Global Business Languages

Volume 26 Article 5

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Recommended Citation

de la Fuente, M. J. (2026). Developing Sustainability Knowledge and Competencies through Language Education: Evidence from a Spanish Instructional Unit on Climate Migration. *Global Business Languages*, 26, 97-120.
Available at (DOI): https://doi.org/10.4079/gbl.v26.6

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Developing Sustainability Knowledge and Competencies through Language Education: Evidence from a Spanish Instructional Unit on Climate Migration

Abstract: This exploratory study investigates the effects of integrating education for sustainable development into language instruction. Data from 24 students enrolled in a sustainability-based, sixth-semester Spanish course were analyzed. The data corresponded to a four-week pedagogical unit on climate change and climate migration framed around the United Nations' Sustainable Development Goals. The study used a mixed-methods design. First, data from pre- and post-surveys measuring students' self-reported achievement of sustainability-oriented learning outcomes and progress in developing key sustainability competencies were quantitatively analyzed. The analysis suggested significant gains in students' perceptions of their attainment of learning outcomes, and growth in *systems thinking*, *normative*, and *global citizenship* competencies. Additionally, a thematic analysis of students' reflective journal entries was conducted. The results were consistent with the quantitative findings regarding gains in emerging sustainability competencies. Reflections showed patterns of progression from an environmentally focused understanding of climate change to a more systemic perspective that connected environmental and social dimensions; a developing *normative competence*, as students connected climate change to its ethical and human implications (inequity, injustice, migration); and an expansion of global and intercultural perspectives on climate migration. Taken together, these findings provide evidence that sustainability-integrated language instruction can serve as an effective context for supporting students' sustainability literacy and their progress in developing sustainability-related competencies.

Keywords: climate migration, education for sustainable development, global citizenship, languages for specific purposes, normative competence, sustainability literacy, systems thinking

The Integration of Education for Sustainable Development into Language Teaching and Learning

One of the most significant global efforts to address today's complex social, environmental, and economic challenges is the United Nations' 2030 Agenda for Sustainable Development (United Nations, 2015), an action plan that targets 17 challenges collectively known as the Sustainable Development Goals (SDGs). In the *Education 2030 Framework for Action*, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) positions education as central to sustainable development and calls for all learners to "acquire the knowledge and skills needed to promote sustainable development" (UNESCO, 2015, p. 21). UNESCO further specifies sustainability-related learning objectives and competencies in *Education for SDGs: Learning Objectives* (UNESCO, 2017), encouraging educational institutions to redesign curricula so that students are equipped with the knowledge and competencies to address sustainability challenges in socially and ethically responsible ways.

Today, there is a broad consensus on the vital role of universities in promoting education for sustainable development (ESD), a learner-centered approach that combines sustainability-related knowledge with the development of critical thinking, ethical reasoning, and sustainability

competencies. Integrating environmental and social sustainability into language education can be one avenue for developing *sustainability literacy*, i.e., the knowledge, skills, and values students need to participate in sustainability-related discourse and decision-making in a globalized world (de la Fuente, 2021a). Because language learning fosters communication across linguistic and cultural contexts, it can provide opportunities to engage with diverse worldviews and reflect on values, norms, and practices that influence how humans interact with others and with the environment (Byram, 2008; Wagner et al., 2018). When aligned with ESD, language education enables learners to develop intercultural understanding, respect for diversity, and the ability to build bridges across communities (Hu et al., 2023). This "global citizenship" will allow them to engage critically with global challenges (Vasiljevic, 2025).

At the pedagogical level, content-based instruction (CBI), which uses subject matter content as a vehicle for language learning, has enabled the meaningful integration of sustainability themes into general and languages for specific purposes (LSP) courses. Sustainability challenges such as environmental degradation, climate change, and inequality create favorable conditions for CBI by inviting critical thinking and discussion of complex problems (Hauschild et al., 2012). This "symbiosis" between CBI and ESD can be instrumental in bringing about positive change toward a sustainable future (Yu et al., 2024). In addition, work in LSP—which conceptualizes language learning as preparation for purposeful communication in specific professional and societal contexts (Lear, 2025)—aligns closely with sustainability-oriented instruction, as sustainability increasingly shapes contemporary public and professional discourse. Responding to these evolving needs requires developing sustainability-focused language courses. From this perspective, sustainability-oriented language instruction extends LSP approaches by foregrounding the language not merely as a transferable skill but as a socially situated and professionally meaningful resource for engagement with complex socio-environmental challenges.

Challenges and Opportunities

Despite growing interest, the inclusion of ESD in tertiary-level curricula has been uneven across disciplines (Thomas, 2020; UN SDSN, 2025), and language education has received comparatively less attention than fields such as the sciences, education, and the social sciences. Maijala et al. (2024) note that "the practical implementation of education for sustainable development (ESD) in language teaching remains an undiscovered realm of research" (p.377). Existing classroom-based work further suggests that sustainability integration is often driven by individual instructors' motivation rather than by institutional initiatives, often through project- or problem-based approaches (Barth & Rieckmann, 2012; de la Fuente, 2022; Lozano et al., 2015).

Several barriers have been noted. In some university contexts, language learning continues to be framed narrowly as the acquisition of a transferable skill rather than as a space for critical inquiry and meaning-making (Kramsch, 2006). In addition, the relevance of ESD to language education is not consistently recognized at the programmatic or departmental levels (de la Fuente, 2021b; Maijala et al., 2024), and uneven institutional commitment to sustainability can constrain structured implementation (Benavot, 2017; Lozano et al., 2015; Thomas, 2020). Additional challenges include limited teaching materials, limited teacher preparation to address sustainability issues, and engaging with complex sustainability topics in the target language. At the same time, recent scholarship calls for making "sustainability dimensions visible to both teachers and learners" (Maijala et al., 2024, p. 381) and for supporting implementation through

open educational resources, interdisciplinary collaboration between language faculty and subject-matter experts, and teacher education (King Ramírez & Bocanegra-Valle, 2025).

Sustainability Pedagogies and Language Pedagogies

Research on ESD has identified *active learning* as the most suitable pedagogical approach for sustainability education because it engages students in constructing meaning, applying knowledge, and developing critical perspectives (Lozano et al., 2017). Two types of active learning pedagogies have emerged as the most frequently referenced and valued: *project-based learning* and *problem-based learning*[1], because they situate learning in real-world (or simulated) sustainability challenges. Additionally, *case studies* (a type of problem-based pedagogy) are widely used in ESD. These are context-specific explorations of sustainability issues that encourage problem-solving (central to sustainability practice), which involves systems thinking, decision-making, and reflection. Essential to active learning pedagogies are c*ollaborative learning* and *experiential learning* (or "learning by doing"), both of which support the development of *sustainability competencie*s.

These learning approaches intersect with long-standing trends in language teaching contexts—both general and LSP—where communicative and task-based practices have also emphasized collaboration and meaning negotiation, resulting in learners' progress in developing *critical thinking* and *problem-solving* competencies (Jodoin, 2020). The alignment between ESD and language pedagogy is strong: both favor learner-centered approaches and active learning methods (de la Fuente et al., 2025). This overlap provides a pedagogical rationale for examining whether sustainability-integrated language instruction can support not only content learning but also progress in emerging or developing competencies.

Competencies in ESD and Language Education

Sustainability education is fundamentally competency-oriented (Riekman, 2012; Wiek et al., 2011). Within ESD, competencies are conceptualized as integrated capacities that enable individuals to act, communicate, and self-organize in dynamic, intercultural contexts. They are relevant across disciplines and contexts and encompass cognitive, affective, and motivational dimensions (UNESCO, 2017, p. 10). Sustainability competencies are developmental constructs that are gradually formed through repeated exposure, reflection, action, and interaction (UNESCO, 2017, p. 10). This means that short-term instructional interventions can contribute to *progress in developing* these competencies, but not to their full development. Several key competencies have been identified in the literature (Wiek et al., 2011; 2016) as central to sustainability education (see Table 1). Rieckman (2012) further identifies additional competencies, such as *critical thinking* (defined as the ability to question norms, practices, and opinions, and to reflect on one's own values, perceptions, and actions) and *self-awareness*, i.e., the ability to reflect on one's own role, motivations, and responsibilities in sustainability contexts.

[1] In problem-based learning, students analyze a real-world problem from multiple perspectives, explore solutions, and develop a comprehensive theoretical plan to solve it. Project-based learning can be considered a type of problem-based learning. Students also start with a real-world problem and explore solutions, but they engage with community members and share their solutions with them. In other words, "they work towards a public product" (Ferry, 2021, p. 53).

Table 1
Sustainability Competencies

Competence	Definition
Systems-thinking	Understanding relationships and feedback across ecological, social, and economic systems
Anticipatory	Envisioning and evaluating possible futures, assessing long-term impacts, and preparing for uncertainty
Normative	Reflecting on values and negotiating principles in contexts of conflict, trade-offs, and contradiction
Strategic	Designing and implementing interventions, governance strategies, and transitions toward sustainability
Interpersonal/Collaborative	Collaborating, motivating, and enabling collective action and participatory problem-solving
*Integrated problem-solving	A meta-competence involving the ability to apply and synthesize the other competencies to address complex sustainability challenges

Source: Wiek et. al. (2011; 2016).

Note: * Wiek et al. (2011) conceptualize problem-solving as a meta-competence that mobilizes the other ones to address complex sustainability challenges.

Although language education uses different terminology, it also prioritizes the development of transferable capabilities beyond competence in the target language (TL), including intercultural competence and cultural awareness (Byram, 2008). Several points of convergence are relevant for sustainability-oriented instruction: the ability to interpret interconnected social, cultural, and environmental contexts through the TL aligns with systems-thinking; critical cultural awareness**,** which involves evaluating values, norms, and ethical positions embedded in the TL and cultural practices, aligns with normative competence; and collaborative interaction in the TL corresponds to ESD's collaborative competence and problem-solving.

Language-mediated engagement with sustainability issues can create opportunities for students to gain sustainability knowledge and to progress in developing competencies. Importantly, this integration does not replace linguistic objectives; instead, it situates language learning within a broader educational framework that supports learners' capacity to engage critically and collaboratively with sustainability challenges. Framed in this way, this integration moves beyond the mere inclusion of sustainability topics in language courses and positions developing competencies as a pedagogically meaningful outcome measure in sustainability-oriented language instruction.

Despite this conceptual and pedagogical alignment, scholarly work examining the effectiveness of integrating ESD into language education constitutes a relatively new area of inquiry. The following section reviews applied research on ESD in language education at the

tertiary level, with particular attention to how learning outcomes have been examined in classroom-based studies.

Applied Scholarship: ESD in Language Education

As environmental and social sustainability education is incorporated into tertiary language college courses and/or curricula, a modest but growing body of applied research has emerged. Much of this work has examined learners' perceptions of sustainability-integrated courses and obtained indirect evidence of sustainability awareness and content learning, often through surveys, questionnaires, reflective thinking protocols, or interviews. In fact, within general ESD, scale self-assessment is the most commonly chosen assessment tool (Redman et al., 2020). Several studies of cross-disciplinary or sustainability-themed instructional courses or units report high engagement and perceived gains in sustainability-related learning outcomes alongside language development (e.g., Gonglewski & Helm, 2021; Peart et al., 2021; Reisinger et al., 2021). Additional classroom-based studies in general language courses support these prior findings, suggesting that SDG-focused instruction can enhance engagement, sustainability-related awareness, and gains in sustainability learning outcomes (e.g., de la Fuente, 2019; Gabaudan, 2022; Maijala et al., 2025).

A smaller set of studies has examined *attitudinal* (i.e., changes in what students value and believe about sustainability) and *behavioral* (i.e., changes in students' actions, intentions, and engagement) outcomes. For example, Jodoin (2020) reported positive associations between ESD-integrated language instruction and shifts in students' environmental attitudes and self-reported behaviors. Broermann et al. (2025) found that while most students developed a more critical understanding of sustainability, only a limited number demonstrated indicators of transformative *learning*, defined as an understanding of the multidimensional nature of sustainability, the development of critical thinking skills for decision-making, and engagement in action (e.g., behavioral change or participation in local initiatives). The authors attributed these results to the need for sustained pedagogical scaffolding through structured reflection and discussion.

Taken together, this body of research suggests that sustainability-integrated language instruction may be associated with increased engagement with sustainability issues and the development of sustainability-related knowledge and awareness. Under certain conditions, it may also support attitudinal change and aspects of transformative learning. However, given the small-scale, exploratory nature of the studies, the findings should generally be interpreted as correlational. Studies with more robust designs are needed to examine *changes* in sustainability knowledge, competencies, and behaviors. The use of mixed-methods designs, combining quantitative and qualitative data, can strengthen the interpretation of results and provide evidence of emerging intercultural, affective, and behavioral sustainability patterns. In addition, within sustainability education more broadly, the assessment of students' developing sustainability competencies is still in its infancy (Redman et al., 2021), and, within language education in particular, the relationship between sustainability-integrated language instruction and progress in developing *ESD competencies* remains unexplored. The present study addresses this gap by examining changes in sustainability learning outcomes and developing competencies within a sustainability-integrated Spanish instructional context.

The Study

Rationale and Research Questions

Using data from students (n = 24) enrolled in two sustainability-based sections of a third-year, sixth-semester Spanish college language course, this study explores whether a pedagogical unit on climate change and climate migration can support students' achievement of sustainability-oriented learning outcomes. Addressing a gap in existing research, the study also focuses on learners' developing sustainability competencies within a language instructional unit. Methodological triangulation was employed by integrating survey-based self-assessments with qualitative thematic analysis of student reflections.

The instructional unit is framed around the United Nations' Agenda 2030 with a primary emphasis on SDG 13 (climate action) and selected targets of other SDGs that address migration and the protection of migrants' rights. By foregrounding climate migration, the unit highlights the interdependence of environmental and social dimensions of sustainability. In addition to language learning outcomes, the unit includes specific SDG-related learning goals, and opportunities for developing sustainability competencies are intentionally embedded in instructional tasks. The study addresses the following research questions:

- Research Question 1: Is there a positive correlation between the integration of a four-week Spanish pedagogical unit on climate change and climate migration and students' perceived achievement of sustainability-oriented learning outcomes?
- Research Question 2: Is there a positive correlation between the integration of a four-week Spanish pedagogical unit on climate change and climate migration and students' perceived progress in developing sustainability competencies?

Subjects

This study used non-identifiable data from two intact groups of university students (n = 24) enrolled in a sixth-semester Spanish course during Spring 2025. The sample included 18 sophomores, four juniors, and two first-year students[2]. Most students (n = 19) were enrolled in the School of International Affairs, with the remaining (n = 5) enrolled in the College of Arts and Sciences. Enrollment in these two sections was based on their sustainability designation.

Instructional Unit: Climate Change and Climate Migration in Latin America

The four-week instructional unit examined is part of a CBI, sixth-semester Spanish course that aims to consolidate learners' communicative ability in Spanish at the B2 level (CEFR, 2020), while also targeting selected B2+/C1 features. Grounded in the principles of ESD (UNESCO, 2015), the course integrates key values—such as inclusion, human rights, and cultural diversity—and positions social justice as central to sustainability. The overarching goal of the course is to develop bilingual or multilingual users of Spanish who can engage critically and communicatively with sustainability issues in Spanish. This goal is articulated through three

[2] This study was reviewed by the George Washington University Committee on Human Research and determined to be exempt from IRB review (IRB #NCR256929) under DHHS Regulatory Category 4. The research involved secondary analysis of de-identified data; no direct contact with participants occurred, and no identifiers were recorded or retained.

instructional objectives: (1) developing cross-cultural sustainability literacy and selected sustainability competencies; (2) analyzing and negotiating complex sustainability dilemmas and proposing solutions; and (3) communicating sustainability-related knowledge effectively in Spanish. To achieve these objectives, pedagogical approaches common to both ESD and language education (problem-based learning, case study pedagogy, and collaborative learning) are employed. The course focuses on Latin America, engaging students with the region's social and environmental challenges. Content is organized into pedagogical units, each centered on a sustainability-related case study linked to one or more of the SDGs (see Appendix A).

Learning outcomes for this unit are adapted from UNESCO's *Learning objectives for SDG 13: Climate action* and relevant targets of other SDGs (UNESCO, 2017, p. 36)[3]. These objectives are divided into two domains: cognitive (knowledge related to SDGs' targets, and the challenges involved in achieving them) and emotional/ethical (values, attitudes, and dispositions supporting self-reflection and engagement) (see Table 2).

Table 2
Climate Change and Climate Migration: Sustainability Learning Objectives

Type	Objective
Cognitive	1.View current climate change as an anthropogenic phenomenon caused by increased greenhouse gas emissions
	2.*Know which global human activities contribute most to climate change
	3.*Understand and be able to explain to others the main environmental, social, cultural, and economic consequences of climate change
	4.*Understand the importance of prevention, mitigation, and adaptation strategies in combating climate change
	5.*Be aware of the relationship between climate change, poverty, food insecurity, and migration
Emotional/ Ethical	6.*Be aware that climate injustice exists (some human groups and regions are more vulnerable than others) and understand the reasons
	7. Understand some countries' responsibilities to reduce the risk of migration, and other countries' responsibilities to ensure the dignity, security, and human rights of climate migrants
	8. *Be able to recognize that climate migration is a human rights issue
	9. *Understand personal impact on climate change, and the need to reevaluate my behavior in light of this

Note: Asterisks refer to sustainability learning objectives measured in this study.

The unit spans four weeks (12 instructional days, equivalent to 10 hours of classroom instruction) and is complemented by *independent work* that introduces content, builds background knowledge, and supports the acquisition of grammar, vocabulary, and key concepts through comprehension tasks, short videos, and exploratory activities. *In-class collaborative tasks* emphasize data analysis, interpretation, and argument development. Tasks are scaffolded and

[3] Because climate migration is not explicitly named in the SDGs, we developed some learning objectives based on SDGs 10 and 11, through targets related to climate resilience, inequality, and human mobility.

culminate in discussions, role-plays, debates, and presentations. Each unit concludes with a reflective journal entry (see Table 3).

Table 3
Instructional Unit: Daily Plan

Week	Contents	Independent work	In-class collaborative tasks
1	1. SDG 13 SDG 10	Survey 1: learning objectives* Reading: *SDG 13: Climate action* Vocabulary activities Exploration 1: Targets 1, 2, and 3 Explor. 2: Connections to other SDGs	Migration in SDG 10 The Global Compact for Migration: Goals Analysis of some Migration Governance Indicators (MGI)
	2. Climate migration in the SDGs	Language Module 1 Survey 2: Sustainability competencies* Reading: C*limate migration in the SDGs?*	Analysis of internal displacements in Honduras, Nicaragua, and Guatemala
	2. Climate migration in the SDGs	Data on climate internal displacements: US and Latin America Video: *Honduras after hurricane Iota*	Evaluation of the application of the Guiding Principles on Internal Displacement (UN)
2	3. What is climate change?	Reading: *Climate change and the COPs* Vocabulary activities Language Module 2	The value of Conferences of the Parties (COPs)
	4. Climate change in Latin America	Reading: *Effects of climate change in Latin America* Vocabulary activities	Analysis of Global Adaptation Index (several Latin American countries)
	5. Climate migration in Latin America	Reading: *The Central American Dry Corridor* Opinion: Video Guatemala Language Module 3	Analysis of climate and structural factors of migration in Central America Adaptation and mitigation measures: purpose and benefits
3	6. The rights of climate migrants	Reading: *Climate migrants or environmental refugees?* Vocabulary activities Opinion – Video	Examination of climate migration cases
	7. The Case: El Bosque (Tabasco, Mexico)	Reading: *Climate displacement in El Bosque* Opinion: Video on C*limate migration from Guatemala*	Analysis and evaluation of Mexico's governance: IGM: mobility in crises related to disasters/conflicts
	8. Case analysis	Exploration 3: Videos: *El Bosque* and *Testimony of El Bosque resident: Inter-American Commission on Human Rights* Exploration 4: identify stakeholders' motivations and interests	Determining human rights violations: testimonies of El Bosque residents

4	9. Sustainable solutions	Groups A, B: Reflective journal* Groups A, B: Work on Action Plan (steps 1 and 2)	Sustainability analysis of case Groups A, B: work on Action Plan (steps 1 and 2) Groups C, D: Reflective journal*
	9. Sustainable solutions	Groups C, D: Panel preparation submission Groups A, B: Work on Action Plan	Groups C, D: Panel discussion Groups A, B: Work on Action Plan
	10. Presentations	Groups A and B: Work on Presentation Survey 1: Learning objectives* Survey 2: Sustainability competencies*	Presentations and peer assessment

Note: * Data sources for the study are marked with asterisks.

The *case study* introduced in Week 3 —Climate displacement in El Bosque, Tabasco (Mexico)— guides students through a structured analytical process, including examining the case context, identifying key dimensions of the case, analyzing the problem, examining stakeholder perspectives, and proposing sustainability-oriented solutions. Through the case, students engage with multimodal, authentic sources—such as texts, media articles, graphs, maps, infographics, and videos—that present multiple perspectives on the case. Following Jonassen's (2000) framework, the sustainability case is structured, with the instructor providing much of the information needed for analysis, an approach well-suited to CBI language courses, where content learning is mediated through the target language, which is also the learning objective. All collaborative tasks support problem-solving by focusing on the following sustainability competencies (see Table 4 below).

Table 4

Climate Displacement in El Bosque, Tabasco (Mexico): Sustainability Competencies

Competence	Definition
Systems-thinking	Ability to understand and analyze a sustainability issue—climate displacement in El Bosque—as the outcome of interconnected environmental, social, economic, and political variables that interact (e.g., sea-level rise, coastal erosion, livelihoods dependent on fishing, government planning, and social vulnerability); identifying key actors (residents, government agencies, environmental forces) and their roles; recognizing causal relationships and impacts; and articulating how policy or adaptation measures may exacerbate or mitigate displacement risks.
Normative	Ability to understand and evaluate the El Bosque case through sustainability values and ethical principles such as social justice, equity, and environmental responsibility. This includes (a) assessing the fairness of relocation processes, the adequacy of state responses, the distribution of risks and benefits, and the motivation behind these decisions, and (b) the ability to judge proposed solutions against SDGs and articulate ethically grounded positions.
Collaborative	Ability to participate in cooperative problem-solving related to the El Bosque displacement case through group analysis and discussion: engaging with different stakeholders, negotiating perspectives, communicating different viewpoints, and working collaboratively toward feasible and socially responsible solutions.

Global citizenship	Ability to situate the El Bosque case within the global patterns of climate change and human mobility while recognizing its local and cultural context. Develop awareness of how climate migration intersects with inequality, poverty, and rights. Appreciate multiple perspectives, develop empathy toward displaced communities, and demonstrate a commitment to informed, ethical action in support of global well-being.

Source: Adapted from Wiek et al. (2016) and UNESCO's 2017 Framework for Education for Sustainable Development.

Instruments

As part of the course assignments, students complete *two reflective survey*s[4] for each instructional unit, both administered at the beginning and end of each unit. These surveys use Likert scales and are designed to align closely with the instructional objectives and sustainability competencies targeted in each unit. Items are phrased as self-assessment statements to capture students' perceived learning and progress in developing competencies.

For the unit analyzed in this study, *Survey 1* assesses students' self-reported knowledge of the unit's targeted sustainability content and their dispositions toward the social and ethical aspects raised by the unit (see Appendix B). The seven items selected from this survey had been operationalized (aligned with seven of the unit's learning objectives). Four belonged to the cognitive area and three to the emotional/ethical area (see also Table 2, items marked with an asterisk).

Survey 2 assesses students' self-reported development of sustainability competencies (see Table 4) and is also administered at the beginning and end of the unit (see Appendix C). Although the courses' survey contains a total of eight items related to all four competencies, this analysis focused on three competencies: systems thinking (two items), normative (one item), and global citizenship (one item). To illustrate, two items related to systems thinking competence were selected for analysis. These items operationalize two key dimensions of systems thinking competence as we defined it (see Table 4):

1. I can analyze a climate change/migration sustainability problem involving different variables (environmental, economic, and social) and understand their interconnections.
2. I can identify the causes and impact (environmental, economic, and social) of a climate change/migration decision, plan, or project.

It is important to note that this instructional unit was implemented as Unit 2 of the semester. Students had therefore already completed comparable surveys related to Unit 1 sustainability content and competences, which familiarized them with the survey format. This prior exposure to similar surveys enhances the validity of the surveys used in Unit 2 by minimizing misinterpretation of items and improving the consistency of students' self-reported responses (Redman et al., 2021).

[4] Redman et al. (2021) identify three types of assessment procedures to measure competence development: self-perceived-based (i.e., surveys, reflective writing), observation-based, and test-based (p. 119).

Quantitative Data Analysis and Results

To examine within-group changes in students' perceived learning outcomes and progress in sustainability competencies, pre- and post-intervention scores for each survey item were analyzed using paired-samples *t*-tests. Because we had ordinal data, Wilcoxon signed-rank tests were conducted as a non-parametric robustness check. Effect sizes were calculated using Cohen's d_z. Ninety-five percent confidence intervals (CIs) for the mean differences were computed using the *t* distribution.

Survey 1: Learning Outcomes

Item-level analysis indicated pre- to post-instructional-unit gains across all seven items (see Table 5). As shown, mean scores increased, and paired-samples *t*-tests and Wilcoxon signed-rank tests indicated large within-subject effect sizes for all items.

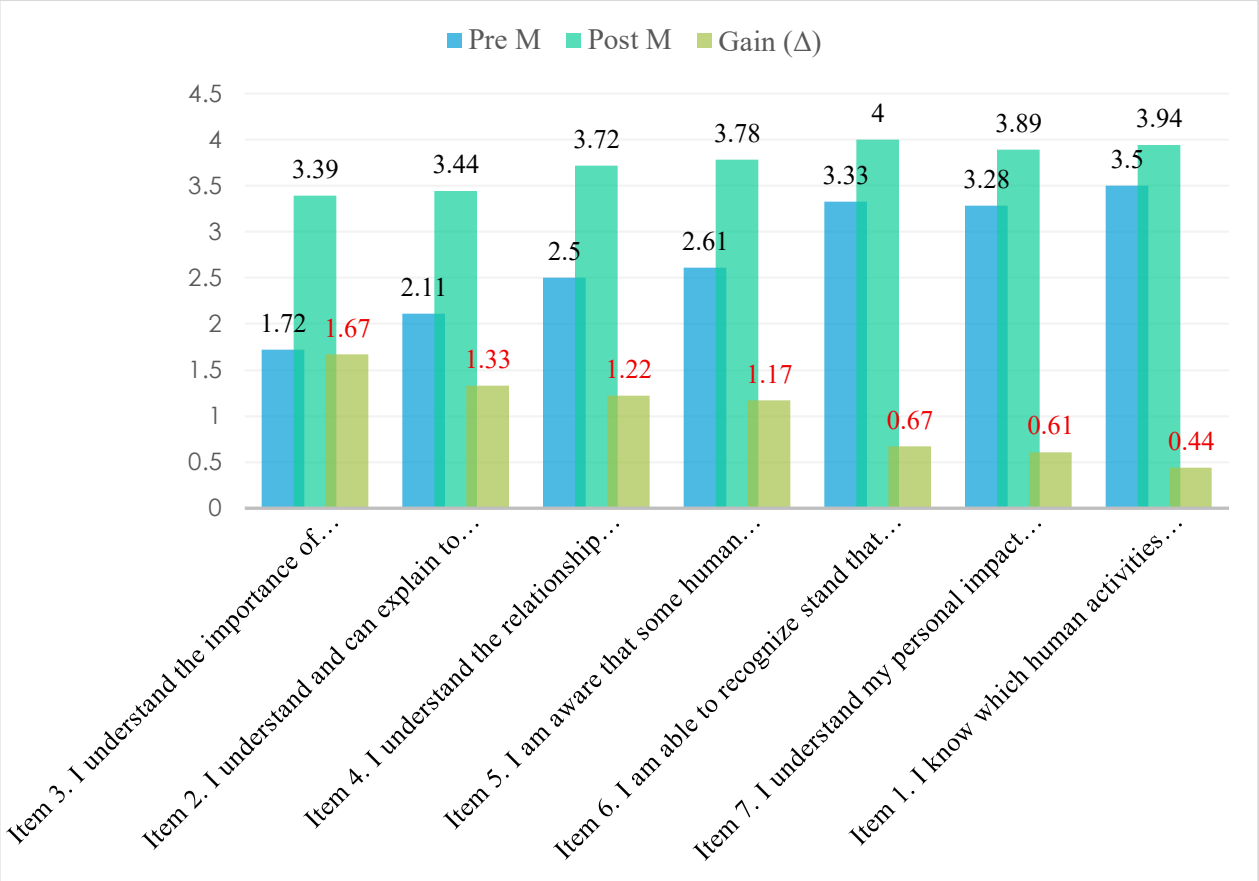
Table 5
Survey 1: Pre/Post Statistics

Item	Pre M	Pre SD	Post M	Post SD	Δ (Post -Pre)	95% CI Δ (low)	95% CI Δ (high	*t*(df)	*p* (*t*-test)	Wilcox W	*p* (Wilcox)	Cohen's dz
1	3.5	0.51	3.94	0.24	0.44	0.19	0.7	3.69(24)	0.0018	0.0	0.0047	0.87
2	2.11	0.76	3.44	0.51	**1.33**	1.04	1.63	9.52(24)	0.0	0.0	0.0	2.24
3	1.72	0.67	3.39	0.61	**1.67**	1.25	2.08	8.42(24)	0.0	0.0	0.0	1.98
4	2.5	0.86	3.72	0.46	1.22	0.9	1.54	8.02(24)	0.0	0.0	0.0003	1.89
5	2.61	0.92	3.78	0.43	1.17	0.82	1.52	7.0(24)	0.0	0.0	0.0004	1.65
6	3.33	0.59	4.0	0.0	0.67	0.37	0.96	4.76(24)	0.0002	0.0	0.0013	1.12
7	3.28	0.57	3.89	0.32	0.61	0.36	0.86	5.17(24)	0.0001	0.0	0.0009	1.22

The most significant gains were observed for Item 3: *I understand the importance of prevention, mitigation, and adaptation strategies in combating climate change*, and Item 2: *I understand and can explain to others the main environmental, social, cultural, and economic consequences of climate change*, both showing gains of > +1 point (Δ = 1.67 and Δ = 1.33, respectively; see Figure 1).

Moderate gains were also observed for Item 4, which addresses students' understanding of the relationship between climate change, poverty, food insecurity, and migration; and for Item 5, which focuses on awareness of the differences in vulnerability among human groups and regions. The smaller gains for Items 6, 7, and 1 are due to higher baseline scores pre-instructional unit, leaving more limited room to grow.

Figure 1
Survey 1: Gains per Item



Survey 2: Developing Competencies

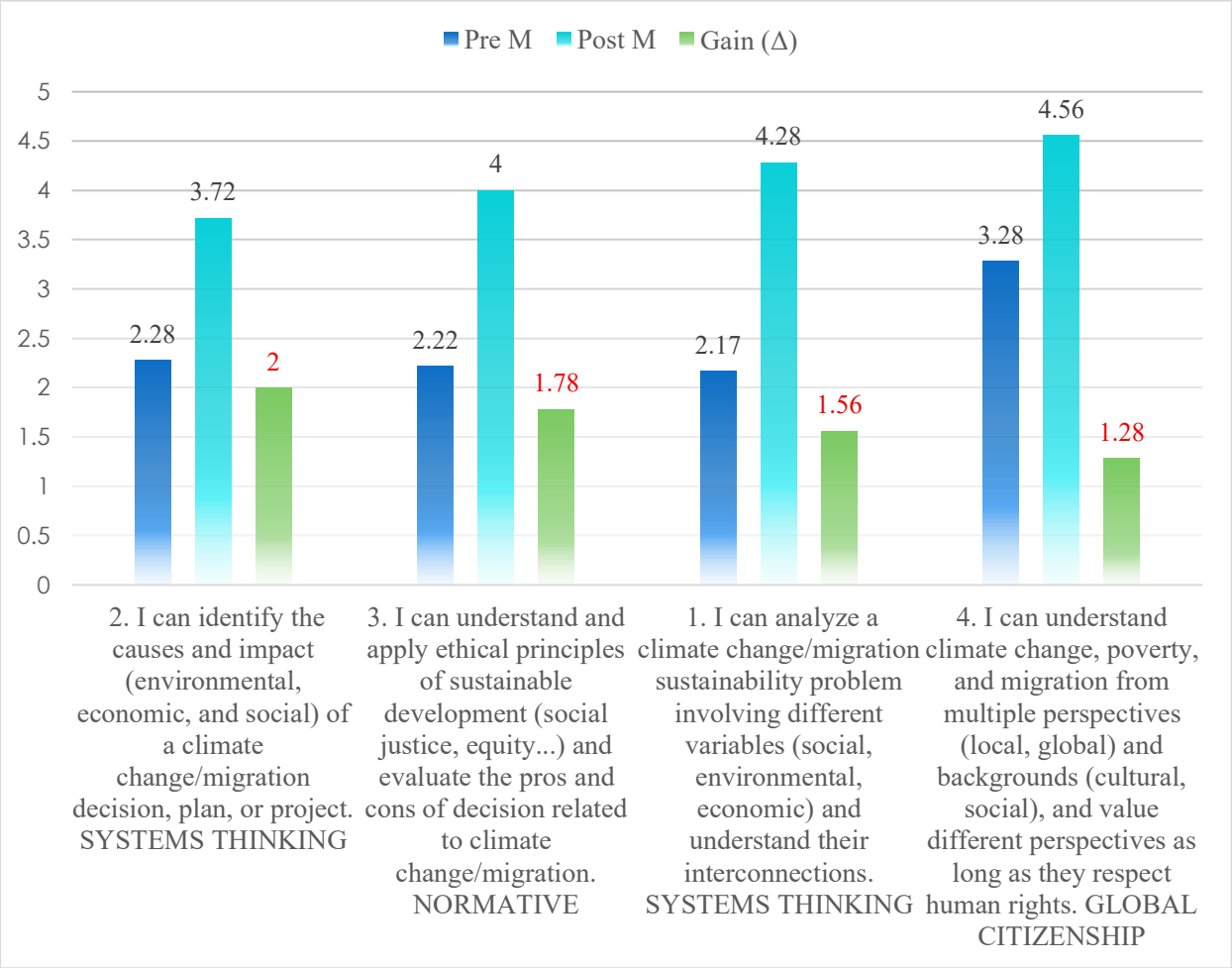
Item-level analysis indicated pre- to post-instructional unit gains across all four items (see Table 6). As shown, mean scores increased, and paired-samples *t*-tests and Wilcoxon signed-rank tests indicated large within-subject effect sizes for all items.

Table 6
Survey 2: Pre/Post Statistics

Item	Pre M	Pre SD	Post M	Post SD	Δ (Post -Pre)	95% CI Δ (low)	95% CI Δ (high)	*t*(df)	*p* (*t*-test)	Wil-cox W	*p* (Wil -cox	Cohen's dz
1	2.17	0.99	3.72	1.18	1.56	1.25	1.86	10.72(24)	0.0	0.0	0.0	2.53
2	2.28	0.967	4.38	0.67	**2.0**	1.76	2.24	17.49(24)	0.0	0.0	0.0	4.12
3	2.22	0.81	4.0	0.91	**1.78**	1.46	2.1	11.66(24)	0.0	0.0	0.0	2.75
4	3.28	0.57	4.56	0.62	1.28	1.05	1.51	11.76(24)	0.0	0.0	0.0	2.77

The most significant gains were observed for Item 2: *I can identify the causes and impact of a climate change/migration activity, decision, plan, or project*; and Item 3: *I can understand and apply ethical principles of sustainable development and evaluate the pros and cons of decisions related to climate change/migration* (Δ = 2 and Δ = 1.78, respectively; see Figure 2).

Figure 2
Survey 2: Gains per Item



Qualitative Data Analysis and Results

A thematic analysis of student reflections (n = 19) identified evidence of emerging or developing competencies. The analysis revealed three recurring themes aligned with systems thinking (e.g., recognition of interconnections), normative competence (e.g., ethical evaluation of sustainability issues), and global citizenship (e.g., awareness of the global and intercultural dimensions of climate change and migration).

Regarding *systems thinking*, reflections indicated that students increasingly recognized climate change and climate migration as interconnected socio-environmental systems. They frequently described links between environmental change, social vulnerability, poverty, and

displacement, reflecting an emerging ability to analyze sustainability challenges across multiple interacting dimensions. In the area of *normative competence*, reflections revealed a growing ethical engagement with climate change as an issue of justice and unequal impact. Students articulated concerns about effects on marginalized populations and evaluated climate-related issues through principles of equity and human rights. Finally, reflections related to *global citizenship* illustrated students' developing awareness of climate change and migration as global challenges shaped by geopolitical inequalities, situating local cases such as El Bosque within broader global contexts.

Discussion

Research Question 1

The first research question examined whether students reported significant pre-post changes in their perceived achievement of sustainability-oriented learning outcomes following participation in a four-week Spanish pedagogical unit on climate change and climate migration. The results shown in Table 5 indicate significant perceived gains across cognitive and emotional/ethical dimensions aligned with the unit's sustainability-oriented learning objectives.

At the cognitive level, students reported improved understanding of three key dimensions of climate change that reflect core principles of ESD: (1) the strategies (adaptation, mitigation) that different countries can use to address climate change; (2) the systemic nature of climate change across all areas of sustainability (social, environmental, cultural, and economic); and (3) the connection between climate change, poverty, and migration, including the role of environmental crises in driving human mobility. These gains suggest a shift from a narrow understanding of climate change (i.e., climate change is bad for the environment) toward a systemic perspective in which environmental change, inequality, and poverty are interconnected. Students also reported an enhanced awareness of climate injustice—the unequal distribution of climate change's causes and effects across populations—and the reasons behind these disparities. In addition, students indicated an enhanced capacity to empathize with those most affected by climate change displacement. Together, these patterns suggest that students believed their ability to recognize the systemic and ethical dimensions of climate change had increased, consistent with the learning outcomes emphasized in ESD frameworks.

Research Question 2: Quantitative and Qualitative Findings

The second research question examined whether students reported significant pre-post changes in their emerging or developing sustainability competencies following participation in the instructional unit on climate change and climate migration. The results of the quantitative analysis, as shown in Table 6, indicated statistically significant perceived gains across the three competencies examined. With respect to *systems thinking* competence, students reported an enhanced ability to analyze climate change and migration as complex phenomena involving interrelated social, economic, and environmental factors. Additionally, the significant gains in Item 5 indicate perceived progress in students' developing *normative* competence, particularly in applying ethical principles such as social justice and equity when evaluating climate-related decisions. Smaller gains were observed in Item 4: students' reported increase in awareness of climate change and migration as issues that transcend local contexts and are embedded in broader global inequalities. However, language research has shown that *global citizenship*

develops through sustained and reflective engagement. According to Byram (2008), "intercultural citizenship requires repeated opportunities for engagement and reflection that cannot be achieved through brief or isolated teaching modules" (p. 156). Nonetheless, students reported some progress in their ability to consider multiple perspectives and cultural backgrounds; this aligns with ESD goals related to intercultural understanding, empathy, and concern for collective well-being.

The results of the thematic analysis of student reflections provided qualitative support for the quantitative findings. As mentioned earlier, three main recurring themes were identified:

- Theme 1: Developing systems-oriented understandings of climate change and migration. Across reflections, students demonstrated emerging and/or developing *systems thinking* by articulating connections between climate change, social vulnerability, and migration. This integrative reasoning aligns with ESD's emphasis on understanding sustainability challenges as complex, interconnected systems rather than isolated problems. Many students referenced moving from viewing climate change primarily as an environmental problem to recognizing it as a systemic phenomenon with environmental, social, economic, and political dimensions:
  (1) "Migration and human rights were not topics that I associated with climate change or sustainability initially. Part of this unawareness came with my not thinking about sustainability socially."
  (2) "Before the unit, I knew what caused climate change, but I was not aware that climate change would cause migration, especially in Latin America."
  (3) "The El Bosque case helped me understand how environmental crises, government responses, and social vulnerability are connected."
  Others explicitly connected climate change to migration and livelihood disruption, particularly in the Global South:
  (4) "Our contribution to climate change affects other people's poverty or having to migrate, so that we can live our lifestyles here in the United States."
  These reflections suggest progress in recognizing causal interconnections central to systems thinking, rather than isolated environmental impacts.

- Theme 2: Emerging ethical reasoning and climate justice awareness.
  A second theme involved students' ability to engage ethically with climate change as an issue of justice, responsibility, and inequality. Reflections frequently framed climate change as a moral issue involving unequal impacts on marginalized populations and unequal responsibility between countries, which indicates an emerging or developing *normative competence*:
  (5) "Before this class, it was obvious that rising sea temperature was a problem; however, it was not obvious how the effects would affect groups such as Indigenous or black communities."
  (6) "When we think about climate change, we think only of global warming. However, what is more important is the impact of changes on the lives of people affected. In my opinion, the issue of climate change is more a human rights issue than anything else."
  (7) "The countries that are least responsible for climate change are the ones that suffer the most."
  (8) "The area that I have learned the most about regarding climate change is the negative effects that our own lifestyles can have on people in less developed environments; our

contribution to climate change affects other people's poverty or having to migrate, so that we can live our lifestyles here in the United States."

- Theme 3: Expanding global and intercultural perspectives on climate migration. A third theme reflected a developing awareness of climate change and migration as global phenomena shaped by cultural, geographic, and political contexts. Many reflections acknowledged uneven responsibility between the Global North and Global South and reflected on international governance, protection gaps, and shared responsibility for action.

(9) "Many wealthy countries, including the United States and China, produce significant amounts of greenhouse gases, but the effects are felt more in the Global South."

(10) "This unit showed me that the more developed countries have a responsibility to help climate migrants, but it is difficult for global governance to create effective policies to hold these countries accountable."

(11) "Everyone needs to work together to address climate change and its impacts."

A cross-cutting, fourth theme was identified, as several reflections articulated an emerging awareness of how individual behaviors contribute to broader systems of climate injustice, and expressed initial steps toward behavior change:

(12) "This led me to think about how I could make a difference to reduce my contribution to climate injustice."

(13) "Paying attention to my carbon footprint became more important after this unit."

(14) "I understand that my actions affect disadvantaged people more than they affect me."

Taken together, the reflections suggest a developmental process along three sustainability competence trajectories: an understanding of climate change as a systemic phenomenon with multiple dimensions, an increased ethical engagement with questions of justice and responsibility, and an expanded awareness of global inequality and governance challenges.

In sum, and in response to Research Question 2, the quantitative and qualitative findings provide convergent evidence of students' reported progress in developing sustainability competencies during the instructional unit. The pre–post gains observed in Survey 2 items on systems thinking, normative reasoning, and global citizenship are mirrored in students' reflections, which offer insights into the emerging competencies. While the quantitative results document reported change, the qualitative analysis reveals the nature of that change, illustrating emerging systems-thinking reasoning, ethical evaluation, and global perspective-taking. This triangulation strengthens the interpretation of the findings as indicative of developmental movement along sustainability competency trajectories, while remaining consistent with the study's exploratory and self-reported nature.

Some limitations should be considered when interpreting the findings. First, the study used data from a small sample of 24 students enrolled in a sustainability-based Spanish course at one US institution. This limits the transferability and generalizability of the results to other institutional contexts, student populations, proficiency levels, or instructional settings. Two additional limitations relate to measurement and research design. All quantitative and qualitative data relied on self-reported measures, which may be influenced by response tendencies such as social desirability bias[5] (particularly given the ethical nature of sustainability topics) or potential overestimation of progress. In addition, the qualitative data analysis was conducted by a single

[5] Social desirability bias refers to participants' tendency to provide answers that align with perceived expectations, which may lead to inflated accounts of attitudes, beliefs, or behaviors.

coder. While the analysis followed a deductive, theory-informed approach, the absence of multiple coders limits the robustness of the qualitative findings. In addition, the researcher also served as the instructor teaching the instructional unit, which may raise concerns about instructor–researcher bias. However, the fact that the non-identifiable data was collected from the course's LMS several months after its conclusion minimized this risk.

Taken together, these limitations underscore the exploratory nature of the study and suggest that the findings should be interpreted as context-specific evidence of students' perceived learning and developmental progress toward sustainability competencies.

Conclusions and Further Research

The findings of this study contribute to ongoing conversations—and to a growing body of research—about the role of language education in education for sustainable development. Taken together, the results suggest that, despite some existing structural and pedagogical barriers, sustainability education can be productively integrated into advanced language courses, and that language education, when framed as a space of meaning making, ethical inquiry, and intercultural engagement, can be a viable pedagogical context for supporting sustainability literacy and students' progress in developing sustainability-related competencies. By demonstrating how ESD principles can be operationalized in an advanced Spanish course, this study offers a concrete response to calls to make sustainability dimensions more visible in language teaching and learning. Moreover, the findings underscore the potential of two educational frameworks, Content-Based Language Instruction and Education for Sustainable Development, to merge in higher education language curricula (both in general and LSP courses) and give students the sustainability literacy and global competencies needed for professional contexts.

The findings of this exploratory study point to several directions for future research on integrating Education for Sustainable Development into language education. First, replication with a larger number of students across multiple institutions, languages, and proficiency levels would improve external validity and help assess the transferability of the observed patterns. Second, future studies would benefit from examining longitudinal designs. Because sustainability competencies are developmental constructs that emerge over time, research that tracks learners across multiple units or semesters—ideally with delayed surveys—would provide insight into students' developmental trajectories in sustainability literacy and competence development. Third, while self-report measures are appropriate for capturing perceived learning and emerging competencies, incorporating performance-based assessments (e.g., case-analysis rubrics) and combining them with qualitative methods would provide a better understanding of how students enact sustainability competencies through language use. These directions underscore the need for sustained, methodologically robust inquiry into how language education can support students' engagement with sustainability challenges, as a place not only for language learning but also for critical, ethical, and intercultural development.

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Appendix A
The Course: Pedagogical Units, SDGs, and Case Studies

Unit	SDGs	Case study
1. Education for sustainable development: The roles of the mother language and culture	SDG 4: Inclusive, quality education for all	The intra-cultural, intercultural, and multilingual education system in Bolivia
2. Climate change and human migration in Latin America	SDG 13: Climate action	The case of the El Bosque community (Tabasco, Mexico)
3. Sustainable use of natural resources	SDG 12: Responsible production	Ecuador v. Texaco-Chevron
4. Inequality and exclusion: Obstacles to sustainable development	SDG 10: Reducing inequality	The case of Vicky Hernández vs. the State of Honduras
5. Informal work in Latin America and its impact on sustainable development	SDG 8: Decent jobs for all	The Yacu Kallpa case in Peru (2015-present)

Appendix B
Survey 1

Answer options: 4. Very well 3. Well 2. Somewhat well 1 Not well

1. I know which human activities globally contribute most to climate change.
2. I understand and can explain to others the main environmental, social, cultural, and economic consequences of climate change.
3. I understand the importance of prevention, mitigation, and adaptation strategies in combating climate change.
4. I understand the relationship between climate change, poverty, food insecurity, and migration.

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5. I am aware that some human groups and regions are more vulnerable than others (climate injustice), and I understand the reasons.
6. I am able to recognize that climate migration is a human rights issue.
7. I understand my personal impact on climate change and the need to reevaluate some of my behaviors in light of this.

Appendix C
Survey 2. Items Selected for Analysis

Levels of agreement:
5. Strongly agree. 4. Agree 3. Somewhat Agree 2. Disagree. 1. Strongly disagree

1. [Systems Thinking] I can analyze a climate change/migration sustainability problem involving different variables (social, environmental, and economic) and understand their interconnections.
2. [Systems Thinking] I can identify the causes and impact (environmental, economic, and social) of a climate change/migration decision, plan, or project.
3. [Normative] I can understand and apply ethical principles of sustainable development (social justice, equity...) and evaluate the pros and cons of decisions related to climate change/migration.
4. [Global Citizenship] I can understand climate change, poverty, and migration from multiple perspectives (local and global) and backgrounds (cultural and social), and value different perspectives as long as they respect human rights.