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Research Article

Outdoor Learning to Improve the Wetland Ecological Literacy of Geography Education Students

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ABSTRACT

Some geography education students score poorly in wetlands ecological literacy. This study aimed to determine the effect of outdoor learning on wetlands ecological literacy using a pre-experimental design and a sample of 60 geography students. The wetlands ecological literacy instruments were adapted from Anderson's cognitive dimensions comprising factual, conceptual, strategic, and metacognitive indicators. Data were analyzed using percentages and non-parametric Wilcoxon ranked statistical sign tests. The result showed that 2-tailed Asymp. Sig. was 0.000, smaller than 0.05. The conceptual and metacognitive indicators had the highest and lowest improvement of 21.11% and 13.33%, respectively. Furthermore, students' wetlands ecological literacy improved through outdoor learning. Outdoor learning increases students' attention to their environment through closer interactions, complementing the learning experience. Therefore, outdoor learning improves students' wetland ecological literacy.

Keywords : Outdoor learning; ecological literacy; teacher candidate; wetlands

1. Introduction

Ecological literacy is understanding the importance of preserving the environment. Capra (2007) stated that ecological or environmental literacy is being highly aware of using the environment wisely. To avoid confusion in the definition, Ha et al. (2021) stated that ecological literacy is a secondary concept and development of environmental literacy. Ecological literacy provides the necessary topics for environmental literacy (Ha et al., 2021; Loubser et al., 2001) and an understanding of relating to nature for sustainability (Hartono, 2020). It contains knowledge, attitudes, and behavior toward ecology (Bruyere, 2008; Huang & Zhao, 2019). Therefore, wetland ecological literacy implies knowledge related to wetlands and their sustainability. According to delegates in Ramsar 1971, wetlands are areas of swamps, bogs, peatlands, or fresh, brackish, or salty water 6 m or 20 feet deep (Moore & Garratt, 2006). An example of wetlands is South Kalimantan because it is dominated by swamps (Soendjoto & Dharmono, 2016) and needs good ecological literacy.

Universitas Lambung Mangkurat (ULM) geography students are prospective teachers who may reside in Kalimantan, meaning they need sufficient knowledge regarding wetland ecology. However, the initial test showed that not all students have sufficient knowledge. Teachers candidates should be aware of their ecological environment by teaching utility values from the concepts studied (moral knowing), fostering attitudes (feeling), and good behavior (acting). The goal is for teachers to be a role model for students in environmental protection. According to Lickona's theory, good character is developed through moral knowing, feeling, and acting (Lickona, 2012). Teachers are curriculum for forming students' character. Upholding the character of a generation would be in vain without a teacher's example (Musfah, 2012).

Universities' efforts to develop students' environmental awareness are also conducted in other countries, such as Malaysia, which has been integrating environmental education into learning for years. Meerah et al. (2010) found that Malaysians in general and students in particular, have not reached the desired level of commitment to the environment. This is because there is no material that shows students the importance of environmental care. Furthermore, Karpudewan & Ismail (2012) stated that other causes are external and logistical barriers such as lack of time, awareness of teaching environmental issues, and difficulties related to pedagogical knowledge.

The main determining factor is how often educators integrate environmental issues into teaching. Ahmad et al. (2015) explained the various universities' efforts to change digital literacy and overcome the obstacles to changing people's behavior. It also discussed the supporting factors that affect ecological literacy. Consumers in developed countries are trained to reduce the use of plastic by paying for shopping bags. Subsequently, buyers are accustomed to bringing their shopping bags, implying environmental concern because plastic is a big enemy for wetlands. This means ecological literacy on wetlands is incomplete when it only focuses on theory and classroom learning.

Intelligent smart thinking patterns and open mindsets are sometimes difficult when students and educators learn with constraints in traditional classrooms. This limits students' views within the classroom walls because they lack a broad perspective on their potential to benefit the public. Sometimes outdoor study is needed to form new experiences in cognitive development than classroom-based learning (Eaton, 2000).

Fayanto et al. (2019) stated that outdoor learning improve students' spatial intelligence and the ability to observe the surrounding environment. It increases students' attention to their environment through closer interactions. According to Salam et al. (2019), outdoor learning complements the theoretical classroom learning considered incomplete. It helps students develop honesty, discipline, responsibility, care, politeness, environment awareness, cooperative behavior, responsiveness, and independence (Sejati et al., 2017).

Outdoor studies bring students closer to nature and society, the real learning resources that help them understand, know and apply subject matter in daily life. It is implemented in the surrounding environment outside the classroom, where the knowledge obtained is real and not the result of a long abstraction. Furthermore, it provides freedom for students because their thinking space is not limited by classroom walls. Thinking outside the box is sometimes difficult when students and teachers work within the constraints of a traditional classroom. Students cannot form exploratory and innovative thinking (Yi et al., 2021) and often lack a wide perspective on their potential to have civic consequences. Outdoor learning allows students to learn from anyone and anywhere, and it could be an alternative for enriching learning resources (Sejati et al., 2017). Based on quantitative calculations, nature education improves map literacy and problem-solving skills (Aladağ et al., 2021; Wahyuni et al., 2017; Widada et al., 2019). Some studies examined the environment in general or only eco-literacy, while others focused on wetland ecological literacy associated with activities outside the classroom. Therefore, this study aimed to measure the wetland ecological literacy of ULM Geography Education Study Program students participating in outdoor learning. The goal was to determine its effect on students' wetland ecological literacy.

2. Methods

This study method was divided into design, data collection, development of instruments, and analysis.

2.1 Design

This descriptive study used a quantitative method with a pre-experimental design that involved calculating the effect of treatment by comparing the mean pre- and post-test scores (Sugiyono, 2015). The aim was to determine the effect of outdoor learning on the wetland ecological literacy of FKIP ULM geography students. Table 1 shows the study's schematic design.

Table 1. Learning Design

Pretest		*Treatment*		*Posttest*
Q1	⟶	X	⟶	Q2

Description:
Q1 = Pre-test
X = Outdoor Learning Treatment
Q2 = Post-test

2.2 Data Collection

The study population comprised 2020 Geography students who selected because they had the lowest scores than other batches and did not take the wetlands course. The wetland literacy instruments were adapted from Anderson's cognitive dimensions comprising the factual, conceptual, strategic, and metacognitive indicators (Wilson, 2016). A questionnaire was distributed twice to students, while pre- and post-test were held before and after outdoor learning activities, respectively.

2.3 Instrument Development

The study instrument was based on Anderson's cognitive domain comprising the factual, conceptual, procedural, and metacognitive indicators, as shown in Table 2.

Table 2. Wetland ecological literacy indicators

Indicator	Sub Indicator
Factual (Basic information)	Knowledge of wetlands terminology
	Knowledge of wetlands details and special elements
Conceptual (Relationships between the parts of a structure)	Knowledge of wetlands classifications
	Knowledge of wetlands principles and generalizations
	Knowledge of wetlands theories, models, and structures
Procedural (How to do things)	Knowledge of wetlands, various special techniques, and methods
	Criteria for when to use appropriate procedures
	Strategy knowledge of wetlands
Metacognitive (thinking) in general and specifically)	Knowledge of wetlands various cognitive tasks, including appropriate and contextual knowledge
	Self-knowledge of wetlands

Source: Wilson (2016)

The wetlands ecological literacy instrument was a questionnaire with 20 questions prepared using the true-false Guttman scale. Multiple True False (MTF) was used because it produces higher reliability and response rate than multiple-choice (MC) tests (Kreiter & Frisbie, 1989; Javid, 2014). Also, MTF reveals students' understanding of the material better (Couch et al., 2018).

The application of the Guttman scale in the questionnaire as a checklist consisted of 20 statement items. Student answers per question item were measured using the highest and lowest scores of 1 and 0, respectively. The categories for positive statements are true=1 and false=0, while negative statements are true=0 and false=1. The number of lowest and highest scores was formulated as follows:

a) $\text{Lowest total score} = \frac{\text{lowest score x number of questions}}{\text{total score}} \text{ x } 100\%$

$$= \frac{0 \text{ x } 20}{0} \text{ x } 100\% = 0\%$$

b) $\text{Highest score total} = \frac{\text{highest score x number of questions}}{\text{total score}} \text{ x } 100\%$

$$= \frac{1 \text{ x } 20}{20} \text{ x } 100\% = 100\%$$

c) Range = highest score total – lowest score total
= 100% - 0% = 100%

d) Interval = Range/number of categories = 100%/2 = 50%

e) Scoring criteria = highest score – interval
= 100% - 50% = 50 %

Based on the Guttman scale scoring step, a score of 50% or more was good, while less than 50% was not good. The instruments passed the internal and external validation tests. Regarding internal validation, material and learning experts stated that the instrument was suitable for collecting data on wetland ecological literacy. External validation was determined using statistical tests on classes other than the study subject. The test was performed on the 2018 class of geography students. Table 3 and Table 4 shows the validation of test results.

Table 3. The validation of test results

Case Processing Summary			
		N	%
Cases	Valid	55	100.0
	Excluded	0	.0
	Total	55	100.0
a. Listwise deletion based on all variables in the procedure.			

Table 4. Reability of instruments

Reliability Statistics	
Cronbach's Alpha	N of Items
.582	20

The reliability test shows Cronbach's alpha value of 0.582, greater than the r-table value of 0.2241, meaning the overall test is reliable. Therefore, the instrument was useful for data collection to improve wetland ecological literacy through outdoor learning.

2.4 Data Analysis

Data were analyzed using percentages and paired sample test statistics. A value more than 50% was good, while less than 50% was not good. The non-parametric Wilcoxon ranked statistical sign test is used when the data is abnormal and homogeneous (Sugiyono, 2015). This study is illustrated in Figure 1.

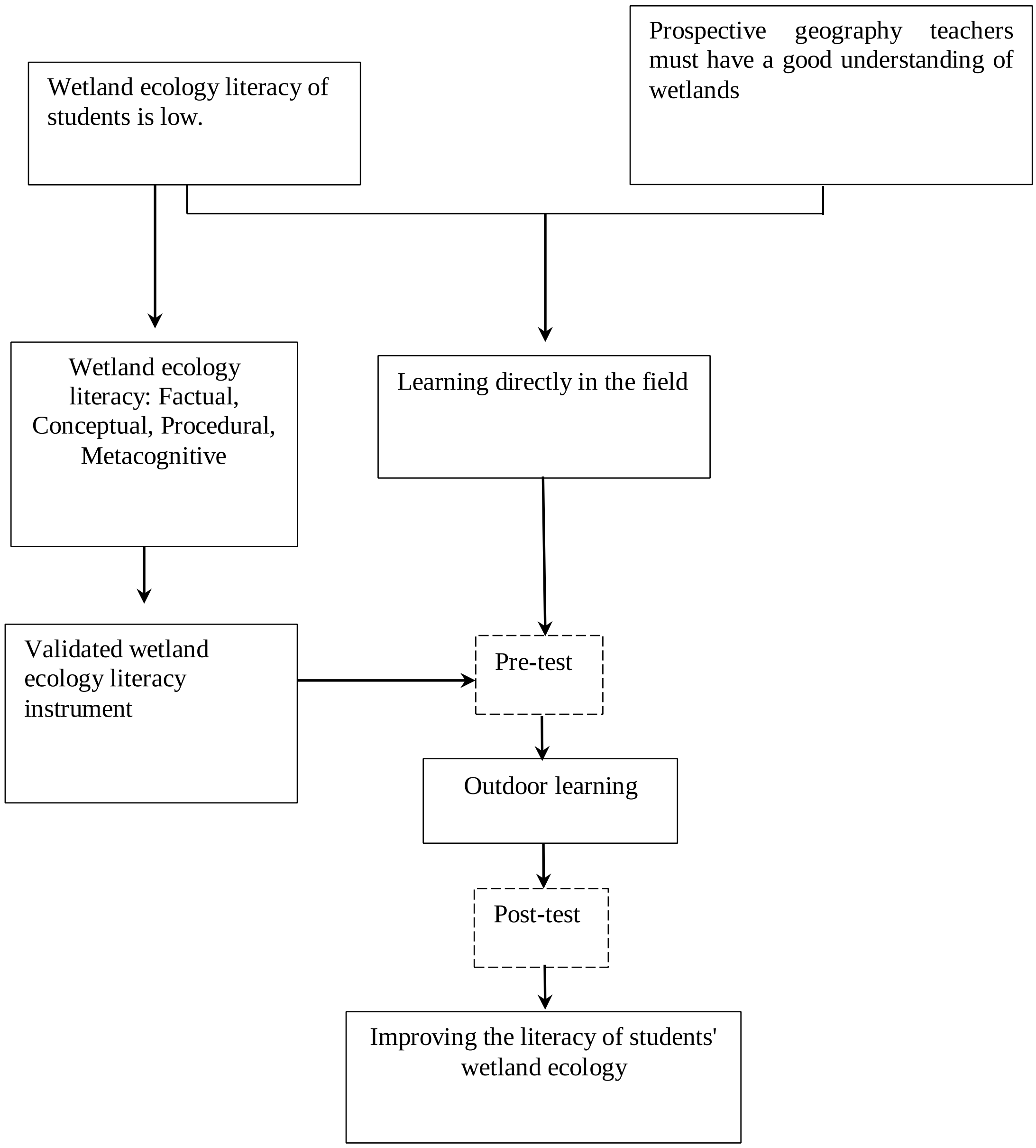

Figure 1. Flow chart of study

3. Results and Discussion

Data were presented regarding the pre- and post-test of the wetland ecological literacy and students' improvement. Table 5 shows students' wetland ecology literacy results.

Table 5. Wetland ecological literacy pre-test scores

Indicator	Sub Indicator	Score	Category
factual (Basic information)	Knowledge of wetlands terminology	53.33	Good
	Knowledge of details and special elements	52.5	Good
	Total	52.92	Good
Conceptual (Relationship between the part of a structure)	Knowledge of wetlands classifications	50.00	Less
	Knowledge of wetlands principles and generalizations	48.3	Less
	Knowledge of wetlands theories, models, and structures	35.83	Less
	Total	44.72	Less
Procedural (How to do things)	Knowledge of wetlands, special techniques, and methods	60.83	Good
	Criteria for when to use appropriate procedures	60	Good
	Strategy knowledge of wetlands	54.17	Good
	Total	58.33	Good
Metacognitive (thinking) in general and specifically)	Knowledge of wetlands various cognitive tasks, including appropriate and contextual knowledge	67.5	Good
	Self-knowledge of wetlands	65	Good
	Total	66.25	Good

The pre-test scores show that the conceptual indicator of the relationship between the structural parts is 44.72%, less than 50%. The knowledge of classification and category sub-indicators obtained 50.00%, principles and generalizations scored 48.3%,while theories, models, and structures scored 35.83%. The highest score is the knowledge sub-indicator on various cognitive tasks, including appropriate and contextual knowledge, at 67.5%. Table 6 shows the post-test scores.

Table 6. Wetland ecological literacy post-test scores

Indicator	Sub Indicator	Score	Category
factual (Basic information)	Knowledge of wetlands terminology	71.67	Good
	Knowledge of details and special elements	70	Good
	Total	70.83	Good
Conceptual (Relationship between the part of a structure)	Knowledge of wetlands classifications	69.17	Good
	Knowledge of wetlands principles and generalizations	68.33	Good
	Knowledge of wetlands theories, models, and structures	60	Good
	Total	65.83	Good
Procedural (How to do things)	Knowledge of wetlands, special techniques, and methods	73.3	Good
	Criteria for when to use appropriate procedures	79.17	Good
	Strategy knowledge of wetlands	80.83	Good
	Total	77.78	Good
Metacognitive (thinking) in general and specifically)	Knowledge of wetlands various cognitive tasks, including appropriate and contextual knowledge	85	Good
	Self-knowledge of wetlands	74.17	Good
	Total	79.58	Good

The post-test results showed that all indicators had good scores. The highest sub-indicator is knowledge of cognitive tasks, including appropriate and contextual knowledge, 85%. The lowest sub-indicator is knowledge of theories, models, and structures, which scored 60%. Figure 3 shows the gain value or difference between the pre- and post-test results. Figure 4 is a graph comparing the value of ecological literacy between pre- and post-test.

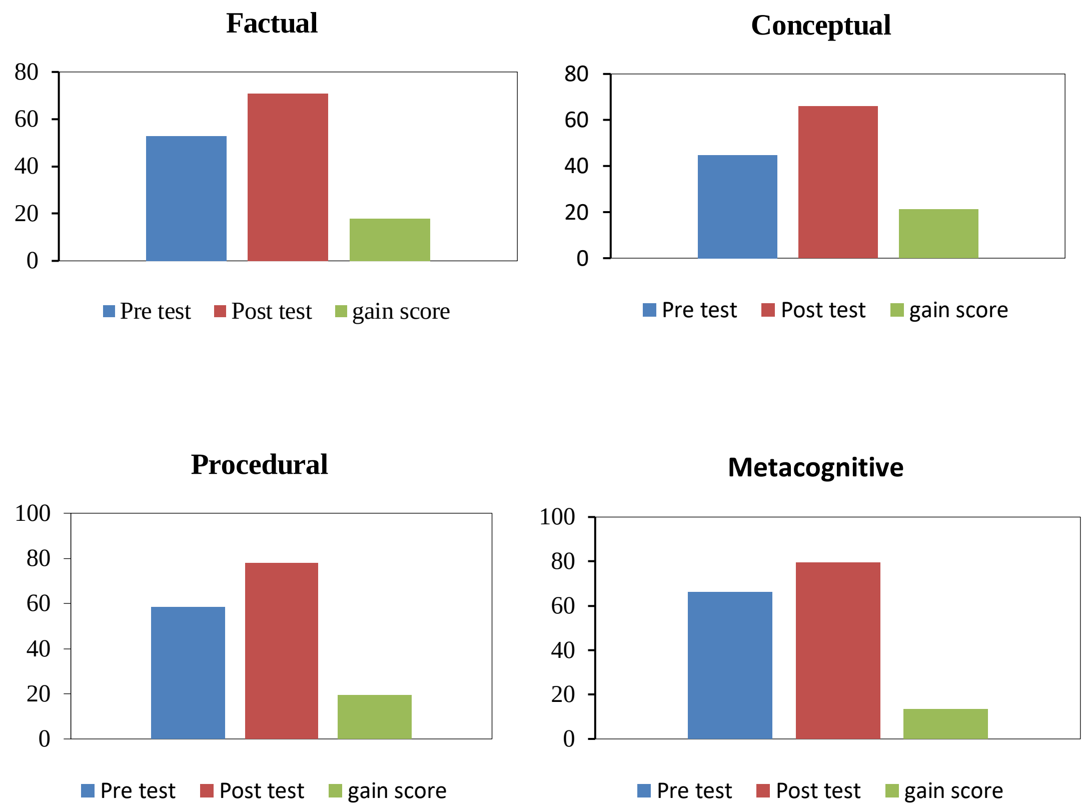

Figure 3. Gain score of wetland ecological literacy per indicator

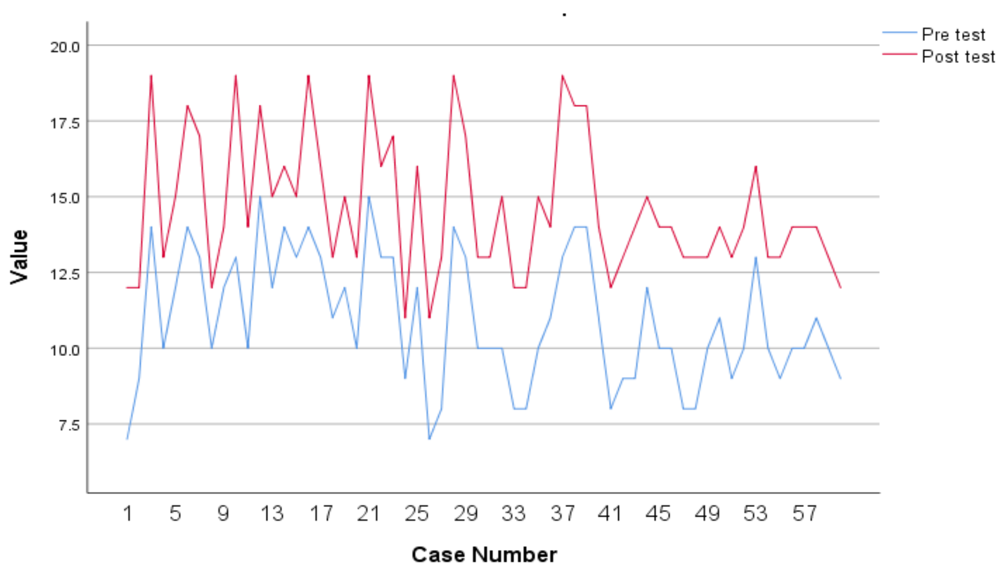

Figure 4. Wetlands ecological literacy in the test result

The gain scorein Figure 3 shows that all indicators have increased. The highest and lowest increases were 21.11% and 13.33% for the conceptual and metacognitive indicators, respectively. Furthermore, a pairwise comparison test was conducted to determine the effect of outdoor learning on students' ecological literacy. The test used the Paired sample T-test, with the condition that the data were normal and homogeneous. The non-parametric Wilcoxon Signed Rank Test statistical test is used for abnormal data. Table 7 shows the results of the normality test of wetland ecological literacy.

Table 7. Result of normality test

	VAR00002	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VAR00001	Pretest group	.189	60	.000	.944	60	.009
	Posttest group	.193	60	.000	.910	60	.000

Note : a. Lilliefors Significance Correction

Table 7 shows that the test data indicated a significance of 0.000, less than the standard 0.05 according to Kolmogorov-Smirnov, implying abnormal distribution. According to Shapiro-Wilk, abnormal data are 0.009<0.05 and 0.000<0.05 for pre and post-test, respectively, meaning they did not meet the statistical test requirements. Therefore, the Wilcoxon signed-rank test was used, and the results are presented in Table 8 and Table 9.

Table 8. Results of the wilcoxon signed-rank test

		N	Mean Rank	Sum of Ranks
Post-test - Pre-test	Negative Ranks	0[a]	.00	.00
	Positive Ranks	60[b]	30.50	1830.00
	Ties	0[c]		
	Total	60		

Note : a. Post-test < Pre-test
b. Post test > Pre test
c. Post test = Pre test

Table 9. The Wilcoxon signed-rank test results (Statistic test)

	Post-test & Pre-test
Z	-6.812[b]
Asymp. Sig. (2-tailed)	.000

Note : b. Based on negative ranks.

Table 8 indicates 0 as the score of negative ranks, which shows the negative difference between wetland ecological literacy for pre-test and post-test. The N value, Mean Rank, and Sum Rank are also 0, indicating no decrease or reduction from two tests. Furthermore, Table 8 shows 60 as the score of positive ranks, which shows the positive difference between wetland ecological literacy for the two tests. This means 60 students experienced an increase in wetland ecological literacy. The mean ranks show an average increase of 30.50, while the sum of ranks is 1830.00. Moreover, the ties value of 0 implies no equal value between the two tests. The Wilcoxon test facilitates decision-making as follows:

1. Ha is accepted when the 2-tailed Asymp. Sig. is <0.05, implying a difference between students' ecological literacy of the wetlands for pre- and post-test.
2. Ha is rejected when the 2-tailed Asymp. Sig. is > 0.05, indicating no difference between students' ecological literacy for pre- and post-test.

Table 9 shows a 2-tailed Asymp. Sig. of 0.000 <0.05, meaning Ha is accepted. This implies a difference between the students' literacy for pre- and post-test. Subsequently, outdoor studies improved the wetland ecological literacy among students of 2020 class.

The wetland ecology literacy increased because learning outside the classroom directs students to study outside the classroom. Jonassen (1991) stated that learning is more effective when conducted contextually outside than in the classroom. The learning in this study creates a real atmosphere relevant to the material on wetlands issues. This makes it easier for students to know the wetland environment. The gain knowledge by listening to teachers' explanations and linking them with new information obtained from learning outside the classroom. Learning outside is enjoyable and creates a pleasant atmosphere for students to examine the real object, helping increase their interest (Khan et al., 2020). Motivated students follow good learning and obtain high outcomes. However, worksheets should be provided to maintain outdoor study steps to ensure that the activity is authentic science and not risky fun (Glackin, 2016).

Students observe, record, and confirm the wetlands classification and problems presented in the guide for outdoor activities. This provides steps for environmental identification activities that may be overlooked. Quibell et al. (2017) stated that contextual learning increases student participation and skills. According to Aladağ et al. (2021), these activities are also based on daily situations that become meaningful because of awareness. Yokuş (2020) stated that learning outside the classroom facilitates personal development, including greater self-confidence, autonomy, motivation, and curiosity. In the context of this study, it increases curiosity about wetlands.

The exploration by students narrows the distance between what is learned in the book and their minds. This supports Parsons & Traunter (2020), which stated that outdoor studies enrich the learning experience. Moreover, extensive exploration promotes the individual's physical, social, and deeper level of learning (Yli-Panula et al., 2019). According to Genc et al. (2018), education in nature provides an opportunity to compare theoretical knowledge with field conditions.

The post-test scores for the wetlands ecological literacy were higher than pre-test. Students integrated the material obtained during outdoor learning with real field problems, completing the post-test questions correctly. Therefore, learning resources from students' environmental conditions make the outcomes more optimal (Arisona & Utsman, 2018). This is consistent with Berg et al. (2021),which stated that field event observations improve students' performance. Learning outside the classroom is beneficial, specifically for prospective geography teachers who need good spatial abilities (Fayanto et al., 2019; Asiyah et al., 2021).

Field observation activities conducted during outdoor studies improve students' reasoning skills. This makes them understand the material provided and relate them to their environmental problems. Consequently,their outcomes increase because they answer questions that require reasoning in solving problems scientifically. According to Lawson (1992), reasoning skills are the most consistent predictors of learning achievement than style, cognitive, mental capacity, and fluid intelligence. Outdoor activities also increase students motivation and activities. In line with this, mental promotion or motivation and physical activity affect student learning outcomes. Furthermore, learning groups increase motivation, making students more enthusiastic about taking the subject matter (Fatchan et al., 2016). Learning outside the classroom also makes them find concepts directly through field observations regarding environmental problems. Therefore, it trains them to be creative and self-regulated during learning (Waite, 2020).

4. Conclusion

Through closer interactions, outdoor learning significantly increases students' wetlands ecological literacy score and their environmental attention and complements the learning experience. Students need knowledge on the ecological literacy of wetlands because it is part of their environment and is prone to damage from human activities. Therefore, students and the community need ecological metacognitive literacy of wetlands' formation and possible change caused by various activities.

Conflict of Interest

The authors declare that there is no conflict of interest with any financial, personal, other people or organizations related to the material in this article.

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