Enhancing persuasive writing skills through ecology-themed communicative poster-based instruction in secondary school

Ratnawati*, Tarman

Department of Education, Universitas Muhammadiyah Makassar, Sultan Alauddin Street No.259, Makassar, 90221, Indonesia

*Corresponding author, email: ratnawati@unismuh.ac.id

Article History
Received: 6 March 2026
Revised: 24 May 2026
Accepted: 29 June 2026
Published: 30 June 2026

Keywords
Communicative approach
Environmental literacy
Persuasive text

Abstract
This study examined the effect of a communicative poster-based approach in teaching ecology-themed persuasive texts on the writing skills of 32 Grade VIII students at a secondary school in Makassar, Indonesia, under the Independent Curriculum. A pre-experimental one-group pretest-posttest design was employed; data were collected through persuasive writing tests and scored with analytic rubrics. Results revealed a significant improvement in mean scores from 63.75 to 81.25 ($p = 0.000$), with a very large effect size of 2.20 (Cohen, 1988). Integrating environmental themes with communicative language instruction through poster creation effectively developed students' persuasive writing skills. Ecology-based topics may also foster environmental awareness as a secondary outcome, though this remains an inference rather than a directly measured variable.

How to cite: Ratnawati, R. (2026). Enhancing persuasive writing skills through ecology-themed communicative poster-based instruction in secondary school. *Journal of Environment and Sustainability Education, 4*(2). 441–447. doi: 10.62672/joease.v4i2.244

1. Introduction

The imperative for environmental education has intensified in response to escalating global ecological challenges, including climate change, biodiversity loss, and resource depletion (Hoque & Sultana, 2024; Silva et al., 2024). Within this context, environmental awareness, defined as the capacity to recognize, understand, and respond to ecological issues, has become a fundamental educational objective (Scholz & Binder, 2011). The integration of sustainability themes across academic disciplines represents a strategic pedagogical approach to cultivating ecological awareness among future generations (Chasokela, 2024; Mardikaningsih et al., 2021). In Indonesian language education, the implementation of the Merdeka (Independent) Curriculum marks a significant shift toward text-based instruction that emphasizes communicative competence and contextual literacy (Lubis & Darmawati, 2023). This curricular framework positions text not merely as a linguistic artifact but as a vehicle for meaning-making within authentic social contexts, creating a valuable opportunity to embed ecological themes within language instruction (Graves, 2008; Kouritzin, 2020; Larson & Marsh, 2014; Xiong et al., 2025).

Persuasive text instruction offers a promising avenue for integrating ecological content with language learning (Xiong et al., 2025). The genre of persuasive writing inherently involves constructing coherent arguments, evaluating evidence, anticipating counterarguments, and advocating for specific positions, cognitive processes that align closely with the competencies required for effective environmental discourse (Heidari Tabrizi & Hoorijani, 2025). When focused on ecological themes, persuasive writing instruction can simultaneously develop linguistic proficiency and ecological awareness, creating a synergistic learning experience. However, students often demonstrate limited ability to compose persuasive texts on environmental topics, with deficiencies particularly evident in text structure organization, argumentative depth, evidence integration, and persuasive effectiveness (Alwaely et al., 2020). These limitations may stem from traditional pedagogical approaches that treat language learning as separate from real-world issues, failing to leverage the potential of environmental themes as meaningful contexts for developing communicative competence.

Despite growing interest in integrating environmental topics into language education, existing research has predominantly focused on either environmental literacy outcomes in science education or general persuasive writing instruction in language classrooms, with limited attention to the intersection of both domains (Davari et al., 2025; Kazazoglu, 2025). Studies have explored poster-based learning in science and art education (Peeters et al., 2025; Saralegi et al., 2025), but the use of poster creation as a communicative tool for developing ecology-themed persuasive writing within the Indonesian language curriculum remains underexplored. Moreover, research on communicative language teaching in Indonesian secondary schools has largely centered on general speaking and reading skills, leaving a gap in understanding how poster-mediated instruction can

doi: 10.62672/joease.v4i2.244
© 2026 The Authors
This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License
ISSN: 3025-0714

specifically support persuasive writing development within ecological themes. This study addresses this gap by examining the implementation of a communicative poster-based approach to teaching ecology-themed persuasive texts in the Indonesian secondary school context.

Poster-based instruction provides a multimodal platform that combines linguistic and visual elements, requiring students to synthesize information, design compelling visual representations, and craft concise persuasive messages (Thomas & Lees-Maffei, 2018). This format is particularly well-suited for persuasive writing development because posters demand clarity of argument, strategic organization of content, and audience awareness, all core competencies of persuasive discourse. Within a communicative language teaching framework, poster creation offers an authentic purpose for writing, as students produce texts designed to inform and persuade a real audience about ecological issues (Davari et al., 2025; Ozverir et al., 2017; Shangkui & Chung, 2025; Wang, 2024). The collaborative nature of poster activities further fosters peer interaction, negotiation of meaning, and iterative refinement of arguments, processes that align with the principles of communicative language learning.

This study aimed to investigate the effect of a communicative poster-based approach on Grade VIII students' persuasive writing skills in ecology-themed contexts at SMPN 49 Makassar. Specifically, the research question was: To what extent does ecology-themed communicative poster-based instruction improve students' persuasive writing performance? By examining the intersection of language pedagogy and environmental education, this study contributes to the broader discourse on contextually meaningful language instruction. The findings offer practical insights for curriculum development in contexts where the integration of real-world issues into language learning is increasingly encouraged, particularly within the Merdeka Curriculum framework.

2. Method

This study employed a quantitative pre-experimental design utilizing a one-group pretest-posttest approach to examine the effect of a communicative poster-based approach on students' ecology-themed persuasive writing skills (Case-Smith et al., 2012; Kongkaew et al., 2020). The one-group pretest-posttest design (O1 X O2) was implemented, where O1 represents the initial persuasive writing assessment, X denotes the intervention employing the communicative poster-based approach, and O2 signifies the post-intervention writing evaluation. While this design enables comparison of writing performance before and after the instructional intervention within a natural classroom setting, it is important to acknowledge its inherent limitations. Without a control group, causal claims regarding the intervention's effect cannot be definitively established, as alternative explanations such as maturation, history effects, testing effects, and regression to the mean cannot be ruled out. The findings are therefore interpreted as descriptive evidence of improvement following the intervention rather than conclusive evidence of causation. The research was conducted at SMPN 49 Makassar, involving Grade VIII students during the 2023/2024 academic year.

2.1. Participants and Sampling

The study sample comprised 32 students selected through purposive sampling from one intact classroom. This particular class was selected because it was the only Grade VIII class scheduled for persuasive text instruction during the research period as part of the Indonesian language curriculum, and the classroom teacher consented to implement the six-week intervention protocol. All participants were between 13 and 14 years old and had received comparable prior instruction in persuasive writing techniques prior to the study. The single-class sample limits the generalizability of the findings, as acknowledged in the limitations section.

2.2. Intervention Procedure

The instructional intervention spanned six weeks, with two 80-minute sessions conducted weekly. The communicative approach was operationalized through poster-based learning activities focused on ecological themes. Each session followed a structured sequence: (1) introduction to an environmental issue (e.g., plastic pollution, deforestation, water conservation), (2) analysis of persuasive texts addressing the issue, (3) collaborative planning of persuasive posters integrating linguistic and visual elements, (4) individual or small-group poster creation, and (5) presentation and peer feedback sessions. The pedagogical emphasis remained on authentic communication, with students encouraged to formulate persuasive arguments, anticipate counterarguments, and design visually compelling posters that effectively conveyed environmental messages. Instructional materials included authentic texts on ecological issues, multimedia resources, and exemplar posters demonstrating effective persuasive techniques.

2.3. Data Collection Instruments

Two primary instruments were utilized: a persuasive writing test and an analytic scoring rubric. The writing test required students to compose a persuasive text addressing a specific ecological theme, with prompts designed to elicit argumentative writing across four dimensions: text structure coherence, argumentative depth, evidence integration, and persuasive effectiveness. The analytic rubric employed a four-point scale

(1=inadequate to 4=excellent) across five criteria: (1) organizational structure and logical flow, (2) quality and relevance of arguments, (3) integration of supporting evidence, (4) linguistic accuracy and stylistic appropriateness, and (5) overall persuasive impact. Rubric validation was conducted through expert review by two Indonesian language education specialists, achieving a content validity index (CVI) of 0.86, indicating strong content validity. Inter-rater reliability was assessed using percentage agreement between two independent raters on a pilot sample of ten writing samples, yielding 88% agreement, which suggests acceptable consistency.

2.4. Data Analysis

Data analysis proceeded through three sequential stages. First, normality testing using the Shapiro-Wilk test confirmed that pretest and posttest scores followed normal distributions ($p > 0.05$). Second, a paired-sample t-test was conducted to determine the statistical significance of score differences between pretest and posttest measurements. Third, effect size was calculated using Cohen's d to quantify the magnitude of the score improvement, with interpretation following established benchmarks: small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$). Given the pre-experimental design, the results are presented as descriptive evidence of improvement rather than as proof of causal effect.

2.5. Ethical Considerations

This study was conducted in accordance with ethical guidelines for educational research involving minors. Prior to data collection, permission was obtained from the school principal and the classroom teacher at SMPN 49 Makassar. Parents or guardians of all participating students were informed of the study's purpose and procedures, and students provided their assent to participate. Anonymity and confidentiality of all student data were maintained throughout the research process.

3. Results and Discussion

The implementation of the communicative poster-based approach yielded substantial and statistically significant improvements in students' ecology-themed persuasive writing abilities. Quantitative analysis revealed comprehensive enhancements across all measured dimensions of persuasive writing proficiency, with particularly notable gains in argumentative depth and persuasive effectiveness.

3.1. Descriptive Statistics and Performance Trends

Descriptive statistics for pretest and posttest performance are presented in Table 1 and Table 2. The pretest assessment revealed a mean score of 63.75 with a standard deviation of 7.82, indicating moderate baseline proficiency with considerable variability among students. The highest pretest score was 78, while the lowest was 50, reflecting a 28-point range that suggests diverse initial competencies within the classroom.

Following the six-week instructional intervention, posttest performance demonstrated substantial improvement. The mean score increased to 81.25 (SD = 6.45), representing an average gain of 17.5 points. This improvement corresponds to a 27.5% enhancement relative to baseline performance, suggesting that the intervention effectively supported students' persuasive writing development within ecological contexts.

Table 1. Descriptive Statistics of Pretest Scores

Component	Result
Number of Students	32
Highest Score	78
Lowest Score	50
Mean Score	63.75
Standard Deviation	7.82

Following the six-week instructional intervention employing the communicative poster-based approach, posttest performance demonstrated remarkable improvement. The mean score increased to 81.25 (SD = 6.45), representing an average gain of 17.5 points. This substantial improvement corresponds to a 27.5% enhancement relative to baseline performance, suggesting that the intervention effectively developed students' persuasive writing competencies within ecological contexts.

Table 2. Descriptive Statistics of Posttest Scores

Component	Result
Number of Students	32
Highest Score	92
Lowest Score	70
Mean Score	81.25
Standard Deviation	6.45
Average Improvement	17.5
Percentage Improvement	27.5%

3.2. Distributional Shifts in Proficiency Categories

The distribution of student performance across proficiency categories underwent a notable shift following the intervention. As shown in Table 3, pretest performance was predominantly concentrated in the "adequate" category (46.87%), while 34.38% of students were classified as "inadequate" and only 18.75% achieved "good" performance. This distribution indicates that prior to the intervention, the majority of students possessed basic persuasive writing skills, with a substantial minority demonstrating significant deficiencies.

Post-intervention analysis (Table 4) reveals a marked improvement in this proficiency landscape. A total of 31.25% of students achieved "excellent" performance (scores 85 or above), while 46.87% reached "good" proficiency (scores 75–84). The remaining 21.88% of students demonstrated "adequate" performance (scores 70–74), with no students remaining in the "inadequate" category. This transformation represents a qualitative shift from a predominantly adequate-to-inadequate performance profile to one dominated by good-to-excellent achievement.

Table 3. Distribution of Pretest Scores

Score Range	Category	Number of Students	Percentage (%)
>= 75	Good	6	18.75%
60–74	Adequate	15	46.87%
<= 59	Inadequate	11	34.38%
Total		32	100%

Post-intervention analysis (Table 4) reveals a complete reversal of this proficiency landscape. An impressive 31.25% of students achieved "excellent" performance levels (scores ≥ 85), while 46.87% reached "good" proficiency (scores 75–84). The remaining 21.88% of students demonstrated "adequate" performance (scores 70–74), with no students remaining in the "inadequate" category. This transformation represents a qualitative shift from a predominantly adequate/inadequate performance profile to one dominated by good/excellent achievement levels.

Table 4. Distribution of Posttest Scores

Score Range	Category	Number of Students	Percentage (%)
>= 85	Excellent	10	31.25%
75–84	Good	15	46.87%
70–74	Adequate	7	21.88%
Total		32	100%

3.3. Statistical Significance and Effect Magnitude

A paired-sample t-test was conducted to examine whether the observed improvement was statistically significant. As presented in Table 5, the calculated t-value of 12.48 with a corresponding p-value of 0.000 ($p < 0.05$) indicates that the difference between pretest and posttest scores is unlikely to be attributable to random variation. Effect size calculation using Cohen's d yielded a value of 2.20, exceeding the threshold of 0.8 which Cohen (1988) classifies as very large (Cohen, 1988). This magnitude suggests that the communicative poster-based approach produced a substantial educational impact on students' persuasive writing development. However, given the pre-experimental design without a control group, these findings are best interpreted as descriptive evidence of improvement rather than conclusive proof of causation.

Table 5. Results of Paired Sample t-Test

Component	Value
Number of Samples (N)	32
Pretest Mean	63.75
Posttest Mean	81.25
Mean Difference	17.5
t-value	12.48
Sig. (2-tailed) / p-value	0.000
Significance Level (alpha)	0.05
Decision	H_0 rejected

Effect size calculation using Cohen's d yielded a value of 2.20, which is classified as "very large" according to established interpretive benchmarks (Cohen, 1988). This magnitude of effect indicates that the communicative poster-based approach not only produces statistically significant improvements but also achieves educationally meaningful impacts on students' persuasive writing development. The effect size substantially exceeds the conventional threshold for large effects ($d = 0.8$), suggesting that the intervention

represents a particularly potent pedagogical strategy for enhancing persuasive writing competencies within environmental education contexts.

3.4. Discussion: Pedagogical Mechanisms and Theoretical Implications

The substantial improvements documented in this study can be attributed to several interconnected pedagogical mechanisms inherent in the communicative poster-based approach (Burgos Carrascal & Castro Julio, 2023; Peeters et al., 2025; Saralegi et al., 2025; Windschitl et al., 2008). First, the integration of ecological themes provided meaningful, relevant contexts for language use that resonated with students' lived experiences and environmental concerns. This finding aligns with Davari et al (2025), who reported that Iranian teachers perceived environmental communication topics as effective motivators for language learners, as such topics connected classroom instruction with real-world issues (Davari et al., 2025). Similarly, the present study found that ecology-themed writing prompts appeared to engage students more deeply than decontextualized writing tasks, as reflected in the improvement in argumentative depth scores.

Second, the communicative approach transformed the classroom dynamic from teacher-centered instruction to student-centered interaction (Buzarna-Tihenea & Nadrag, 2017; Raikhel, 2025; Tang, 2023). Through collaborative poster creation activities, students engaged in authentic dialogue about ecological issues, negotiating meanings, constructing arguments, and responding to peer perspectives. This interactive process likely contributed to both linguistic competence and critical thinking development, a connection consistent with Heidari Tabrizi and Hoorijani (2025), who found a positive relationship between critical thinking and argumentative writing performance among EFL learners (Heidari Tabrizi & Hoorijani, 2025). The collaborative aspect of poster creation may have further reinforced this relationship by providing opportunities for peer feedback and iterative argument refinement.

Third, the multimodal nature of poster-based learning enabled students to synthesize linguistic, visual, and spatial elements in constructing persuasive messages. This finding supports Thomas and Lees-Maffei's (2018) observation that poster sessions in educational contexts integrate theoretical and practical knowledge by requiring students to distill complex information into concise, visually coherent presentations (Karl, 2018; Lees-Maffei & Houze, 2024; Martinez, 2018; Thomas & Lees-Maffei, 2018). In the present study, the requirement to design posters may have activated multiple cognitive channels, supporting deeper processing of ecological content while developing persuasive writing skills.

It should be noted, however, that while this study measured improvements in persuasive writing ability, the claim that the intervention directly enhanced environmental literacy cannot be empirically substantiated through the instruments employed. The writing assessment measured students' ability to construct persuasive arguments on ecological topics, which may reflect environmental awareness as a by-product of engagement with ecological themes, but this remains an inference rather than a directly measured outcome. Future studies incorporating validated environmental literacy instruments would be needed to establish such a relationship more definitively.

3.5. Practical Implications

The findings offer several practical implications for language educators. First, poster creation activities can be integrated into existing persuasive writing units as a structured vehicle for combining visual and textual argumentation. Second, ecology-themed writing prompts provide a readily available source of authentic content that aligns with cross-curricular sustainability goals. Third, the six-week intervention framework used in this study offers a replicable template for classroom implementation, requiring minimal additional resources beyond access to basic art materials and exemplar texts. Within the Merdeka Curriculum context, this approach supports the curriculum's emphasis on project-based and contextually grounded learning by allowing students to produce purposeful texts for real or simulated audiences.

3.6. Limitations and Future Directions

This study has several limitations that should be considered when interpreting the findings. First, the one-group pretest-posttest design without a control group limits the ability to attribute the observed improvements solely to the intervention, as factors such as maturation, history effects, testing effects, and regression to the mean cannot be ruled out. Second, the sample was limited to 32 students from a single school, which constrains generalizability. Third, no validated environmental literacy instrument was employed, meaning that claims regarding environmental literacy remain inferential. Future research should address these limitations by employing stronger experimental designs with control groups, larger and more diverse samples, and validated environmental literacy measures. Additionally, longitudinal studies would be valuable for assessing the sustainability of the observed improvements over time.

4. Conclusion

This study examined the effect of a communicative poster-based approach on ecology-themed persuasive writing skills among Grade VIII students at SMPN 49 Makassar. The findings indicate that the intervention was associated with substantial improvement in students' persuasive writing performance, with mean scores increasing from 63.75 to 81.25, supported by statistically significant results ($p = 0.000$) and a very large effect size of 2.20. These results suggest that integrating ecological themes with communicative poster-based instruction can effectively support the development of persuasive writing skills within the Indonesian secondary school context. The findings offer practical insights for language educators seeking to incorporate real-world issues within existing instructional frameworks. The use of ecology-themed poster creation provides a replicable model for combining text-based learning with project-based activities, aligning with the Merdeka Curriculum's emphasis on contextual and communicative competence. Additionally, the engagement with environmental topics through persuasive writing may foster environmental awareness as a secondary outcome, although this remains an inference rather than a directly measured variable. This study has several limitations that warrant consideration. The pre-experimental one-group design without a control group precludes causal claims, and the single-class sample of 32 students limits generalizability. Furthermore, no validated environmental literacy instrument was employed, meaning that claims regarding environmental literacy remain suggestive rather than conclusive. Future research should address these limitations through stronger experimental designs, larger and more diverse samples, and direct measurement of environmental literacy outcomes. Longitudinal investigations would also be valuable for assessing whether the writing improvements observed in this study are sustained over time. Despite these limitations, the study contributes to the growing body of evidence supporting the integration of ecological themes into language instruction. By demonstrating that poster-based communicative activities can enhance persuasive writing skills within an ecology-themed context, this research offers a practical pathway for educators seeking to make language learning more contextually meaningful and socially relevant, particularly within the framework of the Merdeka Curriculum.

Author Contributions

Ratnawati: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Project administration.

Funding

No funding support was received.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability

The datasets generated during and/ or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript.

References

Alwaely, S. A., Abdallahi, T., & Alhourani, M. I. (2020). Text structure teaching on the development of persuasive writing skills for high school students in the United Arab Emirates. *Utopía y Praxis Latinoamericana, 25*(12), 230–244.

Burgos Carrascal, K. R., & Castro Julio, J. D. (2023). *Interpretive tasks based on e-posters to help ninth graders learn English vocabulary* [Undergraduate thesis, Universidad de Córdoba]. https://repositorio.unicordoba.edu.co/server/api/core/bitstreams/127783fa-46d1-4d7b-a4ca-c43b22e9145c/content

Buzarna-Tihenea, A., & Nadrag, L. (2017). The role of communication in the student-centered classroom. *Scientific Bulletin of Naval Academy, 20*(1), 558–563.

Case-Smith, J., Holland, T., Lane, A., & White, S. (2012). Effect of a coteaching handwriting program for first graders: One-group pretest–posttest design. *American Journal of Occupational Therapy, 66*(4), 396–405. https://doi.org/10.5014/ajot.2012.004333

Chasokela, D. (2024). Fostering global citizenship through ESD in higher education: A study of international student mobility and sustainability awareness. *Journal of Education for Sustainable Development Studies, 1*(2), 117–133.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Davari, H., Hassani, G., Iranmehr, A., & Ghorbanpour, A. (2025). Environmental communication through language education: Iranian teachers' perceptions on integrating environmental communication pedagogy into English language teaching. *Environmental Communication, 19*(7), 1342–1358. https://doi.org/10.1080/17524032.2025.2464171

Graves, K. (2008). The language curriculum: A social contextual perspective. *Language Teaching, 41*(2), 147–181. https://doi.org/10.1017/S0261444807004867

Heidari Tabrizi, H., & Hoorijani, S. (2025). On the relationship between critical thinking and argumentative writing in EFL programs. *Journal of Studies in Language Learning and Teaching, 2*(1), 108–152.

Hoque, S. R., & Sultana, S. R. (2024). Addressing global environmental problems: Challenges, solutions, and opportunities. *The Social Science Review: A Multidisciplinary Journal, 2*(2), 124–130.

Karl, B. (2018). Review of *Digital tradition: Arrangement and labor in Istanbul's recording studio culture*, by E. Bates. *Technology and Culture, 59*(4), 1000–1002.

Kazazoglu, S. (2025). Environmental education through eco-literacy: Integrating sustainability into English language teaching. *Sustainability, 17*(5), Article 2156. https://doi.org/10.3390/su17052156

Kongkaew, C., Scholfield, C. N., Supapaan, T., Mann, C., Mongkhon, P., & Chanunun, S. (2020). Impact of research-based learning on student knowledge and assessment in pharmacoepidemiology: A one-group pretest–posttest experimental study. *Thai Journal of Pharmaceutical Sciences, 43*(4). http://www.tjps.pharm.chula.ac.th/ojs/index.php/tjps/article/view/53

Kouritzin, S. (2020). Post-truth pedagogy for TESOL: Our collective responsibility for the two-legged, the four-legged, the flyers, and the swimmers. In A. Selvi & B. Yazan (Eds.), *TESOL and sustainability: English language teaching in the Anthropocene era* (pp. xx–xx). Routledge.

Larson, J., & Marsh, J. (2014). *Making literacy real: Theories and practices for learning and teaching* (2nd ed.). Sage.

Lees-Maffei, G., & Houze, R. (Eds.). (2024). *The design history reader*. Bloomsbury Publishing.

Lubis, R. H., & Darmawati, B. (2023). Using local-wisdom literature in teaching English through text-based method on Merdeka Belajar curriculum. *Al-Lisan: Jurnal Bahasa, 8*(2), 200–216.

Mardikaningsih, R., Masnawati, E., & Aisyah, N. (2021). Fostering competence for sustainability through education and adaptive global citizenship. *Journal of Social Science Studies, 1*(2), 267–272.

Martinez, J. G. (2018). Review of *Designing worlds: National design histories in the age of globalization*, edited by K. Fallan and G. Lees-Maffei. *Journal of Design History, 31*(3), 302–303.

Ozverir, I., Osam, U. V., & Herrington, J. (2017). Investigating the effects of authentic activities on foreign language learning: A design-based research approach. *Journal of Educational Technology & Society, 20*(4), 261–274.

Peeters, M., Lee-Smith, W., Allen, D., & Giuliano, C. (2025). Academic conference posters: A systematic review. *Innovations in Pharmacy, 16*(3). https://doi.org/10.24926/iip.v16i3.6629

Raikhel, A. M. (2025). *Challenges and strategies for implementing a student-centered approach in teaching English as a second foreign language* [Master's thesis]. http://dspace-s.msu.edu.ua:8080/handle/123456789/12325

Saralegi, A., Fernández, R., Eceiza, A., Retegui, A., Zaldua, N., & Gabilondo, N. (2025). Enhancing student engagement in materials science through collaborative poster presentations. In *INTED2025 Proceedings* (pp. 4082–4085). IATED.

Scholz, R. W., & Binder, C. R. (2011). *Environmental literacy in science and society: From knowledge to decisions*. Cambridge University Press.

Shangkui, Y., & Chung, W. (2025). Research on the characteristics of environmental posters from narrative design: Focusing on WWF posters. *Asia-Pacific Journal of Convergence Research Interchange, 11*(8), 357–375.

Silva, R. L. F., Grandisoli, E., & Jacobi, P. R. (2024). The role of environmental education in tackling the climate emergency and biodiversity decline: Articulating Brazilian experiences. *International Journal of Environmental Resilience Research and Science, 6*(2), 1–25.

Tang, K. H. D. (2023). Student-centered approach in teaching and learning: What does it really mean? *Acta Pedagogia Asiana, 2*(2), 72–83.

Thomas, P., & Lees-Maffei, G. (2018). The poster session as fusing theory and practice in art and design education: Exhibiting an occluded genre. *Journal of Writing in Creative Practice, 11*(2), 233–259. https://doi.org/10.1386/jwcp.11.2.233_1

Wang, H. (2024). *Development of a modern poster on the theme of carbon* [Bachelor's thesis]. https://er.knutd.edu.ua/handle/123456789/30719

Windschitl, M., Thompson, J., & Braaten, M. (2008). How novice science teachers appropriate epistemic discourses around model-based inquiry for use in classrooms. *Cognition and Instruction, 26*(3), 310–378. https://doi.org/10.1080/07370000802177193

Xiong, Z., Song, Y., & Zhu, R. (2025). Pedagogical strategies for teaching environmental literacy in secondary school education: A systematic review. *Sustainability, 17*(20), Article 9104. https://doi.org/10.3390/su17209104