



The Effect of Contextual Teaching and Learning on Environmental Literacy Competence of Pre-Service Teachers in Learning Media Course

Muhamad Ramdan Gumilar^{1*}

Universitas Halim Sanusi Bandung¹

* Corresponding Author: muhamad.ramdan.gumilar@gmail.com

Article info

Accepted : April 24th 2026
Approved : July 6th 2026
Published : July 10th 2026

Keywords:

Contextual Learning; Literacy;
Environment; Pre-Service
Teachers

ABSTRACT

Contextual learning has strategic relevance for strengthening environmental literacy among pre-service primary teacher students, yet its integration in learning media courses remains predominantly technical and less contextual. This study aims to analyze the effect of Contextual Teaching and Learning (CTL) on environmental literacy competence at Universitas Halim Sanusi Bandung. The study applied a quantitative approach with a quasi-experimental nonequivalent control group design. The research population consisted of students enrolled in the Learning Media course, with a total sample of 98 students divided into experimental ($n = 49$) and control ($n = 49$) groups. The sample selection procedure employed purposive sampling based on class availability and equal group size considerations. Data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, the Wilcoxon Signed Ranks Test, and Pearson correlation. The findings indicated a significant improvement in environmental literacy in the experimental group (Sig. 0.012 ; 0.05) and a strong positive correlation between pro-environmental attitudes and environmental literacy scores ($r = 0.684$; $p = 0.000$). The discussion confirms CTL as an effective learning ecosystem to support both cognitive ecological understanding and affective environmental reinforcement through authentic contextual experiences. The study concludes that CTL is more effective in improving environmental literacy competence than learning without contextual intervention. It is recommended that lecturers adopt CTL based on local environmental issues, while institutions provide systematic support through innovative, sustainability-oriented pedagogical training.

<https://jurnal.uinambon.ac.id/index.php/JTI/index>

How to Cite: Gumilar, M.R. (2026). The effect of contextual teaching and learning on environmental literacy competence of pre-service teachers in learning media course. *Al-Alam: Islamic Natural Science Education Journal*, 5(2) 524-532. DOI: <https://doi.org/10.33477/al-alam.v5i2.13381>

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INTRODUCTION

Contextual Teaching and Learning (CTL) is an educational approach that emphasizes the connection between academic material and students' real-life contexts, rendering the learning process more meaningful and applicable. Theoretically, CTL is rooted in constructivism, which posits learning as an active process of constructing knowledge through experience, interaction, and reflection on the surrounding

environment. Through contextual learning, students do not merely comprehend concepts abstractly; they are empowered to correlate this knowledge with real-world situations encountered in daily life Joyce (2003). Mashudi (2020) asserted that CTL facilitates students in discovering the intrinsic value of learning by analyzing the relationship between the subject matter and real-life contexts, ensuring that knowledge is not isolated from their lived experiences. Furthermore Slavin (2011) posited that educators must create an effective learning environment to yield positive outcomes for students.

In the context of pre-service primary school teacher education, contextual learning is highly relevant, as future educators are expected to possess pedagogical skills that are reflective, adaptive, and responsive to their students' environmental conditions. This approach encourages pre-service teachers to master learning theories while simultaneously designing instructional methods that are pertinent to the actual needs of schools and communities. Previous research conducted by Parhusip et al., (2020) demonstrated that contextual learning is empirically effective in enhancing conceptual understanding, active engagement, and students' internalization of the studied material.

Concurrently, environmental literacy represents a crucial 21st-century competence that pre-service primary teachers must master. Environmental literacy is defined as an individual's capacity to understand environmental concepts, identify and analyze environmental problems, and make responsible decisions accompanied by pro-environmental attitudes and behaviors Rabadia et al. (2024) This literacy encompasses not only cognitive aspects but also affective and behavioral dimensions, thereby playing a pivotal role in shaping awareness and responsibility toward environmental sustainability. According to Novitasari et al. (2024), environmental literacy necessitates pedagogical approaches that provide direct experiences, foster critical reflection, and contextualize concepts within the students' surrounding environment.

Furthermore, the Learning Media course occupies a strategic position in shaping the pedagogical mindset of pre-service primary teachers. This course should not be solely oriented toward technological proficiency and media design; rather, it should serve as a space for integrating values, contexts, and contemporary issues relevant to students' lives. From a contextual learning perspective, educational media should ideally be developed based on real-world problems proximate to the students' environment. Consequently, media functions not just as a visual aid, but as an instrument for internalizing values and reinforcing environmental literacy. Instruction that links educational media with local environmental issues has been proven to enhance students' awareness and understanding of the human role in maintaining environmental sustainability Mawarni (2024).

However, empirical evidence indicates that the environmental literacy competence of pre-service teachers at Universitas Halim Sanusi Bandung has not developed optimally. Based on preliminary observations in the Learning Media course, students tended to focus predominantly on the technical aspects of media production, such as visual design and technology utilization, without contextualizing the developed media within real environmental problems. The learning process remained procedural and product-oriented, while the integration of meaning, values, and environmental awareness was

systematically lacking. Similar phenomena were observed by Anggraini & Nazip (2022) at another private higher education institution, where students' overall environmental literacy competence fell into the moderate category with a score of 144.

This situation reveals a discrepancy between theoretical ideals and empirical realities. Theoretically, contextual learning is believed to enhance environmental literacy by linking academic material with tangible experiences and actual environmental issues (Parhusip et al., 2020). Empirically, however, the implementation of instruction in the Learning Media course has not fully leveraged the contextual approach as a mechanism for strengthening students' environmental literacy. Consequently, the course's potential as a vehicle for cultivating environmental awareness remains underutilized.

Various preceding studies have shown that contextual and innovative learning approaches can enhance student competencies across conceptual, affective, and psychomotor domains. Fitriana et al. (2024) emphasized that innovative learning linking material to real contexts can increase student engagement and competence. Sustri, Dede. Gumilar, M.R. dan Nurjanah, (2021) also demonstrated that contextual learning significantly elevates engagement and learning outcomes by positioning students as active subjects. Additionally, studies by Muhammad Sururuddin *et al* (2023) and Handiyati (2023); Mawarni (2024) revealed that utilizing context-based environmental learning media positively impacts the intrinsic emergence of environmental awareness and concern among students.

Nevertheless, Irawati et al (2024) found that students' initial environmental literacy capabilities were relatively low, particularly when instruction was not systematically integrated with contextual experiences. Moreover, most environmental literacy research has focused on primary and secondary education levels or specific subjects, whereas studies specifically investigating the effect of contextual learning on the environmental literacy competence of pre-service primary teachers in Learning Media courses remain relatively scarce Mawarni (2024). This condition highlights a significant research gap.

Based on this rationale, the present study holds strong urgency. Differentiating itself from prior research, this study focuses on integrating contextual learning with the enhancement of pre-service teachers' environmental literacy within the specific context of the Learning Media course, which has traditionally overemphasized technical aspects. This research aims to provide theoretical contributions by reinforcing contextual learning literature in teacher education, as well as practical contributions in the form of instructional design recommendations and the development of media oriented toward environmental literacy and sustainability.

Therefore, this study aims to investigate *the effect of contextual learning on the environmental literacy competence of students at Universitas Halim Sanusi Bandung in the Learning Media course*. The findings are expected to serve as a foundation for developing more meaningful, contextual, and sustainability-oriented instructional designs for future educators.

METHOD

This study employed a quantitative approach utilizing a quasi-experimental nonequivalent control group design to analyze the effect of Contextual Teaching and Learning (CTL) on students' environmental literacy competence. This design was selected because full randomization of subjects was not feasible; however, it allowed for the comparison of two distinct groups with comparable characteristics: an experimental group and a control group.

Table 1 : quasi-experimental nonequivalent control group design

Group	Pre-Test	Treatment	Post-Test
Experimental Class	O_1	X_1	O_3
Control Class	O_2	-	O_4

source: (Sugiyono, 2020)

Notes :

O_1 : Pre-Test for the experimental group

O_2 : Pre-Test for the control group

O_3 : Post-Test for the experimental group

O_4 : Post-Test for the control group

X_1 : Contextual Teaching and Learning (CTL) model

The population consisted of Universitas Halim Sanusi Bandung students enrolled in the Learning Media course. The sampling technique utilized purposive sampling, considering class availability and the equivalence of participant numbers. The sample comprised 98 students distributed into two classes: the experimental class ($n = 49$), which received the CTL intervention, and the control class ($n = 49$), which received conventional instruction without specific strategic interventions.

Research instruments included: (1) an environmental literacy test comprising objective items based on environmental competencies, administered during both the pretest and posttest; and (2) a pro-environmental attitude questionnaire utilizing a 3-point Likert scale to measure students' affective ecological dimensions. The test instrument underwent content validity testing by educational and environmental experts, while its reliability was analyzed using Cronbach's Alpha. The questionnaire was similarly tested for validity and reliability prior to data collection.

The research procedure was executed in three primary phases: (a) the pre-intervention phase, involving the initial measurement of environmental literacy competence via a pretest and the completion of the pro-environmental attitude questionnaire; (b) the intervention phase, wherein CTL was implemented in the experimental class, orienting course activities around real environmental contexts, while the control class underwent conventional instruction; (c) the post-intervention phase, involving a reassessment of environmental literacy through a posttest and a subsequent questionnaire to observe the dynamics of students' affective ecological dispositions.

Data analysis was conducted sequentially based on data characteristics. Descriptive statistics (mean, maximum score, minimum score, and standard deviation) were used to

map the dynamics of environmental literacy scores. Normality was tested using the Shapiro–Wilk test. The results indicated that the data were not normally distributed ($p < 0.05$); therefore, nonparametric statistics were employed. Differences between pretest and posttest scores in each group were analyzed using the Wilcoxon Signed Ranks Test, with a decision criterion of $\alpha = 0.05$ (Creswell, 2009).

Analytical procedures were performed using IBM SPSS 21 software to ensure computational accuracy and inferential validity. This study strictly adhered to academic ethical principles, securing informed consent from all participants and maintaining the confidentiality of individual data throughout and subsequent to the research process.

RESULTS AND DISCUSSION

RESULT

Dynamics of Student Environmental Literacy Scores

Table 2: Pretest and Posttest Statistical Data for Experimental and Control Classes

Statistical Data	Pretest		Posttest	
	Eksperiment	Control	Eksperiment	Control
Number of Students	49	49	49	49
Maximum Score	100	90	100	100
Minimum Score	10	20	30	20
Mean	82.85	75.10	92.24	74.69
Standard Deviation	22.36	19.59	16.11	18.38

Based on Table 2, the initial capabilities of both classes were relatively comparable, although the experimental group exhibited a slightly higher pretest mean (82.85) than the control group (75.10). The experimental class also showed a higher standard deviation (22.36) compared to the control class (19.59), indicating greater variance in pre-intervention scores.

Following the intervention, a significant transformation occurred in the experimental class. The mean posttest score for the experimental class increased to 92.24, whereas the control class mean remained relatively stagnant at 74.69. The standard deviation in the experimental class decreased to 16.11, suggesting that student competencies became more uniform after the treatment. In contrast, the control class standard deviation remained high at 18.38. Both classes achieved a maximum posttest score of 100, but the experimental class's minimum score rose to 30, outperforming the control class's minimum score, which remained at 20.

Statistical Prerequisite Tests

The normality test (Table 3), evaluated using the Shapiro–Wilk method for $n = 49$ per group, revealed significance values of 0.000 ($p < 0.05$) for all pretest and posttest datasets in both the experimental and control classes (Table 3). Consequently, the data were not normally distributed, necessitating the use of the non-parametric Wilcoxon Signed Ranks Test for further analysis.

Nonparametric Difference Test (Wilcoxon Test)

The Wilcoxon Signed Ranks Test (Table 4) was utilized to discern differences between pretest and posttest learning outcomes. In the experimental class, 25 students demonstrated increased scores, 9 experienced decreased scores, and 15 remained unchanged. The sum of positive ranks (441.00) substantially exceeded

Table 3: Tests of Normality

Class	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest (Control)	.258	49	.000	.794	49	.000
Posttest (Control)	.201	49	.000	.872	49	.000
Pretest (Experimental)	.299	49	.000	.732	49	.000
Posttest (Experimental)	.379	49	.000	.551	49	.000

Table 4: Wilcoxon Signed Ranks Test (Ranks)

		N	Mean Rank	Sum of Ranks
Posttest Experimental - Pretest Experimental	Negative Ranks	9	17.11	154.00
	Positive Ranks	25	17.64	441.00
	Ties	15		
	Total	49		
Posttest Control - Pretest Control	Negative Ranks	21	20.62	433.00
	Positive Ranks	20	21.40	428.00
	Ties	8		
	Total	49		

the negative ranks (154.00). The test (Table 5) yielded a Z-value of -2.508 with a significance of 0.012 ($p < 0.05$), confirming a significant difference between pretest and posttest scores following the CTL intervention.

Table 5: Wilcoxon Signed Ranks Test (Test Statistics)

	Posttest Exper. - Pretest Exper.	Posttest Control - Pretest Control
Z	-2.508	-0.033
Asymp. Sig. (2-tailed)	0.012	0.974

Conversely, in the control class, 20 students showed score improvements while 21 demonstrated a decline, with 8 ties. The sum of positive ranks (428.00) and negative ranks (433.00) was nearly balanced. The resulting Z-value of -0.033 and significance of 0.974 ($p > 0.05$) indicated no statistically significant difference in learning outcomes without the contextual intervention

Pro Environmental Attitude Scores and Correlation

The pro-environmental attitude questionnaire revealed an average score of 2.59 (out of 3.00) for the experimental group, compared to 2.27 for the control group. Pearson correlation analysis demonstrated a strong and significant positive relationship between pro-environmental attitudes and environmental literacy scores ($r = 0.684$; $p = 0.000$). This indicates that the enhancement of environmental literacy in the experimental group was accompanied by a robust strengthening of affective ecological dispositions, underscoring the holistic and synergistic nature of environmental literacy.

DISCUSSION

The findings elucidate that the experimental class achieved superior improvements in environmental literacy competence compared to the control class. The increase in mean scores from pretest to posttest, coupled with a reduction in standard deviation, suggests that the CTL intervention not only elevated overall environmental literacy but also mitigated disparities in capability among students. In essence, the contextual learning approach uniformly assisted students, regardless of their initial proficiency levels.

Conversely, the lack of significant improvement in the control class indicates that conventional in-struction, devoid of specific pedagogical interventions, fails to significantly impact students' environmental literacy. This disparity reinforces the hypothesis that the CTL treatment is substantially more effective. These findings align with prevailing educational theories positing that appropriate instructional strategies can effectively stimulate motivation, enhance comprehension, and elevate competency outcomes.

The utilization of the Wilcoxon non-parametric test verified that these improvements were not coincidental but were the direct result of the pedagogical intervention. In the experimental class, the contextual framework fostered meaningful learning by directly correlating academic theories with tangible ecological issues. The stagnant results in the control class further validate that without explicit contextual integration, potential environmental awareness remains dormant.

Furthermore, the significant elevation in the experimental group's pro-environmental attitude scores (2.59) reflects an effective internalization of ecological values. This is fundamentally linked to the characteristics of CTL, which situates learners within real-world problem-solving scenarios, demanding authentic reflection on local environmental issues. The strong positive correlation ($r = 0.684$) emphasizes that environmental literacy is multidimensional; cognitive mastery is inherently intertwined with affective ecological maturation. The absence of parallel affective growth in the control group further demonstrates that non-contextual teaching methods struggle to foster optimal emotional engagement and ecological consciousness.

Ultimately, CTL has proven to be an effective educational ecosystem that nurtures both cognitive ecological understanding and affective pro-environmental attitudes, verifying that holistic ecological competence develops through an integrated cognitive and affective synergy.

CONCLUSION AND SUGGESTIONS

CONCLUSION

Based on data analysis and discussion, this study concludes that Contextual Teaching and Learning (CTL) significantly enhances the environmental literacy competence of pre-service teachers. Descriptive statistics demonstrated a notable increase in the experimental group's mean posttest scores. The Wilcoxon Signed Ranks Test confirmed a statistically significant difference ($p = 0.012 < 0.05$) between pretest and posttest results in the experimental class, validating the efficacy of the CTL intervention. Conversely, the control group exhibited no significant difference ($p = 0.974 > 0.05$), indicating that conventional instruction lacks the impact necessary to cultivate environmental literacy. Overall, the CTL approach proved substantially more effective in fostering students' environmental literacy and pro-environmental attitudes than conventional methods.

SUGGESTIONS

Drawing upon these conclusions, the following recommendations are proposed:

- 1) For Educators: Lecturers are strongly encouraged to adopt Contextual Teaching and Learning as an alternative instructional strategy, as it effectively elevates environmental literacy and promotes active student participation.
- 2) For Institutions: Universities, particularly Universitas Halim Sanusi, should systematically support the implementation of innovative contextual learning strategies through professional development and training programs for educators, thereby elevating the quality of instruction.
- 3) For Students: Pre-service teachers must actively engage in contextual learning processes to fully realize the pedagogical and ecological benefits of the implemented strategies.
- 4) For Future Researchers: Future studies should employ broader sample sizes, combine quantitative and qualitative approaches, and incorporate additional variables such as learning motivation, intrinsic interest, and behavioral shifts to yield a more comprehensive understanding of environmental literacy development.

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