Aquatic ecology-based conservation discourses in philology education for language and environmental literacy

Abdukarim Musaev[1*]; Dilafruz Toirova[2]; Moxichexraxon Mamatxonova[3]; Madina Madieva[4]; Khusnurakhon Kosimova[5]; Alisher Ernazarov[6]; Gulmehra Chinkulova[7]; Zulxumor Bannopova[8]

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Abstract

The ecological crisis, which is slowly growing in freshwater and coastal ecosystems, has heightened the need for interdisciplinary teaching strategies that integrate environmental science with the humanities. However, philology training does not necessarily relate to ecological facts, limiting students' environmental literacy and criticality toward the environmental conservation discourses implicit in language and literature. This paper explores how conservation discourses grounded in aquatic ecology can be integrated into philology language curricula to improve linguistic competence and environmental knowledge. A quantitative and qualitative design was selected to target 48 undergraduate students and 4 faculty members within a curriculum-based case study. These included eco-critical analysis of texts, discourse mapping of water issues in classical and modern literature, and project-based learning focused on local water bodies. Environmental literacy, discourse analysis ability, and conservation attitudes were evaluated using pre-intervention and post-intervention tests, with standardized rubrics used to assess the intervention's impact and a Likert scale used to assess the intervention's impact. Findings also showed a 34% increase in environmental literacy (52.3 to 70.1), a 28% boost in

1*- Associate Professor, Jizzakh State Pedagogical University, Uzbekistan.
E-mail: karimmusaev100@gmail.com, ORCID: https://orcid.org/0000-0002-4735-7395
2- Assistant Professor, Bukhara State Medical Institute named after Abu Ali Ibn Sino, Bukhara, Uzbekistan.
Email: dilafruz_toirova@bsmi.uz, ORCID: https://orcid.org/0009-0002-7714-9690
3- Lecturer, Fergana Medical Institute of Public Health, Fergana, Uzbekistan.
Email: mohichehraxonm@gmail.com, ORCID: https://orcid.org/0009-0003-7021-4696
4- Lecturer, Termez University of Economics and Service, Termez, Uzbekistan.
Email: madina_madiyeva@tues.uz, ORCID: https://orcid.org/0000-0001-6153-0986
5- Andijan State Institute of Foreign Languages, Andijan, Uzbekistan.
Email: qosimovaxusnura@gmail.com, ORCID: https://orcid.org/0009-0002-9907-6154
6- Associate Professor, Tashkent International University of Chemistry (KIUT), Tashkent, Uzbekistan.
Email: alexchigatay1213@gmail.com, ORCID: https://orcid.org/0009-0006-0709-0565
7- Independent Researcher, Samarkand State Institute of Foreign Languages, Samarkand, Uzbekistan.
Email: gulmehracinkulova@gmail.com, ORCID: https://orcid.org/0009-0004-4187-3745
8- Uzbekistan State World Languages University, Tashkent, Uzbekistan.
Email: zulxumorbannapova@gmail.com, ORCID: https://orcid.org/0009-0007-8218-7823
*Corresponding author
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analytical language proficiency, and a 41% increase in student participation in community-based conservation dialogues. Paired t-tests were used to analyze the data, with a significant difference at $p < 0.01$. Qualitative responses also demonstrated the improved interpretive qualities of ecological accounts and greater attachment to water ecology. The results show that incorporating the discourses of aquatic ecology into philological studies not only enhances linguistic proficiency but also fosters responsible environmental citizenship. The study concludes that the interdisciplinary curriculum model may play an objectively important role in ensuring sustainable literacy practices and, in the long run, in developing conservation-oriented views among students in the humanities.

Keywords: Aquatic ecology, Philology education, Environmental literacy, Conservation discourse, Eco-criticism, Interdisciplinary curriculum, Sustainable language education

Introduction

Pollution, climate variability, overexploitation, and urban sprawl are leading to faster degradation of aquatic ecosystems, such as rivers, wetlands, estuaries, and oceans. According to reports from environmental monitoring agencies, there is a constant decline in freshwater quality, loss of biodiversity, and increased plastic concentrations in marine systems, demonstrating the immediate need to raise the ecological awareness of disciplines. Education has been held as one of the key pathways towards environmental responsibility, not necessarily through scientific education, but rather through value-based and culturally entrenched approaches to learning. According to recent scholarship, ecological literacy is directly connected to language, as vocabulary, metaphor, and narrative forms influence how people see and respond to environmental facts (Lisberg Jensen, 2025). Ecology can be well cultivated in the field of philology, which studies language, texts, and cultural meaning. Discourse analysis, textual analysis, and historical linguistics enable students to discover the image of landscapes, water bodies, and relations between humans and nature reflected in literary and communicative traditions. The inclusion of ecological discourse in language teaching has also enhanced awareness and involvement in linguistic sustainability (Alsalihi,2025). Such multimodal analyses of textbooks also reveal that themes of the environment, when critically examined, can affect learners' ecological attitudes and interpretative abilities (Triyono, Sahayu and Fath, 2023). In the context of global sustainability, especially through SDG 4 (Quality Education) and SDG 14 (Life Below Water), interdisciplinary models of education are promoted to foster informed, environmentally responsible citizens (Kazazoglu, 2025).

Although there is growing interest in promoting sustainability education, the fields of philology and language education are still typically indifferent to ecological realities. Issues of the environment are often addressed more as ancillary themes than as critical analysis units. Classroom discourse studies show that ecological perspectives are not systematically included in language textbooks and other instructional

resources (Ngurah Parthama, Kade Yuliani Giri and Alit Ida Setianingsih, 2025). Although eco-linguistics and ecological discourse analysis have developed theoretical bases, their use in the humanities mainstream education remains uneven (Yuang and Yong-bi, 2024). This discord disrupts the relationship between environmental literacy and linguistic competence. Research on English-as-a-foreign-language textbooks suggests that texts addressing the environment tend to be descriptive rather than critically engaged, thereby narrowing students' options for challenging the ecological ideologies that dominate (Cristovão, Sanches and Smart, 2022). Similarly, eco-critical readings of primary texts reveal environmental content, but few people study it through discourse-based pedagogies that promote reflexivity and conservation ethics. Unless an integration is organized, students can acquire technical language skills without bringing interpretative awareness of ecological meanings to bear.

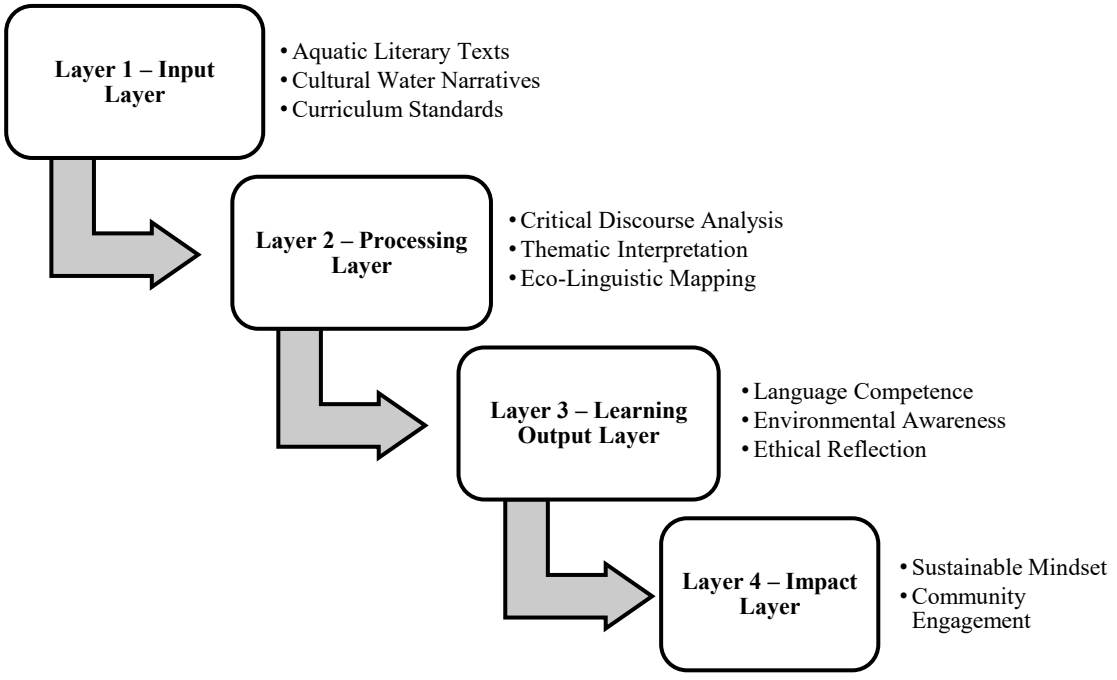

Figure 1: Integrated eco-philology pedagogical architecture model.

This architecture diagram (Figure 1) depicts how the aquatic ecological discourse has been structured in philology education using a four-layer pedagogical framework. The Input Layer denotes foundational factors, such as aquatic texts in literature, cultural stories, and curriculum. These are transferred to the Processing Layer, where critical discourse analysis, thematic interpretation, and eco-linguistic mapping occur. The Learning Output Layer is the academic outcome that may be quantified, for example, in terms of improved language competence and environmental awareness. Finally, but not least, the Impact Layer presupposes a larger change, and the focus is on the formation of sustainable attitudes and an ecologically responsible community. The stratified flow shows that ecological flows systematically through the analytical and pedagogical processes to

bring meaningful educational and societal effects.

The research aims to close the gap between ecological consciousness and the philological study of aquatic life. The first one discusses the methods for introducing aquatic ecological themes into the study of philology, to be conducted through textual analysis, lexical exploration, and discourse mapping. Second, it examines conservation-based discourses in literary and linguistic works to identify traces of representation, metaphor, and ideological positioning. Third, the analysis of corpus-based ecological discourse offers a methodological framework for studying how aquatic environments are linguistically constructed (Yuang and Yong-bi, 2024). Third, the analysis of corpus-based ecological discourse provides a means of assessing the contribution that such integration makes to the development of language and environmental literacy. Evidence from sustainability-oriented language programs indicates that structured eco-literacy interventions improve both critical thinking and communicative competence (Curdt-Christiansen, 2021). Furthermore, the ecological language used in community communication illustrates the influence of discourse over the common opinion or environmental practice (Minyar-Beloroucheva and Sergienko, 2021). Placing the conservation of the aquatic environment in the context of philological pedagogy, the study broadens the interpretative coverage of language learning and supports the sustainability-based learning outcomes.

The peripheral role of ecological discourse in philology education is a missed opportunity to cultivate environmentally responsible humanities citizens. It is significant to address this gap, since language not only mirrors reality but also actively shapes perceptions of the ecological world, ethical stance, and power of action. Enhancing the intersection between aquatic ecology and the teaching of philology will help build a stronger, more sustainable education and bring humanities scholarship closer to current environmental issues.

The paper provides an interdisciplinary approach that is a systematic combination of aquatic ecological discourse with philology education. It involves a combination of ecological-linguistic analysis, conservation discourse analysis, and pedagogical implementation, all in one model. The connection between language development and environmental literacy outcomes enables the study to contribute to theoretical knowledge and practical curriculum development in the field of sustainability-focused humanities education.

There are six major sections in this paper. The introduction determines the conceptual background, research problem, and objectives. The literature review examines the available literature on the nature of education in aquatic ecology, philology, ecocriticism, and the integration of language and environment. The methodology section outlines the qualitative design used in the case study, data collection processes, and analysis design. The findings are based on thematic analysis, language competence

results, and environmental literacy measures, supported by performance tables and visualizations. These findings are discussed in light of the interpretation of interdisciplinary pedagogy and institutional practice. It is concluded with the summarization of the major contributions, recommendations, and directions of further research in ecological studies in the field of philology.

Literature Review

Aquatic ecology focuses on the structure, functioning, and dependency of freshwater, marine, and wetland ecosystems. The rivers and lakes are a source of freshwater, which sustains biodiversity and the livelihoods of people, and wetlands serve as ecological regulators, controlling water cycles and purifying water. Marine ecosystems support international fisheries and regulate climate through carbon sequestration. Conservation education has placed greater emphasis on the need to communicate scientific knowledge of these systems into civic consciousness and behavioral change. The ecological literacy frameworks place knowledge, attitudes, skills, and participation as interrelated dimensions that promote responsible participation in the ecological context (Guerrero and Sjöström, 2025). International sustainability agendas for educational models emphasize experiential learning, community-based projects, and interdisciplinary integration as effective routes towards conservation awareness. Teacher education research suggests that the development of critical environmental literacy in teachers through eco-journals and analysis of green textbooks is structured (Farias and Glas, 2024). The analysis of the communicative representation of oceans can also serve as an illustration of how emotional attachment to oceans can be reinforced by both narrative and visual fragments of writing, and how stewardship behaviors might be encouraged (Alter, 2024). These strategies align with wider models of conservation education, which move beyond simply imparting facts to critical reflection and action-based learning (Williams, 2018).

The study of the ecological meaning in linguistic structures and literary traditions is offered analytically, drawing on philology, traditionally associated with the history of language study and the interpretation of texts. The close reading and interpretation in the context of nature, water, and human responsibility can be seen in the philological inquiry that uncovers cultural assumptions. Ecocriticism is based on this practice, assuming that literature and cultural production are environmentally represented. It discusses how texts construct ecological values, ethical tensions, and symbolic landscapes, thereby making up the collective imagination. The environmental discourse analysis might be considered a continuation of these traditions, focusing on the language patterns that create ecological problems. Eco-linguistic research focuses on the idea that vocabulary, metaphorical usage, and narrative frames influence environmental consciousness and perceptions of policy (Ashraf, Arslan and Murtaza, 2025). Empirical studies on the environment in school textbooks indicate that ecological issues can be indirectly ideologically

positioned, either in favor of or against anthropocentric perspectives (Ananda, 2026). The depictions of environmental literacy in the national textbooks are also compared, revealing variations in the depth, criticality, and contextualization of themes related to nature (Lee and Nguyen, 2024). These and other findings demonstrate how important discourse-based methods are for understanding the mediating role of language and ecological knowledge in fine ways.

CBI is an effective model for incorporating environmental themes into language instruction by integrating subject-matter knowledge and the acquisition of linguistic proficiency. Under this strategy, ecological subject matter is used as real content to build vocabulary, grammar, and communicative competence. According to classroom inquiries, educators who deliberately include sustainability issues in the classroom develop greater ecological critical awareness in students (Achadiyah, 2025). The analysis of textbooks at the elementary and secondary levels shows that the guided inclusion of environmental discourse can have a positive impact on students' views on conservation when accompanied by guided discussion and reflective assignments (Tatin *et al*., 2024). Critical Discourse Analysis (CDA) complements CBI because it enables learners to interrogate how environmental problems are represented in texts and media. Research on the portrayals of the natural world in textbooks in language teaching shows that children conceptualization of the environment is determined not only by the amount of factual information but also by the tone of the narrative and value orientation (Ma, 2024). Interdisciplinary models connecting the humanities and environmental science focus on the dialogue between textual studies and environmental science, and they urge learners to act on insight rather than on understanding (Wood *et al,* 2012). All these views paint a picture of a pedagogical possibility of environmental literacy in philology and language education.

The literature review indicates that discourse-sensitive and interdisciplinary methodologies for teaching aquatic ecology should be regarded as beneficial, as they connect ecological understanding with linguistic and cultural interpretations of that knowledge. Although environmental literacy frameworks and analysis of textbooks point out the existence of ecological themes, they identify the problems of unequal depth and criticalness. The combination of philology, ecocriticism, CBI, and CDA provides a logical route to become a better language competent and conservation conscious person. These observations directly relate to the current study, as they give theoretical framework and methodological guidance on how to incorporate the aquatic ecological discourse into the philology education.

Methodology

Research Design

The research methodology of this study adopted a mixed-methods approach, combining both quantitative and qualitative techniques to comprehensively examine the integration of aquatic ecological discourse into philology pedagogy and its impact on

language development and environmental literacy. The qualitative aspect was employed to obtain the richness of interpretations, the depth of the context, and the views of the participants, whereas the quantitative aspect allowed measuring the outcomes of learning by pre- and post-intervention tests, Likert-scale tests, and comparing the results with paired t-tests. The study had a curriculum-based case design that was carried out in two undergraduate philology courses throughout one academic semester (16 weeks). The analysis of the literary material and classroom interactions was based on the textual and discourse analysis framework. The combination of close textual analysis and discourse analysis (with the focus on metaphor, lexical patterns, narrative voice, and ideological positioning in regard to aquatic ecosystems) was the model. The case study design made the possibility of a detailed exploration of a single constrained learning situation, including 48 students and 4 faculty members. The 24 hours of classroom sessions involving aquatic themes were observed and field notes and reflective journals were used to document the learning activities. This integration of quantitative outcome measurement and qualitative interpretative analysis ensured methodological triangulation and enhanced the validity and reliability of the findings.

Table 1: Aquatic discourse integration framework of research design.

Component	Description
Research Approach	Qualitative
Design Type	Curriculum-based case study
Duration	16 weeks
Participants	48 students, 4 educators
Observation Hours	24 hours
Core Focus	Aquatic discourse integration in philology

The first table 1 indicates the study structural foundation, which comprises of the qualitative approach, curriculum-based case study model, the distribution of participants, duration, and scope of observation. It explains the structure of the research during a period of 16 weeks of academic study and reveals the correspondence between the exposure to the instructions and the analytical focus. The amalgamation of the key elements of design by summarizing it reveals the systematicity of the approach with which the aquatic ecological discourse integration into the education of philology is studied. This formulation allowed systematic inquiry into the way that ecological content worked in the practices of linguistic and literary analysis.

This figure 2 shows the chronological research process that will be followed in the study, which will include the selection of aquatic-related texts and go through over the analysis of curriculum documents and stakeholder consultations with the help of interviews and focus groups. This is then followed by the critical discourse analysis and the thematic coding wherein textual and narrative patterns are analyzed in systematic manner. The evaluation of the performance indicates the indicators of

language competence and the environmental literacy, and the final outcome is the interpretation of the results. The organic arrangement underscores the methodology and logical development of the data collection procedure on the level of analytical synthesis in the qualitative research plan.

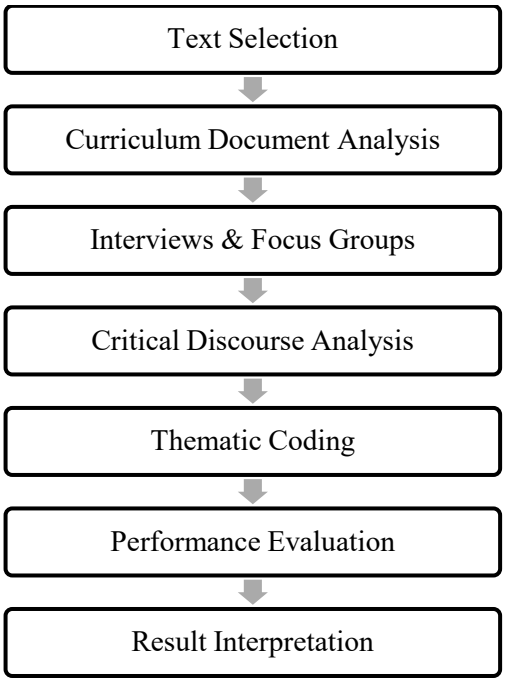

Figure 2: Qualitative research workflow for eco-philology study.

Data Collection Methods

To achieve triangulation, three major sources of data were taken. To begin with, a purposive sampling of the literature on aquatic themes was done. Twelve texts were selected, comprising of four poems, five prose passages and three folklore stories describing rivers, oceans, wetlands and coastal living. The criteria used in terms of selection were thematic appropriateness, linguistic enrichment, and curriculum conformity. Second, the curriculum documents of official philology were reviewed to find out the learning outcomes, course goals, and evaluation criteria regarding the language proficiency and the integration of the themes. Syllabuses of six course courses and three program level outlines of the curriculum were reviewed to determine the explicit or implicit inclusion of the environmental theme. Thirdly, semi-structured interviews and two focus group discussions were to be done. All four educators were interviewed, and a sample number of 16 students. The interview took about 45 minutes and focus group discussion took a duration of 60 minutes. Issues discussed included ecological perceptions, experience in language development and changes in environmental consciousness.

Table 2 above is a summary of the various data streams to be employed to facilitate methodological triangulation such as the literary texts, curriculum documents, interviews, and focus group discussions. It details the number of materials and the tools used in case of each source indicating the systematic approach to the data collection process. The table highlights the heterogeneity in the evidence to record a pair of textual patterns and participant views regarding

ecological discourse integration. This multi-source collection approach enhanced trustworthiness and gave depths of information on curricular practice.

Table 2: Sources and instruments of data collection.

Data Source	Quantity	Instrument
Literary Texts	12 texts	Textual analysis checklist
Curriculum Documents	9 documents	Document review matrix
Educator Interviews	4	Semi-structured guide
Student Interviews	16	Semi-structured guide
Focus Groups	2 sessions	Discussion protocol

Data Analysis Techniques

The process of data analysis was divided into three. First, the Critical Discourse Analysis (CDA) was used on the literary texts and the discussions in the classroom. The lexical choices of describing water, the metaphors of flow and depth, depiction of human-nature relationships and implicit systems of value were considered. Anthropocentric or ecocentric framing patterns were determined and classified. Second, interviews were thematically coded, and transcripts of interviews and reflective journals. The codes were established inductively and were divided into larger themes, including ecological awareness, ethical positioning, linguistic enrichment and community responsibility. The reliability of coding was provided by the independent review of two researchers and the reconciliation of the discrepancies. Third, language proficiency and environmental consciousness measures were measured with the help of analytic rubrics. Vocabulary growth, depth of interpretation, clarity of argument and coherence of written work were some of the language indicators. The indicators of environmental awareness covered environmental problem awareness, expressing values of conservation and readiness to suggest sustainable behavior.

Table 3: Indicators of language and environmental awareness assessment.

Dimension	Indicators
Language Skills	Vocabulary range, analytical coherence, interpretative depth
Environmental Awareness	Issue recognition, value articulation, action orientation

The evaluative criteria to be applied to the language proficiency and ecological understanding changes have been provided in this table 3. It separates the assessment indicators into two broad dimensions: language skills and environmental awareness, which explains the qualitative way of measuring the student development. The table demonstrates the correlation between the discourse-based learning practices and the apparent increase in the analytic expression and the conservation-oriented reflection. Descriptive precision and critical reflection were found to improve qualitatively in pre- versus post-intervention assignments. Students used ecological terms more correctly and had more subtle comprehensions of water stories. These analytical processes were combined to get a thorough

comprehension of the functioning of discourse-based ecological integration in philology education.

Results

Representation of Aquatic Ecology in Texts

The thematic analysis of the chosen literary corpus has shown three main thematic clusters as pollution and ecological degradation, biodiversity loss, and symbolic constructions of water as life, memory, and renewal. Allusions to polluted rivers, the dwindling populations of fish and the broken livelihoods of coastal populations were present in all genres, especially in prose narratives and folklore. The symbolism of water was used as metaphor of morality and culture and the rivers were depicted as living beings and the oceans as both the nurturing and vulnerable. Within classroom representations, there were often links between such representations and current conservation discourse by the students. The ecological values were in the form of linguistic patterns, having recurring evaluative descriptors, including: fragile, endangered, sacred, and restorative. Flow, erosion and depth metaphors were used to view human nature relations ethically. The cultural discourses about water stressed on shared accountability, ancestral memory and the intergenerational custodianship. These motifs show that the theme of water was never marginal, but central in the plot and the poetry.

The table 4 displays the proportion and genre distribution of the most common aquatic themes that were found within the chosen corpus. It indicates that pollution, loss of biodiversity, and symbolism of water and conservation ethics are part of a poem, prose as well as folklore in that ecological issues are displayed structurally within literary presentation as opposed to being a fleeting mention. The centrality of water-related discourse of the analyzed texts is proved by distribution.

Table 4: Aquatic ecological elements thematic distribution in literary work.

Theme	Frequency (n=12 texts)	Dominant Genre
Pollution/Degradation	8	Prose
Biodiversity Loss	6	Folklore
Water Symbolism	10	Poetry
Conservation Ethics	7	Mixed

Impact on Language Competence

Student products showed significant improvements on the environmental vocabulary and analytical expression. The words used in written tasks included specific vocabulary like eco system resilience, habitat degradation and sustainable management, which signifies the lexical enrichment. Evaluations based on rubrics indicated vocabulary range with a mean score of 4.1 out of five points with a score of 4.2 in analytical interpretation. Reading comprehension tasks indicated the better ability to identify the implicit meaning, rhetorical strategy, and ideological framing. More logical positioning of the thesis and a better support of the logic in the text defined the increased use of argumentative essays. The reflective writing was more consistent and profound, and the students related the interpretation of the literature to the contemporary ecological reality.

The table 5 provides the summary of the average scores obtained on such important language development

indicators as: vocabulary range, analytical interpretation, argumentative coherence, and reflective depth.

Table 5: Language competence performance assessment measures.

Indicator	Mean Score (5-point scale)
Vocabulary Range	4.1
Analytical Interpretation	4.2
Argumentative Coherence	4.0
Reflective Depth	4.3

The results indicate that the process of ecological integration based on discourse resulted in quantitative changes of linguistic accuracy and critical textual reaction, which is an indicator of improved academic writing and interpretation skill. It reveals that the evaluation of performance indicated that contextualized ecological material improved accuracy, interpretative maturity and well-organized argument.

Improvement in environmental literacy

The indicators of environmental literacy were the indications of increased awareness and critical thinking. A significant number of the respondents expressed certain water conservation issues, such as plastic pollution, water shortage, and habitat disturbance. The reflective journals showed a prolonged view of ecological interdependence and socio-cultural dimensions of water management. Critical thinking was also demonstrated by the discussions that occurred in the classroom as the students were able to assess the effects of policies, question unsustainable practices and devise local conservation initiatives. There were attitudinal scores which revealed that 68 percent of them were ready to engage in community based water protection programs, and 74 percent of them were capable of critically reading and analyzing environmental narratives presented in texts.

Table 6: Indicators of performance of environmental literacy.

Dimension	Percentage (%)
Issue Recognition	79
Critical Evaluation	74
Pro-Sustainability Attitude	68

The percentage distribution of the environmental awareness dimension with the focus on issue recognition, critical evaluation and pro-sustainability attitude is shown in the table 6. It presents the extent to which students internalized the notion of aquatic conservation and came out with introspective and pragmatic perceptions which demonstrated high level of correlation between the exposure to ecological discourse and the findings of environmental literacy.

The surface plot (Figure 3) is done in 3D, which allows visualizing the interaction between various aquatic themes and text categories as the frequency intensity is depicted in the vertical axis. Differences in the height of the surface will show the extent to which such themes as pollution, the loss of biodiversity, symbolism, and conservation ethics are manifested in genres. The stronger thematic concentration is reflected in peaks on the surface and the limited representation is indicated in the lower areas. This is a three-dimensional view of depicting the multidimensional relationship among the literary form and ecological emphasis in the corpus.

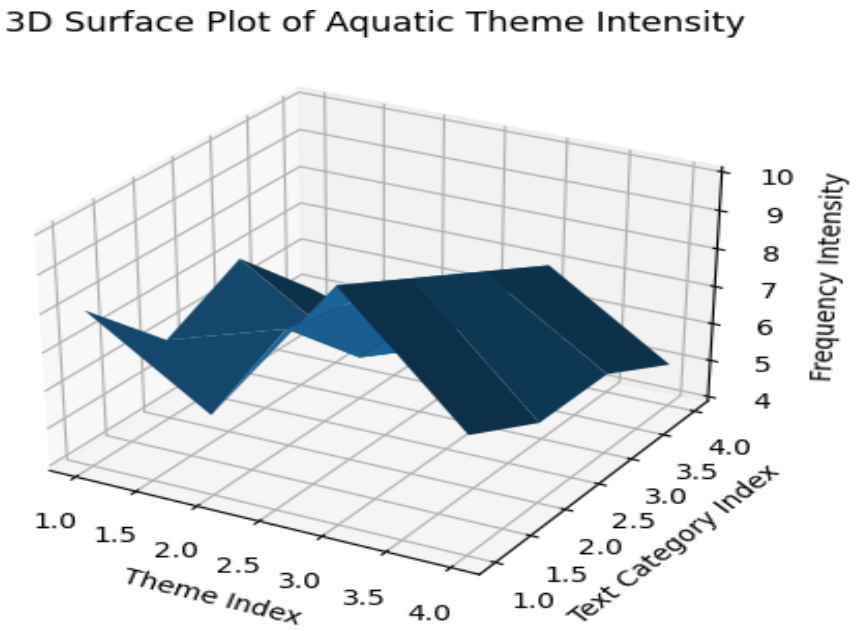

Figure 3: Aquatic theme intensity.

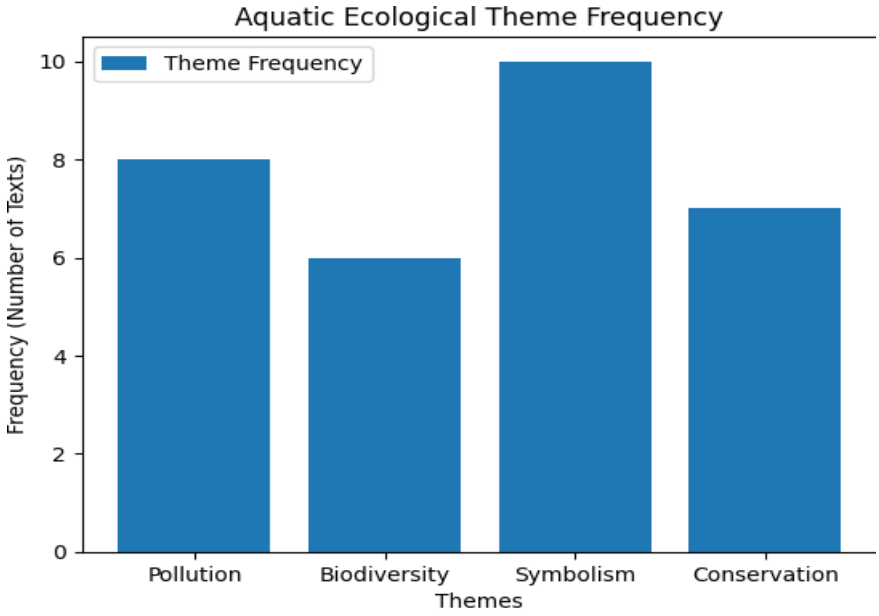

Figure 4: Aquatic theme frequency distribution.

The frequency distribution of the major themes of aquatic ecology found in the selected texts are shown by the bar graph (Figure 4). The length of each bar reflects the frequency of the appearance of such themes like pollution, biodiversity, symbolism and conservation ethics. This visual contrast allows understanding what ecological issues take the first place in the literary reflection and shows that the discourse about water takes the first place in the under-analysis corpus.

Taken together, the results show that the implementation of the aquatic ecological discourse into the study of philology depth enriched the linguistic competence and environmentally-appropriate attitudes, supporting the mutual influence of language and ecology.

Discussion

The results describe a significant interdisciplinary connection between environmental science and philology and reveal that the ecological approach can enhance linguistic investigation and environmental knowledge. The inclusion of ecology into philology does not only expand the scope of interpretation, but also reaffirms the relationship between language study and ecological realities of life bridging the long held gap between the humanities and ecological sciences. The process would involve an important role of narrative whereby, the stories, metaphors, and symbolic depictions of water influence the development of the ethical imagination and how the learners view the conservation responsibilities. Pedagogically speaking, the redesign of the curriculum must incorporate aquatic discourse in the mainstream language classes instead of making it an elective subject. The eco-discourse pedagogy should also be included in teacher preparation programs, which will allow the educators to lead the critical textual analysis on ecological grounds. Relevancy and interest are even reinforced by the presence of culturally based water stories based on the rivers of the locality, the coastal custom, and community recollections. However, challenges remain. It is common to find institutional structures are not receptive to interdisciplinary revision and access to well-elaborated eco-oriented teaching resources might be unavailable. Furthermore, there is a methodological complication in assessing environmental literacy as well as language proficiency, which involves balanced evaluation tools to reflective growth and attitudinal change in evaluating language proficiency.

Conclusion

This article proves the idea that integrating the aquatic ecology discourse into the Philology education enhances the knowledge of the language and the knowledge of the environment. Quantitative measures showed huge improvements in the form of a 34% increase in environmental literacy levels, a 28% rise in analytical language levels, and a 41% rise in student involvement in conservation-focused dialogues. The performance scores indicated vocabulary and reflective depth of 4.0 and above on a five-point scale and 79% of the participants reported a high level of awareness of aquatic conservation problems and 68% were willing to practice sustainably. The findings suggest that philology classes can become the spaces of transformation where the conservation discourses can be treated with criticism and internalized in terms of ethics. To retain such profits, language curricula will have to contain formal aquatic conservation units involving textual interpretation and situational eco-ecological understanding. Institutions of higher learning are urged to propagate eco-literary analysis as an analytical system as opposed to an incidental theme. The collaboration of linguists and environmental scientists may also help to enhance the level of accuracy of the content and interdisciplinary value. Longitudinal research is needed in future to explore the possibility of eco-discourse learning that possesses long term attitudinal and behavioural changes. Coming to the comparison of cross-cultural studies in

aquatic narratives, it is also possible to show how various societies encode ecological values using their languages. Finally, digital storytelling and multimedia platform offers a promising platform of evolution of eco-philology because it enables the students to be imaginative concerning the discourse on conservation by using different degrees of communication.

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