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Research Article

Application of a Learning Model Based on Scientific Literacy to Improve Reasoning Ability Students' Critical Thinking

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ABSTRACT

The purpose of this study was to apply a scientific literacy-based learning model to improve students' critical thinking reasoning abilities in class X SMA Negeri 3 Pematangsiantar. The method used in this study is a Quasi Experimental Design quantitative research method. The results of the study show that the application of scientific literacy-based learning models can improve students' critical thinking reasoning abilities. The hypothesis in this study is that there is an increase in students' critical thinking reasoning abilities in class X SMA Negeri 3 Pematangsiantar. Based on the results of calculations using the t test, it can be concluded that the hypothesis is accepted, namely t_count of 6.217 greater than ttable of 2.002. The results of this study are expected to be useful for related parties such as teachers and further researchers.

Keywords*: Critical thinking, Scientific literacy-based learning model*

Introduction

Thinking is a human activity that leads to discovery and is focused on certain goals. Thinking is a mental process for gaining and developing knowledge (Thahir, 2019). During the educational process, the ability to think critically can be strengthened by providing them with opportunities to solve problems that add depth to their experience. This view is in line with Tyler's opinion in (Mayadiana, 2019) regarding the need to provide them with experience or learning that provides opportunities for them to build abilities in problem solving to encourage the growth of their critical thinking. How important this presentation is to provide a framework for thinking about and approaching problems.

Critical thinking is one of the higher order thinking skills that is learned and developed in school. (Wahab, 2021)offers four justifications for getting into the habit of honing critical thinking skills. (1) the need for citizens to be able to find, evaluate, and apply information in social and governmental contexts; (2) the fact that every citizen must face various challenges and choices; (3) the importance of being able to see things from different points of view when solving problems; and (4) the importance of developing critical thinking skills to be able to compete effectively and fairly.

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The goal of introducing them to scientific ideas is to spark their interest in learning more about the fascinating world in which they live. University of California specialists in the United States agree that can acquire scientific concepts, generalizations, and hypotheses from textbooks in the same way they study other subjects (Jufri, 2018). The study of natural sciences, which has three different but interrelated components (end results, processes, and thought patterns), is generally agreed to be the core of the scientific method. Experimental results and adjustments provide the backbone of scientific explanations. The full potential of science education will be realized if it is able to help students become subject matter experts, foster critical, logical, creative cognition, problem solving, and develop technical mastery and the ability to change with the times (Nurhayani, 2017). An often cited problem in science education is "the belief that people will be considered to have high scientific literacy skills if they are exposed to large amounts of data and ideas, regardless of their actual problem-solving abilities. Learning science requires not only an introduction to ideas and theories, but also the general and practical methods associated with scientific inquiry and how to integrate them, so this framework is clearly at odds with what is in terms of scientific literacy abilities" (Baird et al., 2019).

acquire knowledge, skills in scientific methods, and attitudes that are significant as they fulfill their intended function. The 2013 curriculum provides opportunities to develop good attitudes, skills and knowledge. The following are the objectives of the 2013 Class By asking honest, rational, critical, thorough and responsible what-why-how questions about nature and science, (2) exemplifying a scientific attitude. around, (4) utilizing the five senses and simple tools to investigate science material, (5) presenting the nature of the observed data in the form of tables or graphs, (6) making conclusions and presenting findings. Simple oral and written descriptions of observations of the natural environment that (7 conveys the ideas and principles of science). Based on the results of observations, class X of SMA Negeri 3 Pematangsiantar displays science learning using an innovative model called contextual learning, but in reality contextual learning has not been implemented very effectively. This is because the contextual learning components have not been fully integrated and the teacher is still the main source of learning in the classroom.

The teacher demonstrated through LKPD and test questions used to assess low-level thinking learning outcomes, especially at the level of remembering (C1) and understanding, that critical thinking skills have not been improved and have never been tested (C2). According to class

Scientific literacy refers to the fight against illiteracy and for the dissemination of knowledge. Meanwhile, the origin of the word science is the word science which means knowledge. According to the National Science Education Standards, scientific literacy is defined as "scientific literacy is knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic *productivity*." Scientific literacy is knowledge, an understanding of scientific ideas and procedures that empowers a person to act based on their knowledge and participate in social, cultural and economic development issues (Adisendjaja & Oom, 2020).

The Program for International Student Assessment defines scientific literacy as "an individual's capacity to understand and make decisions about nature and human interactions with nature by applying their knowledge of science, identifying problems, and building conclusions based on scientific evidence" (Griffin & Ramachandran, 2019). Furthermore (PISA), defines scientific literacy as "the capacity to apply scientific knowledge, analyze questions and draw conclusions based on evidence, understand and make decisions related to nature and its activities with humans" (Novili, Utari, Saepuzaman, & Karim, 2017). Science competency (process), science knowledge/content (content), and the science application environment are the three main elements of early literacy developed by PISA.

The overall literacy level is low, especially at SMA Negeri 3 Pematangsiantar. This shows that there are still many who have difficulty understanding and evaluating lesson material, especially in areas related to science learning.

The lack of scientific literacy at the SMA Negeri 3 Pematangsiantar level is expected to have a long-term impact on the inability of elementary schools to grasp key ideas, leading to reduced knowledge, values and skills. (Fitrian & Dewi, 2021). To help develop scientific abilities, especially skills related to basic scientific concepts (Fazilla, 2019a).

Teachers are responsible for instilling not only the knowledge and skills necessary for learning, but also a mindset in them that no other educational source can provide. According to (Sagala, 2019)"teachers are tasked with planning and implementing the learning process, assessing learning outcomes, providing guidance and training, conducting research and studies, and opening communication with the community." Science majors in the SMA Negeri 3 Pematangsiantar program need to be experienced in various subjects and pedagogical methods in order to carry out learning activities effectively and fulfill their professional responsibilities. As a result, it is very important for SMA Negeri 3 Pematangsiantar to have a strong foundation in natural sciences. This means that anyone aspiring to a SMA Negeri 3 Pematangsiantar degree must demonstrate a high level of scientific knowledge.

Aspiring science educators can help them feel comfortable with the idea of being part of a scientific community by giving them opportunities to engage in meaningful discussions about scientific issues and the way science is used in the classroom. Individuals in communities with high levels of scientific literacy are more likely to take part in initiatives that promote positive social change, including educators and others (Medan, 2022). As stated by prospective science educators must have the following skills to effectively foster scientific literacy: a) teach to focus on areas of interest; b) teach reading scientific papers; c) teach to read like a scientist. In this regard, the main aim of this research is to assess the level of scientific literacy at SMA Negeri 3 Pematangsiantar by paying special attention to their competency components which can be the basis for future policy decisions. This research focuses more on the application of a scientific literacy-based learning model to improve the critical thinking reasoning abilities of students at SMA Negeri 3 Pematangsiantar.

Methods

The sample used in this research used a purposive sampling technique, because there were considerations in selecting classes with homogeneous abilities, an experimental class could be determined. The samples in this research were class X Science 1.

The data collection techniques that researchers use to carry out research in teaching and learning activities using a scientific literacy-based learning model are as follows: 1. Test, 2. Observation. Learning outcome data is used as a critical thinking literacy evaluation tool using a scientific literacy-based learning model (Handayani & Muhammadi, 2020). The test questions are given before learning begins (pretest) and after learning at the last meeting (posttest), the pretest and posttest are in the form of essays, each consisting of 3 questions with different scores (Elita, Habibi, Putra, & Ulandari, 2019a).

The data from this observation sheet is used as an observation that the steps in the scientific literacy-based learning model carried out by the teacher in the learning process are appropriate. So that from the observation data it can be seen that the increase in critical thinking skills is taught through a scientific literacy-based model which is carried out according to the model steps.

The data analysis stage is a very important stage in research, because it is at this stage that researchers can formulate the results of their research. After all the data has been collected, to describe the research data, the research data is analyzed using appropriate statistics. The data processed for this research is initial test data and final test data. in the experimental class. The tests carried out were normality, homogeneity, hypothesis testing and ngain score tests (Novianti, Bentri, & Zikri, 2020).

Result and Discussion

The data that will be analyzed in this research is data on critical thinking skills on the material "environmental pollution".

Convert Ordinal Data to Critical Thinking Skills Intervals with MSI (Method of Successive Internal)

Critical thinking ability data is ordinal scale data. Statistical procedures such as t-test, homogeneous and so on, require interval scale data. Therefore, before using the t-test, ordinal data needs to be converted to interval data, in this study the Method of Successive Internal (MSI) was used. The ordinal data above will be converted into periodic interval data to produce interval values. The following are the steps to convert ordinal data into interval data using manual calculations.

1) Calculating Frequency

Based on the table of scoring results of the initial critical thinking ability test for the experimental class, the frequency of ordinal data 0 to 4 is 496, for scale 0 91 times, ordinal scale 1 179 times, ordinal scale 2 187 times, ordinal scale 3 39 times, and ordinal scale 4 0 times. So the total appearance of the ordinal scale from 0-4 is 496 times.

2) Calculating Proportions

Proportions can be calculated by dividing the frequency of each ordinal scale by the total frequency.

3) Calculating Cumulative Proportions

The cumulative proportion is calculated by adding each proportion sequentially, and can be seen in the following table:

Table 1. Cumulative Proportion

Proportion	Cumulative Proportion
0.190	PK $_0$ = 0.189
0.363	PK $_1$ = 0.189 + 0.363 = 0.552
0.363	PK $_2$ = 0.189 + 0.363 + 0.363 = 0.915
0.071	PK $_2$ = 0.189 + 0.363 + 0.363 + 0.071 = 0.986
0.014	PK $_2$ = 0.189 + 0.363 + 0.363 + 0.071 + 0.014 = 1

4. Calculate the Z value

The z value is obtained from the standard normal distribution table. Assuming that the cumulative proportion has a standard normal distribution. PK0 = 0.190, so the p value to be calculated is 0.5 – 0.189 = 0.311. Place it on the right because the value PK0 = 0.189 is less than 0.5. Next, look at the z table which has an area of 0.311. In fact, these values are at Z0.88 = 0.3106 and Z0.89 = 0.3133. Therefore, the Z value for an area with a proportion of 0.311 can be determined by interpolation as follows: Because z is on the right, z is positive. So the Z value for PK0 = 0.189 is Z0 = 0.88. The same calculation is carried out to obtain the Z value for PK1, PK2, PK3, and PK4.

5. Calculating the Density Value of the Z Function

In the same way, calculations are carried out for the values F(Z1), F(Z2), F(Z3), and F(Z4), so that we obtain F(Z1) = 0.0034, F(Z2) = 0, F(Z3) = 0, F(Z4) = 0.

6. Calculating Scale Value

To find the density value, determine the lower limit minus the upper limit, while for the are value, the upper limit is reduced by the lower limit. For SV0 the lower limit value for the first density is 0 (less than 0.1544) and for the cumulative proportion it is also 0 (below the value 0.88)

Table 2. Cumulative Proportin and Density Values (F(z))

Cumulative proportion	Density (F(z))
0.189	0.1544
0.552	0.0034
0.915	0
0.986	0
1	0

7. Calculating Scaling

Table 3. Results of Changing the Ordinal Scale to an Interval Scale Using the MSI Initial Test for the Experimental Class

Successive Detail							
Col	**Category**	**Freq**	**Prop**	**Cum**	**Density**	**Z**	**Scale**
1	0	94	0.189	0.189	0.1544	0.88	1
	1	180	0.363	0.552	0.0034	0.131	1.7652
	2	180	0.363	0.915	0		1.8075
	3	35	0.071	0.986	0		1.8169
	4	7	0.014	1	0		1.8169

Based on the table above, the data shows that the 0-4 ordinal scale data has been converted into an interval scale. Therefore, any data with a score of 0 is replaced with 1.00, score 1 is replaced with 1.7652, score 2 is replaced with 1.8075, score 3 is replaced with 1.8169 and score 4 is replaced with 1.8169. Next, we will change the post-test ordinal data for critical thinking skills in Table 4.5 into ordinal scale data which will be converted into interval data.

Table 4. Results of Changing the Ordinal Scale to an Interval Scale Using the MSI Final Test of the Experimental Class

SuccessiveDetail							
Col	**Categories**	**Freq**	**Prop**	**Cum**	**Density**	**Z**	**Scale**
1	0	4	0.0080	0.0080	0.4920	-6.15	-11,3
	1	8	0.0161	0.0241	0.4759	1.0125	-4.1375
	2	104	0.2117	0.2358	0.2642	40.7115	35,561
	3	227	0.4577	0.6935	0	-0.5772	-5.7272
	4	152	0.3065	1	0	0	-5.15

Manual Processing of Pre-test and Post-test Results of Critical Thinking Ability of Experimental Class

Experimental Class Pre-test Processing

Tabulate the data into a frequency distribution table, determine the average value (x) and standard deviation (s). The data processed is the total score from the critical thinking ability crew condition data. Based on the total score, the frequency distribution for the initial condition data for critical thinking skills taught through the project based learning model is as follows:

Table 5. List of Frequency Distribution of Experimental Class Pre-test Results

Score	**f i**	**i**	**f i × x i**	**i²**	**f i (xi)²**
10,00-10,84	5	11,42	57,1	130,42	652,1
10,85-11,69	8	11,27	90,16	127,01	1.016,08
11,70-12,54	9	12,12	109,08	146,89	1,322.01
12.55-13.39	6	12.97	77.82	168.22	1,009.32
13.40-14.24	3	13.,84	41.52	191.55	574.65
Amount	31	61.62	375.68	600.22	4,574.16

The variance was 0.7038 and the standard deviation 0.84

Normality test

The data normality test aims to determine whether the data from each class in this study

comes from a population with a normal distribution or not, if it is not normal then parametric statistical techniques cannot be used for data analysis. The test criteria are x 2 ≥ x 2 with α = 0.05 in this case HO is accepted. The hypotheses in testing the normality of pre-test data are as follows:

HO : the sample comes from a normally distributed population
H 1 : the sample comes from a population that is not normally distributed

To see the significance value in the normality test using the 5% level (α = 0.05), the decision making criteria are:

1. If the significance value is <0.05 then HO is rejected
2. If the significance value is > 0.05 then HO is accepted

Based on previous calculations, for the initial test (pre-test) of the experimental class x 1 = 12.12 and s 1 = 0.84. Based on a significance level of 5% α = 0.05 with dk = k-1 = 5-1 = 4 then x 2(0.95)(5) = 9.49 the decision making criteria are: "Reject H 0 if x 2 ≥ x 2 with α =0.05, accept H 0 if x 2 ≤ x 2. because x 2 ≤ (1− α)(k −1) (1− α)(k −1) x 2, namely 1.9641≤ 9.49 then accept H 0 and it can be concluded that the initial test data for the experimental class came from a population with a normal distribution.

Experimental Class Post-test Processing

Tabulate the data into a frequency distribution table, determine the average value (x) and standard deviation (s). The data processed is the total score of the final condition data of thinking ability, based on the total score of the frequency distribution for the final condition data of critical thinking ability learning through problem based learning model as follows:

Table 6. Frequency Distribution List of Experimental Class Post-test Results

Mark	f_i	x_i	$f_i \times x_i$	x^2	$f_i (x^2)$
42.00 - 42.81	7	42.41	296,87	1.798,6081	12.590,2567
42.82 - 43.63	6	43.23	259,38	1.868,8329	11.212,9974
43.64 - 44.45	22	44.05	1.013,15	1.940,4025	42,688,855
44.56 - 45.37	4	44.97	179,88	2.022,3009	8.089,2036
45.38 – 46.19	2	45.79	91.58	2,096.7241	4,193.4482
	31	220.45	1,840.86	9,726.8685	78774.7609

The variance is s 2 = 57.260 and the standard deviation s 2= 7.56

Normality test

The data normality test aims to determine whether the data from each class in this study comes from a normally distributed population or not, if it is not normal then parametric statistical techniques cannot be used for data analysis. The test is x 2 ≥ x 2 with α = 0.05 in matter this HO is accepted. The hypothesis in testing the normality of Post-test data is as follows:

HO : the sample comes from a normally distributed population
H 1 : the sample comes from a population that is not normally distributed
Based on previous calculations, for the final test (Post-test) for the experimental class, x 2 = 59.38 and s 2 = 7.56.

Table 7. Normality Test for Final Test Data for Experimental Class

Mark	Limit Class	Z Score	Regional Limits	Wide	Frequency a	Observation Frequency (Oi)
42.00 -42.81	41.95	- 2.3055	0.4943	0.0598	1.8538	7
42.82 -43.63	42.77	-2.1970	0.4345	0.243	0.533	6

Mark	Limit Class	Z Score	Regional Limits	Wide	Frequency a	Observation Frequency (Oi)
	43,59	-2.0886	0.1915			
43.64 -44.45				0.0035	0.1085	22
	44.51	-1.9669	0.1950			
44.56-45.37				0.2407	0.4617	4
	45,33	-1,8584	0.4357			
45.38 -46.19				0.0594	0.8414	2
	46.24	-1,7380	0.4951			

These results are in accordance with Suryani's (Kusnandar, 2019)research. The research results obtained in cycle 1 were that students' critical thinking abilities obtained a score of 62% in the complete category with an average score of 74, the highest score was 88 and the lowest score was 50. Meanwhile in cycle 2 There was an increase in the completeness score of 100%, the average score was 79, the highest score was 85, and the lowest score was 75. Other research that had almost the same results, namely Hagi (Elita et al., 2019)stated that the success criteria were ≥70% in the good category. The research results show that: (1) The Problem Based Learning model can improve classical critical thinking abilities. This can be seen from observations in cycles I and II. The average observation score in cycle I was 2.28 or 57% and cycle II was 2.85 or 73.18%. (2) The ability to think critically influences learning outcomes as seen from the increase in the mastery score for learning outcomes which reached 48.78% in cycle I and 73.18% in cycle II.

Critical Thinking Reasoning Ability Instrument for SMA Negeri 3 Pematangsiantar

In research (Gunawan, Suraya, & Tryanasari, 2016)"In accordance with scientific thinking skills in science, students who have critical thinking skills will have the ability to solve every problem they face well. "This capability is expected to support learning achievement."

This research is in accordance with research (Yudha, 2019), (Hadi & Marzuki, 2021), (siti Sundari, Handayani, & Mulyawati, 2019), (Manurung et al., 2019a), where the research results show "(1) The application of scientific literacy-based learning models to critical thinking skills has experienced continuous improvement with a good assessment category. (2) critical thinking skills have an impact on learning outcomes after applying a scientific approach in the high category. (3) There is a positive and significant effect of implementing a scientific literacy-based learning model on the critical thinking abilities of students at SMA Negeri 3 Pematangsiantar."

Meanwhile, research researcher (Rini, Hartantri, & Amaliyah, 2021), (Marlina, 2019a), (Agustina & Rahmawati, 2021a), (Maulana, 2019), and (Murda & Riastini, 2019)the student competency aspect FKIP UMT received the sufficient category. In each indicator, students' scientific literacy abilities show a low category for the indicator of explaining scientific phenomena, and a sufficient category for the indicator of identifying scientific questions or issues and using scientific evidence. Based on the research results obtained, it shows that students' scientific literacy abilities have not shown good and satisfactory results, so they need to be improved. "Efforts to overcome students' scientific literacy abilities in aspects of competency that are still unsatisfactory are carried out in various ways, including by structuring the scope of the material provided and the lecture process carried out, choosing the right media, and using learning models that are in accordance with the science concept."

Research (Manurung et al., 2019b)science education study program profile is dominated by women with non-science undergraduate degrees who work as non-PNS teachers with a length of service of 1-10 years. Most of them have experience doing practicums and teaching practicums, but their understanding of practicum tools and materials is still low. assessing the kits and practicum modules used in

learning as incomplete. They also know the learning model and aspects that are assessed in learning. The results of critical thinking abilities are in the low category." And research (Marlina, 2019b)with the title "Analysis of Science Literacy Abilities at SMA Negeri 3 Pematangsiantar Semester 1 Academic Year 2019/2020" where the results show that thinking abilities (critical and creative) tend not to develop in science learning.

Science Literacy for SMA Negeri 3 Pematangsiantar

"Scientific literacy is one of the important aspects that must be mastered by SMA Negeri 3 Pematangsiantar, because it influences the IP A learning process. Scientific literacy is a knowledge and understanding of scientific concepts and processes that will enable a person to make decisions with the knowledge they have, as well as being involved in matters of state, culture and economic growth. "Scientific literacy can be defined as an understanding of science and its application to society's needs" (Fazilla, 2019b).

However, the scientific literacy abilities of SMA Negeri 3 Pematangsiantar on average are still below the expected standard or still at the inadequate criteria, this can be seen from research results (Agustina & Rahmawati, 2021b), (Marlina, 2019b), (Widiyanti & Mizan, 2020), (Insani & Fitria, 2022)and (Wardani, 2019). "The research instruments used include scientific literacy questions, scientific attitude questionnaires, observation sheets on abilities in conducting mini research, interview guides, and field notes."

There are different things in research (Muyassaroh, Sunanto, & Kurnia, 2022). It is very important to have a thorough understanding of scientific literacy because advances in science and technology and their impact on the environment require a strong foundation. Indonesia is one of the many countries that still has difficulty increasing scientific literacy, which is one of the global education priorities. "The results of international assessments show that Indonesia's scientific literacy for the last eighteen years has always been at the bottom of the rankings. "Research to increase the scientific literacy of Pelita Bangsa University students through Blended-Collaborative Based Scientific Literacy (CPBL) based on multiple representatives shows that the results of implementing CPBL based on multiple representatives can increase scientific literacy." This research is also in line with research by (Yuliati & Saputra, 2019)(Novitasari, 2018)and (Limiansih & Susanti, 2021).

Conclusion

Based on the discussion of the results of the research carried out, the conclusion was obtained: After implementing the learning implementing the scientific literacy-based learning model, the average pretest score for student learning outcomes was obtained with an average of 75, while the posttest score for student learning outcomes averaged 80. This shows that the application of a scientific literacy-based learning model in science learning has significantly increased the critical thinking abilities of class X students at SMA Negeri 3 Pematangsiantar.

References

Adisendjaja, Y. H., & Oom, R. (2020). Analisis buku ajar biologi sma kelas x di kota bandung berdasarkan literasi sains. *Bandung: Jurusan Pendidikan Biologi, FMIPA Universitas Pendidikan Indonesia*.

Agustina, D. A., & Rahmawati, L. (2021a). Analisis Keterampilan Literasi Sains Mahasiswa dengan TOSLS. *Elementary School*, *8*(1), 15–23.

Agustina, D. A., & Rahmawati, L. (2021b). Analisis Keterampilan Literasi Sains Mahasiswa dengan TOSLS. *Elementary School*, *8*(1), 15–23.

Baird, J., Isaacs, T., Johnson, S., Stobart, G., Yu, G., Sprague, T., & Daugherty, R. (2019). *Policy effects of PISA*.

Elita, G. S., Habibi, M., Putra, A., & Ulandari, N. (2019a). Pengaruh Pembelajaran Problem Based Learning dengan Pendekatan Metakognisi terhadap Kemampuan Pemecahan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(3), 447–458. https://doi.org/10.31980/mosharafa.v8i3.517

Elita, G. S., Habibi, M., Putra, A., & Ulandari, N. (2019b). Pengaruh Pembelajaran Problem Based Learning dengan Pendekatan Metakognisi terhadap Kemampuan Pemecahan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(3), 447–458. https://doi.org/10.31980/mosharafa.v8i3.517

Fazilla, S. (2019a). Kemampuan literasi sains mahasiswa Pgsd pada mata kuliah konsep dasar sains. *Jurnal Pendidikan Dasar (JUPENDAS)*, *3*(2).

Fazilla, S. (2019b). Kemampuan literasi sains mahasiswa Pgsd pada mata kuliah konsep dasar sains. *Jurnal Pendidikan Dasar (JUPENDAS)*, *3*(2).

Fitrian, R., & Dewi, R. (2021). Ragam Tingkat Kemampuan Berpikir Kreatif Siswa dalam Pembelajaran Matematika Daring. *Menjadi Guru Profesional Dan Inovatif Dalam Menghadapi Pandemi (Antologi Esai Mahasiswa Pendidikan Matematika)*, *118*.

Griffin, K. L., & Ramachandran, H. (2019). Science education and information literacy: a grass-roots effort to support science literacy in schools. *Science & Technology Libraries*, *29*(4), 325–349.

Gunawan, I., Suraya, S. N., & Tryanasari, D. (2016). Hubungan kemampuan berpikir kreatif dan kritis dengan prestasi belajar mahasiswa pada matakuliah konsep sains II prodi PGSD IKIP PGRI MADIUN. *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, *4*(01).

Hadi, S., & Marzuki, A. D. (2021). KEMAMPUAN PENALARAN MATEMATIKA MAHASISWA DALAM PEMBELAJARAN MATEMATIKA SD YANG BERKONTEK NALARIA. *JURNAL ILMIAH GLOBAL EDUCATION*, 165–167.

Handayani, R. H., & Muhammadi, M. (2020). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Hasil Belajar Siswa dalam Pembelajaran Tematik Terpadu di Kelas V SD. *E-Journal Pembelajaran Inovasi, Jurnal Ilmiah Pendidikan Dasar*, *8*(5), 79–88.

Insani, M. Y. S., & Fitria, Y. (2022). Pencapaian Kompetensi Literasi Sains Mahasiswa Pendidikan Guru Sekolah Dasar dalam Praktik Pembelajaran Daring Berorientasi Masalah. *Jurnal Basicedu*, *6*(5), 8239–8247.

Jufri, W. (2018). Belajar dan pembelajaran sains. *Bandung: Pustaka Reka Cipta*.

Kusnandar, D. (2019). Pengaruh model problem based learning terhadap hasil belajar kognitif dan motivasi belajar IPA. *MADRASCIENCE: Jurnal Pendidikan Islam, Sains, Sosial, Dan Budaya*, *1*(1), 17–30.

Limiansih, K., & Susanti, M. M. I. (2021). Identifikasi Profil Literasi Sains Mahasiswa PGSD. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, *5*(2), 313–325.

Manurung, D., Putri, L. A. P., Bangun, M. K., Program, A., Agroekoteknologi, S., & Agroekoteknologi, P. S. (2019a). Jurnal Online Agroekoteknologi Vol . 1 , No . 3 , Juni 2013 ISSN No . 2337- 6597. . . *Jurnal Online Agroekoteknolog*, *1*(3), 768–782. https://doi.org/10.1161/CIRCRESAHA.113.301636

Manurung, D., Putri, L. A. P., Bangun, M. K., Program, A., Agroekoteknologi, S., & Agroekoteknologi, P. S. (2019b). Jurnal Online Agroekoteknologi Vol . 1 , No . 3 , Juni 2013 ISSN No . 2337- 6597. . . *Jurnal Online Agroekoteknolog*, *1*(3), 768–782. https://doi.org/10.1161/CIRCRESAHA.113.301636

Marlina, D. (2019a). Analisis kemampuan literasi sains pada mahasiswa PGSD semester 1 tahun akademik 2019/2020. *JS (Jurnal Sekolah)*, *4*(1), 9–18.

Marlina, D. (2019b). Analisis kemampuan literasi sains pada mahasiswa PGSD semester 1 tahun akademik 2019/2020. *JS (Jurnal Sekolah)*, *4*(1), 9–18.

Maulana, M. (2019). Interaksi pbl-murder, minat penjurusan, dan kemampuan dasar matematis terhadap pencapaian kemampuan berpikir dan disposisi kritis. *Mimbar Sekolah Dasar*, *2*(1), 1–20.

Mayadiana, D. (2019). Pembelajaran dengan pendekatan diskursif untuk mengembangkan kemampuan berpikir kritis mahasiswa calon guru SD. *UPI Bandung: Tidak Diterbitkan*.

Medan, U. N. (2022). *School education journal pgsd fip unimed*. *12*(1), 1–7.

Murda, I. N., & Riastini, P. N. (2019). PENGARUH MODEL PEMBELAJARAN

CORE BERBANTUAN LINGKUNGAN TERHADAP KETERAMPILAN BERPIKIR KRITIS IPA SISWA KELAS IV SD GUGUS I KECAMATAN NEGARA. *MIMBAR PGSD Undiksha*, *1*(1).

Muyassaroh, I., Sunanto, L., & Kurnia, I. R. (2022). UPAYA PENINGKATAN LITERASI SAINS MAHASISWA MELALUI BLENDED-COLLABORATIVE PROBLEM BASED LEARNING BERBASIS MULTIPLE REPRESENTATIVES. *Jurnal Cakrawala Pendas*, *8*(3), 915–931.

Novianti, A., Bentri, A., & Zikri, A. (2020). PENGARUH PENERAPAN MODEL PROBLEM BASED LEARNING (PBL) TERHADAP AKTIVITAS DAN HASIL BELAJAR SISWA PADA PEMBELAJARAN TEMATIK TERPADU DI SEKOLAH DASAR. *Jurnal Basicedu*, *4*(1), 194–202. https://doi.org/10.31004/basicedu.v4i1.323

Novili, W. I., Utari, S., Saepuzaman, D., & Karim, S. (2017). Penerapan Scientific Approach dalam Upaya Melatihkan Literasi Saintifik dalam Domain Kompetensi dan Domain Pengetahuan Siswa SMP pada Topik Kalor. *Jurnal Penelitian Pembelajaran Fisika*, *8*(1).

Novitasari, N. (2018). Profil kemampuan literasi sains mahasiswa calon guru biologi. *Biosfer: Jurnal Tadris Biologi*, *9*(1), 36–44.

Nurhayani, N. (2017). *Kesulitan Guru dalam Pengembangan Keterampilan Berpikir Tingkat Tinggi Siswa pada Pembelajaran Biologi Kelas XII di SMA Negeri 1 Gowa*. Universitas Islam Negeri Alauddin Makassar.

Rini, C. P., Hartantri, S. D., & Amaliyah, A. (2021). Analisis kemampuan literasi sains pada aspek kompetensi mahasiswa PGSD FKIP universitas muhammadiyah Tangerang. *Jurnal Pendidikan Dasar Nusantara*, *6*(2), 166–179.

Sagala, S. (2019). Supervisi Pembelajaran dalam profesi pendidikan. *Bandung: Alfabeta*.

siti Sundari, F., Handayani, R., & Mulyawati, Y. (2019). Implementasi Pendekatan Saintifik Berbasis Lesson Study Terhadap Pengembangan Berpikir Kritis Mahasiswa Calon Guru Sekolah Dasar. *Journal of Science Education And Practice*, *1*(1), 32–40.

Thahir, A. (2019). *Psikologi belajar buku pengantar dalam memahami psikologi belajar*. LP2M UIN Raden Intan Lampung.

Wahab, A. (2021). Implementasi dan Arah Perkembangan Pendidikan Kewarganegaraan (Civic Education) di Indonesia. *JURNAL CIVICUS*, *1*(1).

Wardani, E. F. (2019). ANALISIS KEMAMPUAN LITERASI SAINS, SIKAP ILMIAH DAN MERANCANG MINI RISET MAHASISWA PGSD STKIP MUHAMMADIYAH BANGKA BELITUNG PADA MATA KULIAH PRAKTIKUM IPA. *Primary Education Journal Silampari*, *1*(1), 13–23.

Widiyanti, I. S. R., & Mizan, S. (2020). ANALISIS DISTRAKTOR SOAL BERBASIS LITERASI SAINS PADA MAHASISWA PGSD. *Prosiding SNasPPM*, *5*(1), 84–89.

Yudha, C. B. (2019). Pengaruh pendekatan saintifik terhadap kemampuan berpikir kritis mahasiswa. *Buana Matematika: Jurnal Ilmiah Matematika Dan Pendidikan Matematika*, *9*(1), 31–36.

Yuliati, Y., & Saputra, D. S. (2019). Urgensi Pendidikan STEM Terhadap Literasi Sains Mahasiswa Calon Guru Sekolah Dasar. *Proceedings of The ICECRS*, *2*(1), 321–326. https://doi.org/10.21070/picecrs.v2i1.2420