Unnes.J.Biol.Educ. 13 (2) (2024)

Journal of Biology Education

http://journal.unnes.ac.id/sju/index.php/ujbe

The Application of Reflective Journaling Integrated with Literacy to Students' Critical Thinking Skills on Ecosystem Material

Laila Nisfia, Ibnul Mubarok[1]✉

[1]Biology Department, FMIPA, Universitas Negeri Semarang, Indonesia

Info Artikel

Article History:

Received : July 2024

Accepted : July 2024

Published : August 2024

Keywords:

Reflective Journal, Literacy, Critical Thinking Skills

Abstrak

This study aims to analyze the effect of applying reflective journals integrated with literacy on students' critical thinking skills on ecosystem material. The type of research is quasi-experimental. The population in the study was class X students of SMA Negeri 2 Demak in the 2023/2024 academic year. The research sample was class X.11 as the experimental class and class X.12 as the control class. The data collection techniques used were non-test, test, questionnaire and observation methods. Based on data analysis, the level of learning implementation by applying reflective journals integrated with literacy is 91.25% in the excellent category. Questionnaire analysis of students' responses to learning showed that 33% of students responded to the questionnaire in the excellent category, 63.9% of students in the good category, and 2.8% of students in the fair category. The effect of applying reflective journaling integrated with literacy on critical thinking skills was measured by pretest and posttest in classes X.11 and X.12, then calculated using the N-Gain test. The N-Gain test results obtained in the experimental class amounted to 32.75% with a moderate category and in the control class amounted to 13.1% with a low category. These results indicate that the increase in critical thinking skills in the experimental class is higher than the control class. The results of the Spearman Rank correlation test showed a Sig. (2-tailed) of 0.001 and the correlation coefficient value of 0.545. Based on these results, it can be concluded that the application of reflective journals integrated with literacy has a significant effect with a moderate category on students' critical thinking skills on ecosystem material.

✉Correspondence Address:
D6 Building 1st Floor Jl Raya Sekaran Gunungpati Semarang
E-mail: ibnulmubarok@mail.unnes.ac.id

p-ISSN 2252-6579
e-ISSN 2540-833X

INTRODUCTION

Education is an activity that plays an important role in social life. The benchmark of a country's progress is its education sector. Education must answer the needs of society that are constantly evolving along with advances in science and technology. In line with this, education in the 21st century currently requires students to have life skills in accordance with the times, namely 4C skills which include Critical Thinking, Communication, Collaboration, and Creativity (Trilling & Fadel, 2009). One of the prerequisites for realizing these 21st century life skills is through literacy. However, Indonesia's literacy ranking based on the results of the Program for International Student Assessment (PISA) is still low, which is ranked 68 out of 81 countries that participated in the OECD survey (2023) so that a new strategy is needed to improve the quality of education in Indonesia.

The government through the Ministry of Education, Culture, Research and Technology established the Merdeka Curriculum and took effect from 2022/2023. The Merdeka Curriculum has several main characteristics, one of which focuses on essential, relevant and in-depth material on reading literacy and numeracy competencies (Fajrin *et al*., 2024). One of the innovative concepts of literacy refers to the capacity of students to apply their knowledge and skills in solving problems in various situations. In this case, critical thinking skills are needed in every problem-solving process. Critical thinking allows students to have a variety of alternative solutions and creative ideas when facing a problem. The concept of literacy is also relevant to the learning outcomes of the Merdeka Curriculum ecosystem. The description in phase E states that students are required to have the ability to create solutions to various problems related to ecosystem components and interactions between their components, so literacy and critical thinking competencies are needed to fulfill the learning outcomes of ecosystem material.

Merdeka Curriculum carries the concept of Merdeka Belajar which is different from the previous curriculum. Learning outcomes are designed with reference to curriculum development theory through the understanding by design approach by Tighe and Wiggins. Understanding by Design contains 6 dimensions of understanding that students must master, one of which is self-awareness or reflection. (Wiggins and McTighe, 2005). Reflection is part of the metacognitive thinking process that plays an important role in the problem solving process. Reflection can be done before, during or after learning, developing from simple to complex problem-solving questions (Bower, 2003). Reflection helps students gain in-depth knowledge by involving metacognitive skills in the form of awareness of their thinking to meet the demands of learning outcomes. The results of reflection need to be written down in the form of students' personal records over a certain period so that the knowledge gained is not fragmented. This can be realized through a learning strategy in the form of implementing reflective journals integrated with literacy.

The application of reflective journals integrated with literacy is defined as a record or document containing descriptions of student statements that contain one aspect of reflection and aspects of literacy. According to Musdalifah *et al*. (2023) Reflective journals contain five aspects, namely material known, challenges faced, material that wants to be learned further, learning experiences and efforts to meet learning objectives. The application of reflective journals in this study is integrated with reading literacy and numeracy in accordance with the demands of the Merdeka Curriculum which aims to improve students' low literacy skills. Increased literacy skills are expected to encourage increased critical thinking skills needed by students to face the challenges of life in the 21st century. Based on the background that has been described, a study was conducted on the application of reflective journals integrated with literacy to students' critical thinking skills on ecosystem material.

RESEARCH METHODS

This study used a quasi-experimental equivalent control group design. The research location was at SMA Negeri 2 Demak. The research time was in January-February 2024 or even semester of the 2023/2024 academic year. The population in the study were all X grade students of SMA Negeri 2 Demak in the 2023/2024 academic year. The research sample was class X.11 as the experimental class and class X.12 as

the control class. The data collected in this study were reflective journal scores integrated with literacy, literacy scores, critical thinking skills based on pretests and posttests, student response questionnaires, and observations.

RESULTS AND DISCUSSION

Experimental and Literacy Control Class Reflective Journal Scores

The application of reflective journals integrated with literacy in the experimental class contained one aspect of reflection and literacy. Reflection aspects include "material known", "difficulties encountered", "material that wants to be learned further", "learning experiences", and "efforts that will be made to meet learning objectives" on ecosystem material. Literacy aspects include "reading" or "numeracy" literacy. Meanwhile, the literacy implementation in the control class only included the literacy aspects of "reading" and "numeracy", without integrating the reflection aspect. The recapitulation of the two classes' scores during ecosystem learning is summarized in Table 1.

Table 1. Recapitulation of Reflective Journal Scores of Experimental and Literacy Classes Control Classes

Class	Criteria	Number Students	Percentage (%)
Eksperiment			
	Very high	4	11,11
	High	32	88,89
	Low	0	0
	Very low	0	0
Control Class			
	Sangat tinggi	5	14,29
	Tinggi	30	85,71
	Rendah	0	0
	Sangat rendah	0	0

Table 1 shows that the number of students who scored in the high criteria tended to be more than the number of students who scored in the very high criteria. The difference in the number of scores obtained by students is due to the reflection and literacy aspects contained in the journal. In the experimental class, in the reflection aspect, students were given space and freedom to answer the questions presented without being given a limit on the length of the answer. Students wrote reflections according to their abilities, there were students who wrote short reflections, but there were also students who wrote very long reflections. Students who write long reflections will make it easier for teachers to detect their abilities in receiving learning. This causes the score obtained by each student in the reflection aspect to vary. Limitations that are not given can encourage students to be more free to write reflections on the material in the learning that is done. Alfiah *et al.*, (2018) in their research revealed that reflection writing can explore students' thinking skills and realize the knowledge they already have or do not have, and encourage students to recall the understanding that has been obtained before. Reflective journal writing is a place for students to explore their thinking awareness, because it can stimulate students to reflect and evaluate the learning that has been done. In addition, it provides opportunities for students to construct their own knowledge through reflection activities so that students' learning experiences do not pass by. Unlike the control class students who did not carry out the reflection process in learning activities so that the students' learning experience passed by. Reflective journal writing can also provide information about the development of student understanding over time. This development is monitored from the reflective journals written so that it will make it easier for teachers to choose the right learning strategy to achieve more meaningful learning.

In the reflection aspect, students write the material they already know and the material they want to know through questions they make themselves. Indirectly when making questions, students have expressed their knowledge consciously so that the teacher knows the extent of their abilities. The reflection aspect presented in the form of questions indirectly trains students to stimulate their reasoning power, and encourages students to try to recall the knowledge that has been obtained. Writing learning experiences is

proven to help students develop a deeper understanding of the material being studied. This can be seen when students express arguments for the need to study ecosystem material. At first, not all students could provide arguments related to this, but by writing their learning experiences, students could finally express their arguments. This is in accordance with the research of Juanda and Nursaid (2023) which states that reflection on learning experiences is one way to improve the abilities that students already have. When students reflect, students begin to think about knowledge gained from experience more deeply because of the evaluation process. Experiences that attract students' attention then enter the reflection stage. During the reflection process, there is a re-examination of various facts, ideas, and theories obtained from students' new experiences. At this stage, students begin to process various new knowledge and are connected to what was previously known so that they begin to find connections from each concept into a unified concept.

In the literacy aspect in both experimental and control classes, the average student obtained a high score. This is because almost all answers to the questions presented are available in the reading. When students read carefully, they can easily answer the questions. In addition, the reading passages used for literacy were given to students along with the question sheets. This resulted in students being able to answer questions by re-opening the reading provided. Nevertheless, the scores obtained by students at each meeting also varied according to each student's ability to find information in the reading. Based on observations when answering questions in the reading literacy aspect, students seemed to easily answer the questions given after reading the text. However, when answering questions in the numeracy literacy aspect, students seemed less familiar with reading and understanding the data presented. Some students' answers did not seem to be in accordance with the questions asked, which had an impact on the scores in the experimental and control classes. Bani & Komariah (2023) in their research revealed that teachers need to provide guidance and guide students on how to write reflective journals correctly. The application of reflective journals integrated with literacy in schools is new and has never been done before so students need habituation to get a good score. Students need teacher direction and guidance to practice writing reflective journals well and understand the meaning of the text read. This is because previously students were not accustomed to reflecting by making reflection sentences as well as doing literacy both inside and outside of biology learning.

Critical Thinking Ability of Students on Ecosystem Material

Critical thinking skills were measured using pretest and posttest questions totaling 15 items with details of 10 multiple choice questions and 5 description questions. Aspects of critical thinking indicators used include: (1) give a simple explanation; (2) build basic skills; (3) make conclusions; (4) provide further explanation; (5) organize strategies and tactics. Pretest and posttest questions were given to experimental and control classes at the beginning and end of learning ecosystem material. The recapitulation of pretest and posttest results in the experimental and control classes is presented briefly in Table 2.

Table 2 Recapitulation of Pretest and Posttest Results of Critical Thinking Ability

Description	**Experiment Class**		**Control Class**	
	Pretest	***Posttest***	***Pretest***	***Posttest***
Lowest score	27	43	27	37
Highest score	70	83	67	70
Average value	48,72	66,08	46,58	54,85

Table 2 shows that critical thinking skills in the experimental class increased after being treated with the application of reflective journals integrated with literacy. The same thing also happened in the control class where there was also an increase in critical thinking skills after being treated with the application of literacy. Although both classes experienced an increase in critical thinking skills, the magnitude of the increase in the two classes was different. The increase in critical thinking skills in experimental and control classes was then analyzed by the N-Gain test. A comparison of the percentage of N-Gain test results in the experimental and control classes is presented in Figure 1.

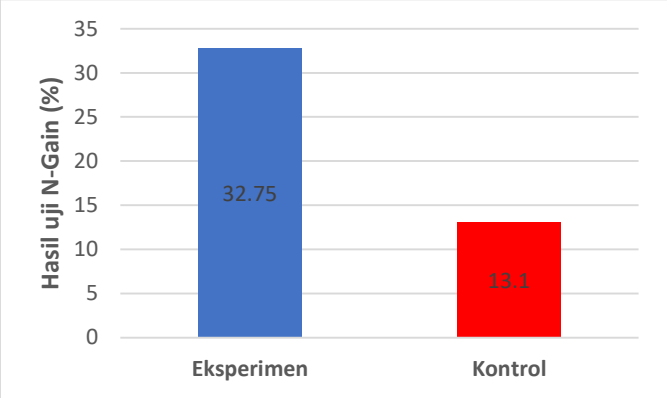

Figure 1. Percentage of Critical Thinking *N-Gain*

Figure 1 shows that the average N-Gain in the experimental class is 32.75%, which means that the increase in critical thinking skills is in the medium category, while the average N-Gain in the control class is 13.1%, which means that the increase in critical thinking skills is in the low category. This shows that critical thinking skills in the experimental class ecosystem material are higher than the control class.

The increased critical thinking skills in both experimental and control classes show that students' understanding of ecosystem material has also increased. Reflective journals integrated with literacy help students realize the extent of their understanding, organize the information obtained, and help compile a line of thought in writing so that in the end students have the ability to think critically in solving problems. This is in accordance with research Munawaroh et al., (2015) (2015) which revealed that reflection in the form of learning journals is related to the way students think in expressing experiences, understanding, and discoveries conveyed in writing. Reflective journals integrated with literacy encourage students to think critically because the reflections made in the journal are the result of their own thinking. In this case, students are required to be sensitive to what has been done, obtained, and what is in the surrounding environment, especially during learning. In addition, students are trained to think critically by being facilitated by literacy reading which allows students to find the truth of information, think about things deeply, and find relevant information rather than just passively receiving information.

Students' critical thinking skills in the experimental class were higher and experienced a higher increase than the control class. This is because students in the experimental class have been trained to reflect and think critically by applying reflective journals integrated with literacy during learning. In-depth reflection is needed to help students determine effective actions when facing problems so that they can formulate appropriate strategies and solutions according to the context of the problem. Reflection is part of a metacognitive thinking strategy that plays a role in learning, critical thinking, and decision making in solving ecosystem problems. This is in accordance with the research of Ismail (2022) which states that optimizing critical thinking can be achieved by intervening in the reflection process in it. Reflective practice in the learning process using a reflection journal integrated with literacy becomes a strength in improving critical thinking skills. The reflection process requires students to be curious, open-minded, and responsible. Literacy encourages students to consider facts and information to create problem solutions through critical thinking. Thus, the application of reflective journals integrated with literacy is proven to provide space for students to explore metacognitive awareness, literacy skills and critical thinking to find solutions to ecosystem problems.Data on critical thinking skills were then analyzed using the Wilcoxon Signed Ranks test and the Mann-Whitney test. The results of the hypothesis testing are summarized in Table 2

Table 2 Wilcoxon Signed Ranks Test and Mann-Whitney Test Result

Hypothesis Test	***Asymp. Sig. (2-tailed)***	**Conclusion**

Wilcoxon Signed Ranks Test	*Pretest-Posttest* of experimental class	0,000	There is a difference
	Pretest-Posttest of controll class	0,000	There is a difference
Mann-Whitney Test	*Posttes*t of experimental and control class	0,000	There is a difference

Table 2 shows the results of the Wilcoxon Signed Ranks test in the experimental and control classes obtained Asymp. Sig. (2-tailed) of 0.000 (≤0.05) which means H1 is accepted and H0 is rejected. This means that there is a significant difference in the mean scores of the pretest and posttest in the experimental and control classes. The Mann-Whitney test results obtained an Asymp. Sig. (2-tailed) of 0.000 (≤0.05) which means H1 is accepted and H0 is rejected. This means that there is a significant difference in the average critical thinking skills of the experimental class and the cont roller. The difference in the results of critical thinking skills in experimental and control classes can be due to the experimental class that applies reflective journals integrated with literacy. In addition, the difference in results can be caused by different student abilities. Students who have high critical thinking skills will be able to formulate problem solutions easily so that they can get high scores, while students who have low critical thinking skills will have difficulty formulating problem solutions so that they get low scores too. This is in accordance with the research of Nuraeni et al., (2019) which states that the development of critical thinking skills is influenced by various things, one of which is the individual ability factor. Students who have critical thinking skills will be able to select and analyze the truth of information, and make decisions appropriately. Conversely, students who do not have the ability to think critically will have difficulty analyzing the truth of information, and making decisions appropriately. Therefore, training on the application of reflective journals integrated with literacy needs to be continued.

Implementation of Reflective Journal Integrated with Literacy

The implementation of learning by applying reflective journaling integrated with literacy needs to be measured. In this study, the level of implementation of learning by applying reflective journals integrated with literacy was measured by student response questionnaires. The level of learning implementation based on student response questionnaires is summarized in Table 3.

Table 3 Learning Implementation Based on Student Response Questionnaire

Category	Number of students	Percentage (%)
Very good	12	33,3
Good	23	63,9
Simply	1	2,8
Less	0	
Number of students	36	100

The results of filling out the questionnaire show that the average student responds to the questionnaire in the good category. This shows that learning by applying reflective journals integrated with literacy on ecosystem material gets a good response from students. The application of reflective journals integrated with literacy makes students gain new learning experiences, realize the parts of ecosystem material that are not yet known and want to know, and realize the importance of learning ecosystem material. In addition, students also obtain a variety of new information through the readings provided at each meeting so that the learning resources used do not only come from school handbooks. Through literacy, students are trained to find information and reflect on the content of the text, and combined with aspects of self-awareness so that they are finally able to assume and argue when faced with a problem, and are able to determine the right effort/action on a problem by considering the suitability of the source of information and the facts at hand. This is in accordance with the results of research Yanti and Novitasari (2021) that through the reflective journals used, students can find out which parts have been understood or not understood, can reveal problems or difficulties faced, and can find out how to overcome these difficulties. The application of reflective journals

integrated with literacy not only helps students realize the extent of their abilities, but also trained to think critically by explaining the assumptions used, realizing the tendency of their thinking, and trying to consider different perspectives so that they can express appropriate hypotheses. It can be concluded that learning by implementing reflective journals integrated with literacy can continue to be done to improve students' critical thinking skills.

The Effect of Reflective Journal Implementation Integrated with Literacy on Critical Thinking Ability

The effect of the application of reflective journals integrated with literacy on students' critical thinking skills on ecosystem material was measured using the Spearman Rank correlation test. Based on the results of the Rank Spearman correlation analysis, the effect of reflective journals integrated with literacy on critical thinking skills is summarized in Table 4.

Table 4 Spearman Rank Correlation Test

		Correlation		
			Reflective Journal	*Posttest* Results
Spearman's rho	Reflective Journal	*Correlation Coefficient*	1.000	.545**
		Sig. (2-tailed)	.	.001
		N	36	36
	Posttest Results	*Correlation Coefficient*	.545**	1.000
		Sig. (2-tailed)	.001	.
		N	36	36

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

Table 4 shows that the results of the Spearman Rank correlation test obtained a Sig value. (2-tailed) of 0.001 which means H1 is accepted and H0 is rejected. The correlation coefficient obtained is 0.545 which means that there is an effect of reflective journals integrated with literacy on students' critical thinking skills on ecosystem material with a moderate category. This is in accordance with the previous theory which states that there is an effect of reflective journals on students' critical thinking skills. Learning by applying reflective journals integrated with literacy is also proven to guide students to think critically by suggesting solutions to problems presented based on the facts and reasoning power of each student. This is in accordance with the research of Rohman (2022) which states that literacy plays a very important role in improving critical thinking skills by being implemented in learning through several stages including monitoring text understanding, providing clear and explicit instructions, and guiding students to respond to various types of questions. Reflective journaling integrated with literacy is still a new thing that is done in schools both inside and outside of learning. In this case, the role of the teacher is needed to provide direction and guide students to write reflective journals properly.

Students' critical thinking skills are not only influenced by reflective journals integrated with literacy, but also by other factors. These factors include students' intellectual development, motivation, physical condition, and learning independence. Students with high intellectual development tend to digest material more easily than students with moderate and low intellectual development. Students who have high motivation tend to be more active in the learning process by actively asking questions, answering, and discussing with other students so that their critical thinking skills develop and improve. Students with good physical condition tend to be easier to concentrate on receiving learning than students with weak physical condition. Students who have learning independence will be more proactive in the learning process and are encouraged to think critically when facing a problem. These factors are in accordance with research Dores et al. (2020) which states that the factors that influence students' critical thinking skills are psychological factors including intelligence, motivation, and anxiety, as well as physiological factors including physical condition, personality, and interactions that occur during the learning process. Therefore, in addition to implementing learning using reflective journals integrated with literacy, teachers also need to pay attention to the psychological and physiological conditions of students in carrying out learning so that learning objectives can

be achieved optimally.

CONCLUSIONS

Based on the results of the research and discussion, it can be concluded that the application of reflective journals integrated with literacy has a significant effect on students' critical thinking skills on ecosystem material. This is evidenced by the difference in the average results of critical thinking skills between experimental classes that apply reflective journals integrated with literacy and control classes that apply literacy to learning ecosystem material. The application of reflective journals integrated with literacy has an effect of 0.545 which means that it has a moderate effect on students' critical thinking skills in learning ecosystem materials.

REFERENCE

Alfiah, A. N., Putra, N. M. D., & Subali, B. (2018). Scrapbook Media as a Reflection Journal to Improve Cognitive Ability and Self-Regulation. Journal of Education (Theory and Practice), 3(1), 57-67. https://doi.org/10.26740/jp.v3n1.p57-67

Bani, E. A. S., & Komariah, D. (2023). The Effectiveness of Character Education Through the Daily Reflection Journal Method for Students of CLASS III A SDN 262 Panyileukan Bandung City. Journal on Education, 06(01), 4492-4498

Bower, L. L. (2003). Student Reflection and Critical Thinking: A Rhetorical Analysis of 88 Portfolio Cover Letters,. Journal of Basic Writing, 22(2), 47-66. https://doi.org/10.37514/jbw-j.2003.22.2.04

Dores, O. J., Wibowo, D. C., & Susanti, S. (2020). Analysis of Students' Critical Thinking Skills in Mathematics Subjects. J-PiMat: Journal of Mathematics Education, 2(2), 242-254. https://doi.org/10.31932/j-pimat.v2i2.889

Fajrin, V. P., Wibowo, F. C., & Nasbey, H. (2024). Needs Analysis of PBL-based Global Warming Teaching Modules to Improve Students' Problem Solving Skills and Self-Efficacy. Cetta: Journal of Education Science, 7(1), 33-42.

Juanda, A., & Nursaid. (2023). The Use of Character Learning Project (PBK) Model in Learning to Write Discussion Text for Junior High School Class IX Students. Journal of Education and Counseling, 5(2), 4862-4867.

Ismail. (2022). Reflection in Inquiry Learning: its impact on Strengthening Students' Critical Thinking in terms of Cognitive Style. Journal of Physics Education, 9(2), 192-197.

Munawaroh, L., Pantiwati, Y., & Rofieq, A. (2015). The Use of Learning Journal in Class Wide Peer Tutoring Learning towards Students' Critical Thinking Ability. JPBI (Indonesian Journal of Biology Education), 1(3), 263-273. https://doi.org/10.22219/jpbi.v1i3.2659

Musdalifah, M., Ismail, & Rahmawati. (2023). Optimizing Biology Learning Outcomes Through the Application of Reflective Journal Integrated Problem-Based Learning Model on Environmental Change Material at SMA Negeri 11 Makassar. Learning Thought and Development, 5, 41-47.

Nuraeni, S., Feronika, T., & Yunita, L. (2019). Implementation of Self-Efficacy and Critical Thinking Skills of Students in Chemistry Learning in the 21st Century. Jambura Journal of Educational Chemistry, 1(2), 49-56. https://doi.org/10.34312/jjec.v1i2.2553

OECD. (2023). Pisa 2022. In PISA 2022 Assessment and Analytical Framework, PISA, OECD Publishing, Paris,. https://doi.org/10.31244/9783830998488

Rohman, A. (2022). Literacy in Improving Critical Thinking Skills in the Era of Disruption. EUNOIA: Journal of Indonesian Language Education, 2(1), 40-47. http://jurnaltarbiyah.uinsu.ac.id/index.php/eunoia/index

Trilling, B., & Fadel, C. (2009). 21st Century Skills: Learning for Life in Our Times. *San Francisco: Jossey-Bass.*

Wiggins, G., & McTighe, J. (2005). The Understanding by Design Guide to Creating High-Quality

Units. In The Understanding by Design Guide to Creating High-Quality Units

Yanti, A. W., & Novitasari, N. A. (2021). The Use of Reflective Journals in Mathematics Learning to Train Students' Mathematical Communication Skills. Mosharafa: Journal of Mathematics Education, 10(2), 321-332. https://doi.org/10.31980/mosharafa.v10i2.891