering holistic growth.

There are two different types of literacy, including environmental literacy and mathematical literacy. Environmental literacy is the capacity, caring attitude toward the environment, and sense of love for the environment that enables people to understand the critical nature of maintaining and preserving environmental balance for present and future life (Setiawati et al., 2020). Environmental illiteracy has a profound effect on public health, productivity, level of concern, and response to information (Goldman et al., 2017). Environmental literacy can be quantified using the following criteria or components: knowledge, cognitive skills, attitudes, and environmentally responsible behaviour (Nurwidodo et al., 2020). Furthermore, mathematical literacy is critical in education, as it is one of the areas of focus for learning achievement (Gabriel et al., 2020). Moreover, mathematical literacy refers to an individual's capacity to use, interpret, and apply mathematics across various situations and contexts. It includes the ability to formulate and solve mathematical problems, as well as to understand mathematical concepts and communicate them effectively (Ekawati et al., 2020). Given its pivotal role in education, evaluating and enhancing mathematical literacy is essential to address existing gaps and support students in meeting global standards.

A study by the Organisation for Economic Cooperation and Development (OECD) found that, although Indonesian students showed improvement in mathematical literacy in 2015, they still do not meet international standards (OECD, 2019). To address this phenomenon, mathematical literacy can be evaluated based on several key components, including communication, mathematising, representation, reasoning and argumentation, problem solving strategies, operational proficiency, and the use of symbolic and formal language (Reddy & Panacharoensawad, 2017). This comprehensive evaluation framework serves as a guideline for improving mathematical literacy by focusing on essential skills that enable students to meet global benchmarks and enhance their problem-solving abilities effectively.

Mathematical literacy is a crucial aspect of mathematics education that enables students to formulate, reason about, interpret, and solve mathematical problems efficiently and logically (Farida et al., 2023; Sitopu et al., 2024). This type of education not only promotes analytical questioning but also incorporates the use of computers, which plays an integral role in modern learning environments. As an essential facility and infrastructure in education (Makarova et al., 2018), computers enhance the teaching and learning experience by providing tools for better problem solving and reasoning. In addition, students need to develop confidence or self-efficacy when using computers, which is a key aspect of the field of information and communication technology. This computer self-efficacy (CSE) supports students in effectively directing and utilising computers, streamlining the mathematics learning process and making it more engaging and productive (Balogun & Adebayo, 2016; Deryakulu et al., 2016; H et al., 2021; Mastuti & Suminar, 2018). By integrating these elements, mathematics instruction becomes more holistic, equipping students with the necessary skills to navigate mathematical challenges and technological advancements seamlessly.

Previous research has established a correlation between mathematical, environmental literacy, and computer self-efficacy. Studies have shown that there is a moderate and positive correlation between computer literacy and mathematical literacy among students (Ic & Tutak, 2018). However, there were exceptions in the correlations: no significant differences were observed in computer literacy levels between private and central schools, and in mathematical literacy levels between district and rural schools. Additionally, research has aimed to determine the effect of environmental literacy and mathematical literacy on students' computer self-efficacy abilities, highlighting the interconnectedness of these skills (Farida et al., 2023). Similarly, digital literacy and environmental literacy can predict mathematical thinking skill (Farida et al., 2023). This correlation underscores the importance of developing both mathematical literacy and computer self-efficacy to enhance students' overall competencies in problem solving and reasoning skills. Similarly, they researched explained that environmental literacy, along with mathematical literacy, can influence students' computer self-efficacy abilities both partially and concurrently. This means that computer self-efficacy abilities have a notable influence on student learning outcomes (List et al., 2020), academic (Abdullah & Mustafa, 2019), and learning success (Huda et al., 2019). Moreover, confidence in mathematical literacy can strengthen the connection between mathematics and activities of daily life.

Although there is existing research on the correlation between mathematical, environmental literacy, and computer self-efficacy, a gap remains in understanding how these literacies collectively impact students' long-term learning and adaptability. There is limited exploration of how a holistic educational approach that integrates mathematics, environmental, and digital literacy can foster both immediate academic success and long-term resilience. Additionally, there is a lack of understanding about optimal teaching practices and learning environments that can enhance these literacies in diverse educational contexts. Therefore, the study aims to investigate the influence of environmental and mathematical literacy on CSE, thus contributing to our understanding of literacy dynamics in educational settings.

METHOD

Research Design

This is a quantitative study that uses a correlational research design. Correlation analysis is a quantitative research technique that was used in this study. Correlation is a collection of techniques to determine the relationship between two variables; The fundamental concept of correlation analysis is to document the relationship between two variables (Kurdi et al., 2019). There are two variables in this study, namely variable X (environmental literacy and mathematical literacy), variable *Y* (computer self-efficacy ability). Therefore, the correlation analysis used in this study aims to determine the effect of environmental literacy and mathematical literacy on the self-efficacy of computer-adolescent students.

Participant

This research was carried out at a secondary school in Lampung province, Indonesia, with a total population of 86 eighth-grade students. The sample size for this study, consisting of 47 students, was determined using the Slovin formula. The sample consisted of 24 females and 23 males from various locations, including urban and suburban areas, and represented different ethnicities, such as Javanese, Lampung, and others.

Instrument

The research instrument is important and has a strategic position in the implementation of research. Circumstances have encouraged the efforts of experts to create procedures and tools that can be used, with the aim of revealing data that can be used as the basis for solving various problems. The instruments applied in this study were test instruments and questionnaires. The test was used to determine environmental and mathematical literacy, while the questionnaire was used to determine CSE. Students were given tests and questionnaires to complete as respondents.

The current research model is outlined in Figure 1. This model incorporates the use of a regression test along with the classical assumption test, also known as the prerequisite test, to ensure the validity and reliability of the analysis. These tests provide a robust foundation for examining the relationships within the data.

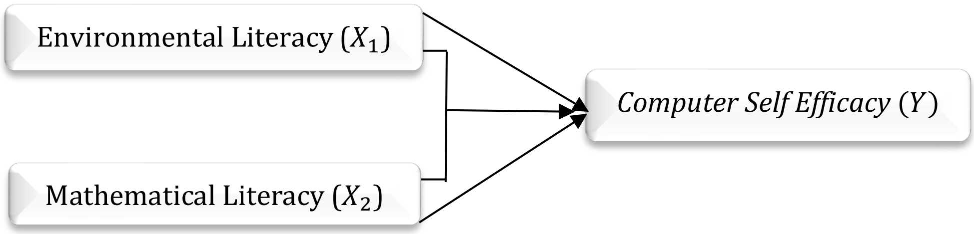

Figure 1. The Process of Linear Regression

To support the figure, here are hypotheses of the research:

1. Hypothesis 1 : There is a spatial influence of environmental literacy on computer self-efficacy.
2. Hypothesis 2 : There is a partial effect of mathematical literacy on computer self-efficacy.
3. Hypothesis3 : There is an effect of environmental literacy and mathematical literacy simultaneously on the ability to self-efficacy on computers.

Data Collection

This study collected data through the use of tests and questionnaires. The correlational research used will obtain data in the form of numbers that will be analysed using multiple linear regression analysis, making it easier for researchers to analyse the data that have been obtained. The analysis procedures were the normality test, the linearity test, the multicollinearity test, the heteroskedasticity test, the simple linear regression test, the multiple linear regression test, the coefficient of determination (R^2), the partial test (t test) and the simultaneous test. Additionally, we used multiple linear regression analysis to test hypotheses.

Data Analysis

The data obtained from the students in this study are the result of the students' ability to answer questions about environmental literacy and mathematical literacy, as well as computer self-efficacy abilities. These data were obtained by distributing mathematical problems in the form of descriptions that contain environmental literacy, environmental literacy, and mathematical literacy, and statements in the form of questionnaires that lead to computer self-efficacy abilities. Data analysis techniques such as simple linear regression and multiple linear regression were used to analyse the collected data. Simple regression analysis is used to determine the partial relationship between environmental literacy and mathematical literacy and their effects on computer self-efficacy abilities; Multiple regression analysis is used to determine the simultaneous relationship between environmental literacy and mathematical literacy and their effects on computer self-efficacy abilities. The results and discussion section describe in detail the relationship between environmental literacy and mathematical literacy, and computer self-efficacy.

RESULTS AND DISCUSSION

Since this research was conducted online during the Covid-19 pandemic, it was not optimal and several obstacles occurred during the research period, delaying student work on questions and questionnaires. These barriers include the following: Some students struggle with technology, others lack mobile phones, others lack Internet quota, and others lack the time necessary to complete test questions and questionnaires. Following a computer-based assessment of environmental literacy, mathematical literacy, and self-efficacy, the following data are compiled.

Table 1. The Description of the Test

Data	Min	Max	Mean	Median	Range	Variance	SD
Environmental literacy	39.584	79.167	54.875	54.167	39.584	52.702	7.259
Mathematical literacy	45.333	84.000	62.070	61.333	38.667	72.488	8.514
CSE	43.192	73.475	55.953	56.316	30.283	45.272	6.728

According to Table 1, mathematical literacy received the highest average score of 62.070, followed by environmental literacy and CSE ability, which received average scores of 54.875 and 55.953, respectively. The following table summarises the results of the normality test using the Lilliefors test:

Table 2. Normality of the Aspects

Variables	p-value	Information
Environmental literacy	.200	Normal Distribution
Mathematical literacy	.200	Normal Distribution
CSE	.200	Normal Distribution

The normality test revealed that the p-value was greater than the 0.05 significance level. As a result, it can be concluded that the data was distributed normally.

Table 3. Results of Linearity

Variables	p-value	Information
CSE * Environmental literacy	.611	Linear
CSE * Mathematical Literacy	.247	Linear

The linearity test indicates that the p-value is greater than the 0.05 significance level. Therefore, there is no linear relationship between the two variables that affect computer self-efficacy.

Table 4. Results of heteroscedasticity

Variables	p-value	Information
Environmental literacy	.105	There is no heteroskedasticity.
Mathematical literacy	.155	There is no heteroskedasticity.

The results of the heteroscedasticity test indicate that all independent variables in either simple linear regression or multiple linear regression have a value greater than the 0.05 level of significance. Thus, there is no evidence of heteroskedasticity.

Table 5. Multicollinearity Results

	Collinearity Statistics	
	Tolerance	VIF
Environmental literacy	.896	1.543
Mathematical literacy	.896	1.543

The multicollinearity test indicates that all independent variables have a tolerance value greater than 0.1 and a VIF value less than 10, indicating that there is no correlation between them.

Table 6. Result of the autocorrelation test

Data	$P - value$
Durbin Watson	2.200
DU	0.620
4 – DU	2.380
Conclusions	$0.620 < DW < 2.380$

Table 6 indicates that Autocorrelation Test Calculation, there is no autocorrelation symptom because the Durbin Watson value of 2.200 falls between the DU's value of 0.620 and 4 - DU's value of 2.380. After passing the prerequisite test, which includes normality, linearity, heteroscedasticity, multicollinearity tests, and autocorrelation tests, it is possible to test the hypothesis, specifically the regression test.

Hypothesis 1: There is a spatial influence of environmental literacy on computer self-efficacy.

Where the linearity test is not met or the data is not linear, a nonlinear regression test, namely the quadratic regression test, is conducted with the following results.

Table 7. Summary of Hypothesis Test Results 1

Variable	Regression Coefficient	t_{count}	Sig.
Constanta	40.743		
X_1	.277	2.102	.041
R	0.299[a]		
R^2	0.089		

Table 7 shows that the constant value is 40.743 and the value of the environmental literacy/regression coefficient is 0.277. Thus, we obtain the following simple linear regression equation: $\hat{Y} = 40.743 + 0.277X_1$. The regression coefficient $X_1$of 0.339 indicates that for every 1% increase in the value of environmental literacy, the value of computer self-efficacy increases by 0.277, and when environmental literacy is zero, the change in computer self-efficacy is 40.734. Additionally, Table 7 above indicates that the positive regression correlation coefficient, or R, between environmental literacy and computer self-efficacy is 0.299. The R^2 The value is 0.089, indicating that environmental literacy variables have an effect on computer self-efficacy to the tune of 8%, while the remaining 92% are influenced by variables not examined in the study.

The value of $t_{count} > t_{table}$> was 2.102 > 1.679, indicating that environmental literacy is partially related to computer self-efficacy. This is also supported by the p-value of 0.041<0.05, which indicates that the environmental literacy variable was partially related to the ability of CSE, and the regression value for environmental literacy was positive, indicating that the first hypothesis is true: There is a relationship between environmental literacy and CSE. This research has proven that environmental literacy can impact CSE among students (Blessing, 2012; Farida et al., 2023; Vilmala et al., 2023).

Hypothesis 2: There is a partial effect of mathematical literacy on computer self-efficacy.

Table 8. Summary of Hypothesis Test Results 2

Variable	Regression Coefficient	t_{count}	sig
Constant	34.931		
X_2	.339	3.182	.003
R	.429[a]		
R^2	.184		

Table 8 shows that the constant value is 34,931. and the coefficient of mathematical literacy/regression is 0.339. Thus, we obtain the following simple linear regression equation: $\hat{Y} = 34.931 + 0.339X_2$. The regression coefficient X_2 of 0.339 indicates that for every 1% increase in the value of mathematical literacy, the value of computer self-efficacy increases by 0.339, and when mathematical literacy is zero, the change in computer self-efficacy is 34,931. According to Table 8, the positive regression correlation coefficient, or R, between mathematical literacy and computer self-efficacy is 0.429. The R^2 value of 0.184 indicates that the mathematical literacy variables have an 18% effect on computer self-efficacy, while the remaining 82% are influenced by the variables not examined in the study.

The value of $t_{count} > t_{table}$was 3.182 > 1.679, indicating that the mathematical literacy is partially partially partially related to computer self-efficacy. This is also supported by the P value of 0.003<0.05, which indicates that the mathematical literacy variable is partially related to computer self-efficacy and that the regression value for mathematical literacy is positive, indicating that the second hypothesis was accepted. This finding has been proven and supported by previous research that mathematical literacy can predict CSE (Ic & Tutak, 2018). Mathematical literacy is a crucial life skill that must be emphasised and cultivated in education (Sumirattana et al., 2017). Furthermore, the findings of this study indicate that the student's computer self-efficacy improves positively when they possess a strong foundation in mathematical knowledge, highlighting the significant impact of mathematical literacy on their confidence in computer use (Gadanidis et al., 2022; Köysüren & Üzel, 2018; Saribas et al., 2017; Yılmazer & Masal, 2014).

Hypothesis 3: There is an effect of environmental literacy and mathematical literacy simultaneously on the ability to self-efficacy on computers.

Table 9. Summary of results of the hypothesis test 3

Variable	Regression Coefficient	t_{count}	Sig.
Constant	28.642		
X_1	0.166	1.270	0.211
X_2	0.293	2.623	0.012
R	.461[a]		
R^2	0.213		

Table 9 indicates that the constant value is 28.642. and the coefficients of environmental literacy and mathematical literacy/regression are 0.166 and 0.293, respectively. Thus, the simple linear regression equation: $\hat{Y} = 28.642 + 0.166X_1 + 0.293X_2$. The equation indicates that the regression coefficients $X_1$and $X_2$are 0.166 and 0.293, respectively, which indicates that for every 1% increase in the value of environmental literacy and mathematical literacy, the value of computer self-efficacy increases by 0.166 and 0.293, respectively, and that when environmental literacy and mathematical literacy are both zero, the change in computer self-efficacy was 28. Furthermore, the regression correlation coefficient, R, between environmental literacy, mathematical literacy, and computer self-efficacy is 0.461. The R2 value was 0.213, indicating that environmental literacy and mathematical literacy variables have a 21% effect on computer self-efficacy, while the remaining 79% are influenced by variables not examined in the study.

Each independent variable has a $t_{count}>t_{table}$value of 1.270 and 2.623 > 1.679, indicating that environmental literacy and mathematical literacy have a partial relationship with computer self-efficacy. This is also supported by the P-values of 0.211 and 0.012 < 0.05, which indicate that environmental literacy and mathematical literacy are related to computer self-efficacy. Environmental and mathematical literacy have positive regression coefficients, allowing the hypothesis to be accepted.

The results of the statistical analysis indicate that environmental literacy and mathematical literacy have a partial and concurrent relationship with computer self-efficacy abilities. Environmental literacy and mathematical literacy have a stronger relationship with computer self-efficacy than the partial relationship. Environmental literacy and mathematical literacy have a 46% correlation with computer self-efficacy. Meanwhile, the relationship between environmental literacy, mathematical literacy, and computer self-efficacy is weaker than the concurrent relationship, which is 29% and 42%, respectively. In this study, the results showed that the relationship between environmental literacy and mathematical literacy with computer self-efficacy abilities is particularly significant. In fact, the study found that the combined influence of environmental and mathematical literacy on computer self-efficacy is stronger than its individual effects, suggesting a synergistic relationship between these types of literacy.

Previous research supports the notion that environmental literacy and mathematical literacy have a combined effect on computer self-efficacy abilities. For example, a study by Farida et al. (2023) found that students with strong foundations in both environmental and mathematical literacy demonstrated greater confidence and proficiency in computer usage. Similarly, research by Ekawati et al. (2020) indicated that students who excelled in mathematical literacy were better equipped to leverage digital tools effectively. These findings suggest a positive correlation between literacy in the environmental and mathematical domains and improved self-efficacy of the computer, ultimately leading to improved learning outcomes and academic achievement.

CONCLUSION

The study investigated the relationship between environmental and mathematical literacy on computer self-efficacy (CSE). The key findings revealed a positive impact of environmental literacy on CSE, demonstrating that students with greater awareness and knowledge of the environment also exhibited greater confidence and skills in the use of computers. Similarly, mathematical literacy was found to positively influence CSE, suggesting that students' proficiency in mathematics contributes to their ability to navigate digital tools effectively. The study also identified a combined effect of environmental and mathematical literacy on computer self-efficacy, highlighting the interconnectedness of these literacy skills in improving students' digital competence. Although the study provides valuable information, there are some limitations to consider. The sample size may limit the generalisability of the findings, and the study's cross-sectional design does not establish causality. Future research could explore these relationships using longitudinal studies to better understand the direction of causation and the long-term effects of literacy skills on computer self-efficacy. Additionally, investigating different educational contexts and larger and more diverse populations could yield more comprehensive results.

AKNOWLEDGMENT

The authors thank Universitas Islam Negeri Raden Intan Lampung and Palas Secondary School 3, Lampung province, for their support for this study. The authors also thank the University of Szeged for suggestions and discussions of an idea from a research point of view.

AUTHOR CONTRIBUTIONS STATEMENT

All authors contributed to the conception and design of the study.
Ahmad Rozikin: Conceptualization, Writing - Original Draft, Formal analysis, Methodology.
Farida : Editing, and Visualization.
Suherman : Visualization, Review, and Editing.
Riccardo Tasca : Visualization and Review.

REFERENCES

Abdullah, Z. D., & Mustafa, K. I. (2019). The Underlying Factors of Computer Self-Efficacy and the Relationship with Students' Academic Achievement. *International Journal of Research in Education and Science*, *5*(1), 346–354.

Balogun, A. G., & Adebayo, S. O. (2016). Role of computer self-efficacy and gender in computer-based test anxiety among undergraduates in Nigeria. *Psychological Thought*, *9*(1). https://doi.org/10.5964/psyct.v9i1.160

Blessing, A. (2012). Environmental Literacy Assessment: Exploring the Potential for the Assessment of Environmental Education/Programs in Ontario Schools. *International Journal for Cross-Disciplinary Subjects in Education*, *3*(1). https://doi.org/10.20533/ijcdse.2042.6364.2012.0091

Cooper, D., Kim, J., Duderstadt, K., Stewart, R., Lin, B., & Alkon, A. (2017). Interprofessional oral health education improves knowledge, confidence, and practice for pediatric healthcare providers. *Frontiers in Public Health*, *5*, 209. https://doi.org/10.3389/fpubh.2017.00209

Damaianti, V. S., Abidin, Y., & Rahma, R. (2020). Higher order thinking skills-based reading literacy assessment instrument: An Indonesian context. *Indonesian Journal of Applied Linguistics*, *10*(2), 513–525. https://doi.org/10.17509/ijal.v10i2.28600

Deryakulu, D., McIlroy, D., Ursavaş, Ö. F., & Çalışkan, E. (2016). Intrapair Similarity of Computer Self-Efficacy in Turkish Adolescent Twins. *Journal of Educational Computing Research*, *54*(6). https://doi.org/10.1177/0735633116639952

Ekawati, R., Susanti, S., & Chen, J. C. (2020). *Primary students' mathematical literacy: A case study. Infinity Journal, 9 (1), 49-58*. https://doi.org/10.22460/infinity.v9i1.p49-58

Erbay, F., TOKLU, D. A., Kuset, Ş., & Siddik, H. (2021). Comparison of Pre-School Education Curricula of Turkish Republic of Northern Cyprus (TRNC), England, Finland, Southern Cyprus and India. *Participatory Educational Research*, *8*(3), 385–401. https://doi.org/10.17275/per.21.72.8.3

Farida, F., Alamsyah, Y. A., & Suherman, S. (2023). Assessment in educational context: The case of environmental literacy, digital literacy, and its relation to mathematical thinking skill. *Revista de Educación a Distancia (RED)*, *23*(76), 1–26. https://doi.org/10.6018/red.552231

Farida, F., Suherman, S., Widyastuti, R., Anggoro, B. S., Romadhona, A. N., & Septiyani, W. (2023). Computer self-efficacy and its relationship between environmental literacy and mathematical literacy by students in Indonesia. *AIP Conference Proceedings*, *2595*(1). https://doi.org/10.1063/5.0123869

Gabriel, F., Buckley, S., & Barthakur, A. (2020). The impact of mathematics anxiety on self-regulated learning and mathematical literacy. *Australian Journal of Education*, *64*(3), 227–242. https://doi.org/10.1177/0004944120947881

Gadanidis, G., Silva, R. S. R. da, Hughes, J., Floyd, S., & Namukasa, I. K. (2022). Computational Literacy & Mathematics Education. *Revista Internacional De Pesquisa Em Educação Matemática*, *12*(4). https://doi.org/10.37001/ripem.v12i4.3144

Goldman, D., Pe'er, S., & Yavetz, B. (2017). Environmental literacy of youth movement members–is environmentalism a component of their social activism? *Environmental Education Research*, *23*(4), 486–514. https://doi.org/10.1080/13504622.2015.1108390

H, N., Febriati, F., & Ervianti, E. (2021). The Impact of Computer-based Test and Students' Ability in Computer Self—Efficacy on Mathematics Learning Outcomes. *Journal of Education Technology*, *5*(4). https://doi.org/10.23887/jet.v5i4.34942

Huda, S., Rinaldi, A., Suherman, S., Sugiharta, I., Astuti, D. W., Fatimah, O., & Prasetiyo, A. E. (2019). Understanding of Mathematical Concepts in the Linear Equation with Two Variables: Impact of E-Learning and Blended Learning Using Google Classroom. *Al-Jabar: Jurnal Pendidikan Matematika*, *10*(2), 261–270. https://doi.org/10.24042/ajpm.v10i2.5303

Ic, U., & Tutak, T. (2018). Correlation between computer and mathematical literacy levels of 6th grade students. *European Journal of Educational Research*, *7*(1), 63–70. https://doi.org/10.12973/eu-jer.7.1.63

Kurdi, B., Seitchik, A. E., Axt, J. R., Carroll, T. J., Karapetyan, A., Kaushik, N., Tomezsko, D., Greenwald, A. G., & Banaji, M. R. (2019). Relationship between the Implicit Association Test and intergroup behavior: A meta-analysis. *American Psychologist*, *74*(5), 569. https://doi.org/10.1037/amp0000364

Köysüren, M., & Üzel, D. (2018). Matematik Öğretiminde Teknoloji Kullanımının 6. Sınıf Öğrencilerinin Matematik Okuryazarlığına Etkisi. *Necatibey Eğitim Fakültesi Elektronik Fen Ve Matematik Eğitimi Dergisi*, *12*(2). https://doi.org/10.17522/balikesirnef.506418

List, A., Brante, E. W., & Klee, H. L. (2020). A framework of pre-service teachers' conceptions about digital literacy: Comparing the United States and Sweden. *Computers & Education*, *148*, 103788. https://doi.org/10.1016/j.compedu.2019.103788

Makarova, I., Shubenkova, K., & Mavrin, V. (2018). Economics' Digitalization—New Challenges to Engineering Education. *International Conference on Interactive Collaborative Learning*, 699–709. https://doi.org/10.1007/978-3-030-11935-5_66

Mastuti, E., & Suminar, D. R. (2018). Test Anxiety, Computer Self Efficacy, and Perceived Ease of Use During Computer-Based Test on First-Year Students. *International Conference on Education*. https://doi.org/10.17501/icedu.2018.4112

Nurwidodo, N., Amin, M., Ibrohim, I., & Sueb, S. (2020). The Role of Eco-School Program (Adiwiyata) towards Environmental Literacy of High School Students. *European Journal of Educational Research*, *9*(3), 1089–1103. https://doi.org/10.12973/eu-jer.9.3.1089

OECD. (2019). *Draft Framework for the Assessment of Creative Thinking in PISA 2021*. OECD Publisher.

Reddy, M., & Panacharoensawad, B. (2017). Students Problem-Solving Difficulties and Implications in Physics: An Empirical Study on Influencing Factors. *Journal of Education and Practice*, *8*(14), 59–62.

Saribas, D., Kucuk, Z. D., & Ertepinar, H. (2017). Implementation of an environmental education course to improve pre-service elementary teachers' environmental literacy and self-efficacy beliefs. *International Research in Geographical and Environmental Education*, *26*(4), 311–326. https://doi.org/10.1080/10382046.2016.1262512

Setiawati, E., Usmaedi, A. T. N., Nuryati, A. T. M., Sirjon, Y., Aprilyati, S., Ruiyat, A. F., Rahmani, A., Aryadi11, D., & Hartuti12, Y. N. S. (2020). Develop Green Behaviour through Ecoliteracy for Early Children. *Systematic Reviews in Pharmacy*, *11*(11), 1551–1558.

Sitopu, J. W., Khairani, M., Roza, M., Judijanto, L., & Aslan, A. (2024). The Importance of Integrating Mathematical Literacy In The Primary Education Curriculum: A Literature Review. *International Journal of Teaching and Learning*, *2*(1), 121–134.

Suherman, S., Vidákovich, T., & Komarudin, K. (2020). STEM-E: Fostering Mathematical Creative Thinking Ability in The 21st Century. *The 1st South East Asia-Science, Technology, Engineering and Mathematics International Conference 2020*. https://doi.org/10.1088/1742-6596/1882/1/012164

Sumirattana, S., Makanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. *Kasetsart Journal of Social Sciences*, *38*(3), 307–315. https://doi.org/10.1016/j.kjss.2016.06.001

Vilmala, B. K., Suhandi, A., Permanasari, A., Kaniawati, I., & Purwanto, H. (2023). Environmental literacy portrait of pre-service science teacher in Indonesia. *Journal of Environment and Sustainability Education*, *1*(1). https://doi.org/10.62672/joease.v1i1.4

Widyastuti, R., Anggoro, B. S., Negara, H. S., Yuliani, M. D., Utami, T. N., & Suherman, S. (2020). Understanding mathematical concept: The effect of savi learning model with probing-prompting techniques viewed from self-concept. *Journal of Physics: Conference Series*, *1467*(1), 012060. https://doi.org/10.1088/1742-6596/1467/1/012060

Yılmazer, G., & Masal, M. (2014). The Relationship between Secondary School Students' Arithmetic Performance and their Mathematical Literacy. *Procedia - Social and Behavioral Sciences*, *152*. https://doi.org/10.1016/j.sbspro.2014.09.253