

Embedding Sustainability in LSP Curricula: A Transductive Approach for Professionalization and Internationalization

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Embedding Sustainability in LSP Curricula: A Transductive Approach for Professionalization and Internationalization

Abstract: This article explores the integration of sustainability into language education for non-specialist students within French higher education. It argues that sustainability-oriented language education can contribute to professionalization and internationalization by integrating language learning with disciplinary knowledge, cultural awareness and transversal competencies. Drawing on Narcy-Combes's (2005) concept of a transductive (dynamic, interactive) relationship between language, culture, and disciplinary knowledge, the article proposes a revisited, sustainability-oriented transductive model in which these dimensions develop in an interdependent manner. The argument is illustrated through three pedagogical initiatives implemented in a university language department: an AI-supported online English learning pathway, the use of digital twins (virtual replicas of real-world laboratory environments) in a virtual chemistry lab, and a serious game (designed for educational/training purposes) on international logistics and carbon footprint. These initiatives are presented as contextualized and practitioner-based and are analyzed in terms of how they operationalize the proposed model within specific disciplinary and institutional settings. Rather than claiming measurable impact, the article suggests that embedding sustainability into languages for specific purposes curricula may foster learner engagement, professional awareness, and the development of key transversal competencies relevant to global professional environments. The article concludes by discussing implications for curriculum design, teacher development, and future research in sustainability-oriented LSP education.

Keywords: curriculum design, internationalization, languages for specific purposes, professionalization, sustainability, technology-enhanced learning, transversal competencies

Introduction

In recent years, higher education has been subject to profound societal, technological, and environmental changes that are reshaping professional landscapes and the skills needed to navigate them. These “global transitions”—including accelerated digitalization, increased professional mobility and the urgent need to respond to climate change—are placing unprecedented demands on educational institutions to adapt their curricula. In this context, the integration of sustainability, understood in its environmental, economic, and social dimensions, has become a core priority for universities and colleges worldwide (UNESCO, 2017). This priority aligns with both the United Nations' 2030 Agenda for Sustainable Development¹ and the growing expectation among employers and learners that educational programs should foster responsible, ethical, and forward-looking competencies.

¹ The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, sets out a collective vision for advancing global prosperity, social well-being and environmental protection. It establishes 17 Sustainable Development Goals designed to guide coordinated action across countries and sectors. As articulated in the outcome document, the Agenda, it is “a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom,” recognizing that “eradicating poverty in all its forms and
Global Business Languages (2026)

In this context, within the French higher education system, university departments providing language classes to non-specialist students—the so-called “LANSOD” (Languages for Specialists of Other Disciplines) sector²—face a unique set of challenges. LANSOD programs indeed generally serve heterogeneous populations of learners and often struggle to meet the needs of language learners (Taillefer, 2008). They are also characterized by a diversity of learner profiles, a range of professional fields addressed, and a limited number of contact hours available for instruction (Brudermann et al., 2016). The LANSOD sector also faces structural constraints, including limited resources (Terrier & Maury, 2015; Poussard, 2017), uneven access to professional development for teachers (Van der Yeught, 2014; Braud et al., 2015), and a historically fragile research culture (Brudermann, 2024). Taken together, these constraints may lead to fragmented learning experiences, making it difficult to sustain learner engagement and to foster transversal competencies such as sustainability awareness or critical thinking. At the same time, the LANSOD sector is strategically positioned to address sustainability-related challenges. Language and culture learning indeed inherently involve engaging with complex global systems, intercultural perspectives, and professional practices that are directly affected by environmental, economic, and social transformations. From this perspective, sustainability appears not only as a relevant thematic focus but also as a potential structuring principle for languages for specific purposes (LSP) curricula. In this regard, integrating sustainability into LANSOD curricula requires a reconsideration of traditional pedagogical models and calls for innovative approaches that combine language, culture, and subject-specific content in ways that mirror real-world professional contexts.

Against this backdrop, this paper argues that, when approached as a guiding curricular principle rather than as an add-on, sustainability can serve as a potential driver of professionalization and internationalization in higher education. To illustrate this, the paper first revisits the transductive relationship between language, culture, and disciplinary knowledge (Narcy-Combes, 2005) and reconceptualizes it to account for sustainability-oriented learning objectives and the development of transversal competencies. The article then presents three pedagogical initiatives implemented in the LANSOD sector. These initiatives—a hybrid English learning pathway, the use of digital twins in a virtual chemistry lab, and a serious (educational/training) game on international logistics and carbon footprint—are conceptualized not as empirical case studies but as situated and practitioner-based pedagogical designs which illustrate how sustainability can be embedded into LSP curricula through authentic, technology-enhanced, and learner-centered tasks. Their analysis aims to explore pedagogical affordances rather than to demonstrate measurable impact. Ultimately, the article explores the pedagogical and institutional implications of incorporating sustainability into LANSOD curricula and concludes by outlining perspectives for future research, particularly with regard to curriculum design, teacher development, and the transferability of sustainability-oriented LSP practices across contexts.

dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development” (United Nations, 2015, p. 1).

² On this topic, while LANSOD constitutes a French-specific institutional configuration, it falls within the broader international field of languages for specific purposes (LSP), which encompasses language education aligned with disciplinary, professional and institutional needs. Throughout this article, the term “LANSOD” is therefore used to designate the French context, while LSP refers to the wider pedagogical and research field.

Theoretical and Pedagogical Framework

Lifelong and Lifewide Learning in the LANSOD Sector

The LANSOD sector caters to learners who must balance language courses with demanding disciplinary studies or professional commitments. It is therefore transversal in nature and, as such, occupies a unique position within the French higher education system. One of its main challenges is consequently to provide language and intercultural training to students from a wide range of disciplinary backgrounds, with heterogeneous learner profiles and varied professional targets. These realities echo the broader educational imperative of *lifelong and lifewide learning* (Jackson, 2011): the ability to acquire and mobilize knowledge and skills across contexts and throughout life. The concept of lifelong learning emphasizes learning as a continuous process that extends beyond formal education, while “lifewide” learning underscores the need to connect knowledge acquired in multiple contexts, whether formal, non-formal, or informal (Jackson, 2011). In the LANSOD sector, these principles appear particularly relevant because while learners come from diverse disciplines (engineering, business, health sciences, etc.), their language training must both complement their disciplinary studies and foster transversal competencies, comprising skills that are transferable across professional environments.

From this perspective, embedding sustainability into LANSOD curricula can, for instance, mean encouraging students to reflect critically on their future roles as professionals and citizens. Sustainability-related learning objectives can also be aligned with task-based learning approaches, which emphasize the use of authentic tasks to support meaningful language use and professional engagement (Ellis, 2003). Rather than serving merely as thematic content, sustainability can thus function as a context through which language learning is connected to disciplinary practices and broader societal challenges over time and across learning contexts, in line with lifelong and lifewide learning principles.

Sustainability and LSP in Higher Education

Sustainability has become a central concern for higher education institutions worldwide over the past two decades (Sterling, 2011; Tilbury, 2011). In the field of LSP, this growing emphasis has prompted renewed reflection on the role of language education in addressing environmental, economic, and social challenges that increasingly shape professional practices. Based on the definition set out in the Brundtland Report (World Commission on Environment and Development, 1987), sustainability encompasses environmental, economic, and social dimensions that are deeply interconnected and must therefore be addressed in an integrated manner.

Significant work has been carried out at the intersection of LSP and sustainability, demonstrating how sustainability-related issues can be meaningfully integrated into language curricula. These issues are frequently conceptualized as “wicked problems,” defined by Hiver et al. as “diabolical in the sense that they resist all the usual attempts to resolve them” (2022, p. 8) or, as Jackson and Barnett (2020, p. 5) put it, as “wicked problems posed by the turbulent, liquid world of today and tomorrow.” Issues related to the multifaceted dimensions of sustainability clearly fall into this category, as they involve uncertainty, competing values, and complex interdependencies. From this perspective, several scholars argue that language education must move beyond narrowly defined linguistic objectives to engage learners with such complexity. In this regard, de la Fuente—who advocates that “[foreign language] courses and programs need to ‘step out of the language box’ (de la Fuente, 2019) and ‘transcend disciplinary silos’ (Melin, 2019)” (2022, p. 81)—provides examples of how

learners engage with sustainable development issues within language programs. The pedagogical approaches documented in this line of research are varied, including project-based, task-based, and problem-based learning, but they share a common emphasis on balancing content and language instruction. Such approaches are consistent with second language acquisition research, insofar as they promote language development while fostering language and content literacy in tandem. Reisinger et al. (2022) likewise emphasize the added value of the Cultures and Languages Across the Curriculum (CLAC) frameworks, which promote the study and use of languages outside language departments and across institutions. Indeed, by embedding language learning within disciplinary contexts, CLAC approaches contribute to the internationalization of curricula and introduce intercultural perspectives into content areas, including sustainability.

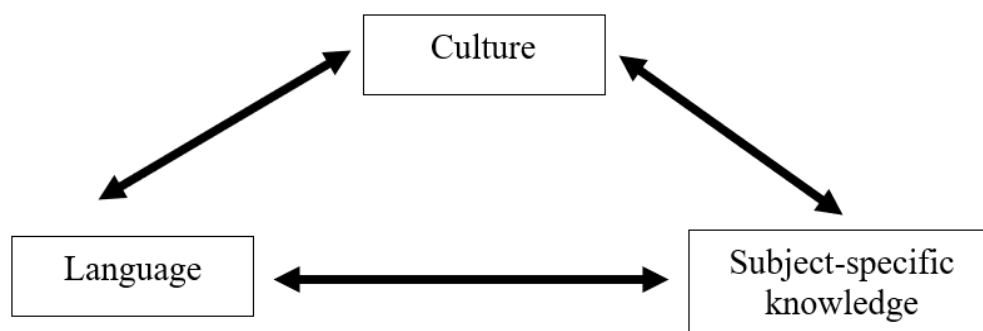
From an LSP standpoint, these frameworks highlight the potential of language education to mediate between disciplinary knowledge, professional practices and global challenges. Taken together, this body of work suggests that sustainability offers a particularly relevant framework for LSP and LANSOD contexts. Rather than functioning as a thematic add-on, it can serve as a structuring principle that connects language learning, disciplinary content, and professional competencies. However, while this literature demonstrates the pedagogical relevance of sustainability-oriented approaches, it also raises questions about how coherence between these dimensions can be ensured at the curricular level. Addressing this issue requires a theoretical framework capable of articulating the dynamic relationships between language, content, and transversal competencies.

Revisiting the Transductive Relationship in LSP Education

To address the need for curricular coherence highlighted in the previous section, this article draws on the concept of *transduction* as developed in the field of language education by Nancy-Combes (2005). Indeed, explicitly building on Simondon's (1989) philosophical work on individuation, Nancy-Combes hypothesizes that languages, cultures, and subject-specific content are likely to be part of a transductive relationship: a relationship in which each component informs and transforms the others to develop together as an indivisible whole (see Figure 1). In this framework, learning therefore does not result from the linear transmission of predefined knowledge but from the dynamic co-emergence of multiple dimensions through pedagogical activity.

Figure 1

Conceptualizing the Transductive Relationship Between Language, Culture, and Disciplinary Knowledge

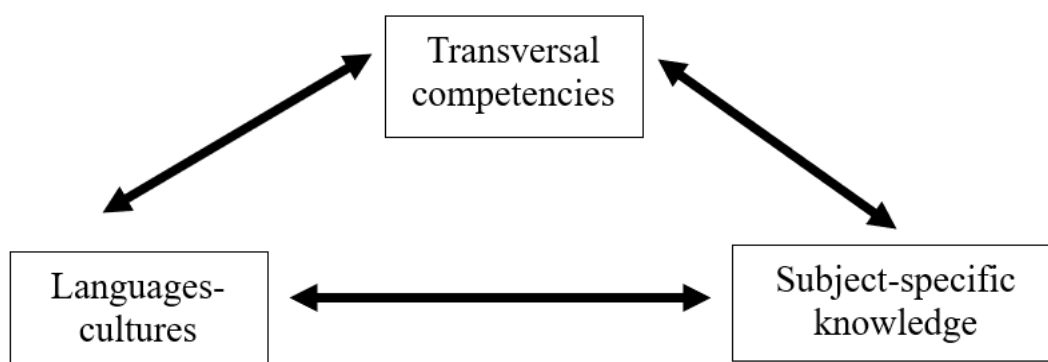


As represented in Figure 1, the original transductive model conceptualizes the relationship between *languages*, *cultures*, and *subject-specific knowledge* as a non-hierarchical and reciprocal process. Languages and cultures are not merely vehicles for content transmission, nor is disciplinary knowledge a neutral object to be encoded linguistically. Instead, each dimension continuously reshapes the others, giving rise to new forms of understanding, meaning-making and engagement. This perspective is particularly relevant in LSP and LANSOD contexts, where language learning is intrinsically linked to disciplinary and professional domains. As such, when learners engage with complex subject-specific content through another language, the learning process becomes transductive since linguistic development, conceptual understanding, and cultural positioning evolve together rather than sequentially.

Figure 2 extends this original model by explicitly integrating transversal competencies into the transductive relationship. This extension reflects the growing recognition that competencies such as critical thinking, collaboration, reflexivity, ethical reasoning, and adaptability are not external outcomes of learning but emergent dimensions of the interaction between languages, cultures, and disciplinary knowledge. In sustainability-oriented curricula, these transversal competencies are particularly salient, as learners are confronted with complex, ill-structured problems that require them to mobilize linguistic, disciplinary, and intercultural resources simultaneously. Importantly, transversal competencies are not positioned as an additional, independent component but as an emergent dimension of the transductive relationship itself.

Figure 2

A Sustainability-Oriented Transductive Model for LANSOD Curricula



It follows that, from this perspective, professionalization, internationalization, and learner development are understood as processual outcomes of sustained engagement in transductive learning environments rather than as predefined instructional targets. This distinction helps avoid instrumental or reductive approaches to both language education and sustainability, in which competencies might otherwise be treated as discrete skills to be “added on” to existing curricula. This is why, by extending Nancy-Combes’s transductive framework in this way, the present study conceptualizes sustainability as a mediating force that intensifies and reconfigures the interactions between languages-cultures, disciplinary knowledge, and transversal competencies (see Figure 2). As such, this sustainability-oriented transductive model provides the theoretical basis for the pedagogical initiatives presented in the next section, which illustrate how such interactions can be deliberately fostered through task design, project-based learning, and technology-enhanced environments in LANSOD contexts.

Sustainability-oriented Pedagogical Initiatives in a LANSOD Context

Institutional and Pedagogical Context

The pedagogical initiatives presented in this section were all developed within the Conservatoire national des arts et métiers (CNAM), a higher education institution based in Paris with a long-standing focus on lifelong and lifewide learning. Founded in 1794, the CNAM occupies a distinctive position within the French higher education landscape, as it primarily serves adult learners who are either fully employed, seeking employment or engaged in professional retraining as part of a career transition. This institutional context has important implications for curriculum design in LANSOD programs, as learners typically combine academic study with professional responsibilities and their expectations are closely tied to employability, professional relevance, and immediate applicability. As a result, language courses at the CNAM are strongly oriented toward professional practices, disciplinary content, and real-world problem-solving, making them particularly conducive to sustainability-oriented and transductive pedagogical approaches.

From a pedagogical standpoint, the initiatives described below were designed within English LANSOD courses targeting learners from different disciplinary backgrounds, including logistics, chemistry, and digital and scientific domains. They do not constitute empirical case studies in the strict methodological sense but rather practice-based pedagogical initiatives, conceived within specific institutional contexts to explore how sustainability could function as a structuring principle in LSP curricula. In line with the transductive framework outlined above, these initiatives aim to foster simultaneous engagement with languages-cultures, disciplinary knowledge and transversal competencies through task-based, project-based, and technology-enhanced learning environments. Rather than relying on systematic data collection, the analysis presented in this article is grounded in pedagogical design rationales and reflective practitioner perspectives. These initiatives should thus be understood as exploratory and illustrative rather than as evidence-based evaluations of impact.

The Artificial Intelligence-supported Online English Learning Pathway

The first initiative involves an online English learning pathway supported by artificial intelligence (AI) tools and designed for third-year engineering students enrolled at CNAM's engineering school, EI-CNAM. Because these learners are part of an apprenticeship-based degree program, their curriculum relies on a dual system combining academic learning and professional experience in companies. Engineering education in this context therefore aims not only to develop technical competencies across domains such as energy, mechanics, or electrical systems, but also transversal competencies increasingly required by employers (Lemaître, 2018).

Against this backdrop, the AI-supported online pathway was designed to enhance learners' professional and linguistic skills through scenario-based tasks addressing sustainability-related concerns, while remaining fully embedded within the remit of the language department. Importantly, the scenarios were conceived and implemented by language instructors and did not involve trainers from other disciplinary fields, which reflects both institutional constraints and the intentionally exploratory scope of the initiative.

As seen in Figure 3 below, in the scenarios, learners are invited to take on professional roles and solve problems related, for instance, to the greenhouse effect. From an LSP perspective, the course is structured around professional scenarios that encourage learners to engage with missions of social and professional relevance, thereby fostering potential forms

of transferability to real-life professional situations. Language learning is thus anchored in simulated professional action rather than treated as an abstract objective.

Figure 3

Enhancing Professional and Linguistic Skills through AI-Supported Online Scenarios

The screenshot displays the 'le cnam Paris' interface. The top navigation bar includes 'le cnam Paris', 'Accueil', 'Tableau de bord', 'Mes cours', and 'Accès directs'. A user profile section shows 'Mode d'édition' (checked) and 'Désactivé'. The main content area is titled 'SCENARIO 1 – THE GREENHOUSE TASK FORCE : A CLIMATE INVESTIGATION'. A left sidebar lists various course elements, with 'SCENARIO 1 – THE GREENHOU...' highlighted. The main text area contains 'Background Information' and 'Your role' sections. The 'Background Information' section discusses the greenhouse effect and the Intergovernmental Panel on Climate Change (IPCC). The 'Your role' section describes the user's position as a Climate Media Analyst and lists two deliverables: a Climate Action Brief and a persuasive climate pitch to the U.S. Government.

A distinctive feature of this pathway also lies in its dual feedback system combining AI-based and human tutoring. Indeed, students' written and oral productions are first processed through an AI tool that provides corrective suggestions regarding grammar, vocabulary, cohesion, and rhetorical organization. Learners are explicitly guided to analyze these suggestions critically, to question their relevance and to identify potential mismatches with their communicative intentions or the content of the task. Once this phase is completed, the revised productions are submitted to human tutors, who provide a second layer of feedback grounded in expert judgment, contextual awareness, and pedagogical mediation. In this design, AI is not positioned as a substitute for human teaching but as a pedagogical mediator supporting learner autonomy and reflexivity. Consequently, this iterative process invites students to develop metacognitive strategies as they compare AI-generated feedback with human input and negotiate meaning and adequacy in revision. Such practices resonate with the growing presence of AI-assisted tools in professional communication environments, where automated tools increasingly complement human expertise rather than replace it.

The scenarios were further grounded in a task-based approach to language learning, thereby encouraging students to engage critically and ethically with disciplinary content related to issues such as climate change, inequality, or technological disruption. Therefore, in line with UNESCO's (2017) perspective on education for sustainable development, the pathway seeks to empower learners to reflect critically, imagine future scenarios, and make informed decisions in an interconnected professional world. The transversal competencies fostered through this initiative include, among others, learner autonomy, time management, self-assessment and intercultural communication. These competencies emerge through the interaction between language use, professional scenarios, and reflective engagement with AI feedback, in line with the sustainability-oriented transductive model outlined above.

Overall, this initiative illustrates how the revisited transductive model (see Figure 2) can be operationalized in a fully online environment where language learning is conceived as an engagement with professional content and mediated technologies. Without claiming measurable learning gains, the initiative highlights the potential of AI-supported pathways to contribute to professionalization and internationalization, by familiarizing future engineers with modes of communication characteristic of global, digitally mediated workplaces. Finally, the digital format also supports the social dimension of sustainability by reducing geographical barriers and promoting more equitable access to language learning opportunities within a lifelong learning perspective.

Digital Twins in Virtual Chemistry Labs

The second initiative focuses on the use of digital twins—virtual replicas of real-world laboratory environments—within an English LANSOD course for students enrolled in industrial chemistry programs at both bachelor's and engineering school levels. The course included three extended practical sessions, each lasting three days. For each session, the first half-day was devoted to immersive practical work in the virtual environment, with a particular emphasis on laboratory safety prior to real-world experimentation. Due to the constraints of the immersive learning environment, the group was limited to six learners. Students were supported by a multidisciplinary instructional team consisting of a content expert, an English instructor, and a technician, which ensured both disciplinary accuracy and pedagogical coherence. In this project, learners worked collaboratively in pairs; one student navigated the immersive environment while the other observed and took notes, before roles were reversed. Together, they interacted with simulations of chemical processes, interpreted safety procedures and reported lab outcomes in English. From an LSP perspective, this environment provided authentic opportunities to practice laboratory-specific vocabulary and procedural discourse such as describing chemical reactions, interpreting hazard symbols, and drafting risk assessments. In order to simulate professional practices in international research and industrial settings, the immersive environment was configured in English and the use of English was required throughout the tasks.

In this project, disciplinary knowledge was fully embedded within the language activities; students had to mobilize prior knowledge in chemistry to operate virtual equipment, understand reaction mechanisms, and troubleshoot issues arising in the simulations. In this respect, the digital twin functioned as more than a visualization tool, as it required active disciplinary engagement as a condition for meaningful language use. The initiative also fostered a range of transversal competencies, notably digital literacy (navigating and interpreting virtual interfaces), collaborative problem solving (working in pairs during and after the simulation to complete lab reports), and sustainability awareness (understanding the environmental implications of certain chemical reactions or processes). In addition, students were encouraged to reflect on green chemistry principles and to discuss the environmental implications of specific substances or procedures with the group, thereby linking scientific practice with broader sustainability concerns.

Overall, this initiative exemplifies how the sustainability-oriented transductive relationship can be operationalized in a technology-enhanced learning environment. In particular, languages-cultures, disciplinary knowledge, and transversal competencies co-evolved through engagement with authentic laboratory protocols, including international safety standards and team-based reporting practices. While exploratory in nature, the project illustrates the potential of virtual labs to support professionalization—by reproducing workplace communication tasks and exposing learners to industry-standard tools—and to

contribute to curriculum internationalization through the use of English as a working language.

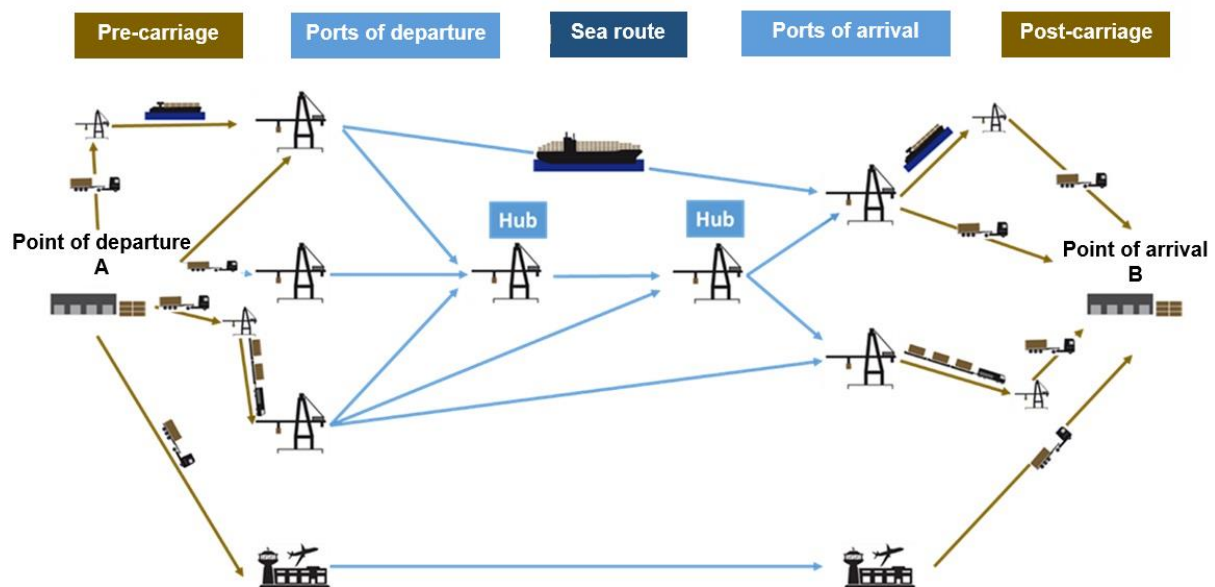
Serious Game on International Logistics and Carbon Footprint

The third initiative involved the integration of a serious (educational/training) game into a professional English course for students specializing in international logistics within a professional bachelor's program. Designed to be played in teams, potentially including international participants, the game simulates the management of global supply chains. As such, learners are required to optimize shipping routes, negotiate with suppliers, and minimize environmental impact, all while communicating in English.

To do so, as shown in Figure 4, from an LSP perspective, the serious game creates an immersive environment in which learners must mobilize professional language skills including technical vocabulary related to logistics and sustainability (e.g., carbon emissions, freight consolidation and intermodal transport), as well as negotiation strategies and persuasive communication. English also functions as a lingua franca within the simulation, reinforcing the authenticity of the learning experience and supporting situated learning (Wouters et al., 2013).

Figure 4

Integrating a Serious Game into Professional English for Logistics



From a disciplinary standpoint, the game aims to deepen students' understanding of global logistics systems by confronting them with trade-offs between economic efficiency and environmental sustainability. Students are also encouraged to engage with regulatory frameworks such as the EU's Fit for 55 package³ and to apply concepts from operations research and carbon accounting to concrete decision-making scenarios.

³ The Fit for 55 package refers to a comprehensive set of legislative proposals adopted by the European Union to align its climate and energy policies with legally binding targets under the European Climate Law. It is designed to ensure that the EU reduces net greenhouse gas emissions by at least 55 % by 2030 compared with 1990 levels and moves steadily toward climate neutrality by 2050. The package brings together interconnected measures across multiple sectors (such as energy, transport, land use, industry and taxation) to accelerate the transition to a low-carbon economy. As stated in the European Commission's communication introducing the package, its aim

The initiative also fosters transversal competencies central to sustainability education, including systems thinking (understanding the interdependencies in supply chains), critical thinking (evaluating trade-offs between cost and emissions), and ethical reasoning (choosing between environmentally harmful but profitable options and sustainable but slower alternatives). These competencies align with the European GreenComp Framework (Bianchi et al., 2022) and emerge as learners negotiate competing priorities and justify their choices within the game environment.

Taken together, this initiative illustrates how the serious game articulates the three dimensions of the revisited transductive relationship (see Figure 2) in an interconnected manner. Linguistic success within the game is also contingent upon cognitive and ethical engagement with disciplinary content, reinforcing the interdependence of language learning, professional knowledge, and sustainability-oriented reflection. While exploratory and context-specific, the initiative highlights the potential of serious games to support professionalization—by mirroring decision-making processes encountered in logistics careers—and to enhance internationalization through simulated cross-border collaboration in English.

Discussion

The three initiatives presented above reflect a deliberate shift from viewing language courses as isolated linguistic training toward conceiving them as communication-oriented learning environments. In line with project-based, task-based, and problem-based approaches, they provide learners with opportunities to engage individually or collaboratively in activities that, as de la Fuente (2022) suggests, “step out of the language box” (p. 81). This orientation is particularly relevant in LANSOD contexts where learners are predominantly adult professionals engaged in lifelong and lifewide learning trajectories as, for this audience, language education gains relevance when embedded in international communities of professional practice, which can function as a lever for engaging with complex, ill-structured or “wicked problems” such as sustainability (Hiver et al., 2022; Jackson & Barnett, 2020). Such communities indeed offer a multidisciplinary and intercultural space in which global challenges can be approached beyond discipline-specific perspectives.

From this standpoint, language departments can be viewed not merely as service units but as potential drivers of curricular and institutional change, particularly when they foster transversal competencies, intercultural mediation, and critical engagement with global issues (Van der Yeught, 2014). The three initiatives also illustrate how sustainability can be meaningfully embedded in LANSOD curricula when approached through the lens of a sustainability-oriented transductive pedagogy, which frames the interaction between languages-cultures, disciplinary knowledge, and transversal competencies as mutually constitutive rather than sequential. As such, although grounded in a French LANSOD context, these observations resonate with broader debates in LSP and language centers worldwide. The following discussion builds on this perspective to examine how the transductive framework supports instructional design, curriculum coherence, and professionalization objectives in LANSOD and LSP contexts.

is “to make the EU ‘fit for 55’ and deliver the transformational change needed across our economy, society and industry” (European Commission, 2021, p. 1).

Reinterpreting the Transductive Relationship for Instructional Design in LANSOD Contexts

Across the three initiatives presented above, the reinterpretation of the transductive relationship plays an instrumental role in structuring sustainability-oriented pedagogical design in LANSOD contexts. Indeed, rather than treating language learning, disciplinary knowledge, and transversal competencies as separate instructional objectives, the model encourages their deliberate and reciprocal articulation through task design, project-based learning, and technology-enhanced environments. Moreover, in each initiative, sustainability functions not merely as thematic content but as a structuring principle shaping learning scenarios and communicative practices. Learners are positioned to mobilize linguistic resources to engage with disciplinary issues related to sustainability, while simultaneously developing transversal competencies such as critical thinking, ethical reasoning, collaboration, and autonomy. This dynamic illustrates the transductive logic of the model, whereby progress in one domain can foster development in the others.

The three initiatives further collectively illustrate how this reinterpretation of the transductive relationship supports a shift from language courses centered on linguistic forms toward communication-oriented curricula anchored in professional and social practices. Whether through simulated professional missions, immersive laboratory environments, or serious-game-based decision-making tasks, language use is indeed embedded in meaningful action, requiring learners to negotiate meaning, make informed choices, and reflect on the social and environmental implications of their decisions.

From an instructional design perspective, the transductive model offers educators a framework for designing learning environments in which language learning becomes inseparable from engagement with complex, real-world issues, particularly those related to sustainability and global challenges. As such, it provides a coherent basis for aligning sustainability education with the professionalization and internationalization objectives that characterize LANSOD contexts. Seen from this perspective, the transductive model also supports a broader redefinition of LANSOD language departments as sites of pedagogical and curricular innovation rather than peripheral service units within higher education institutions. By fostering interdisciplinary dialogue and embedding sustainability into communication-oriented learning environments, language departments can therefore act as levers for curricular transformation.

Embedding Sustainability as a Curriculum Driver

Embedding sustainability as a curriculum driver in LANSOD contexts requires moving beyond the mere inclusion of sustainability-related topics toward a systemic integration of sustainability as an organizing principle for instructional design. As such, the three initiatives discussed above illustrate how sustainability can guide the selection of tasks, the structuring of learning scenarios, and the articulation between language use, disciplinary content, and transversal competencies. Rather than functioning as an add-on or a thematic “wrapper,” sustainability in these initiatives shapes the communicative situations learners are asked to engage with. In this regard, learners are positioned as professionals confronted with complex, real-world challenges (such as environmental risk management, carbon footprint optimization, or ethical decision-making in technological contexts) which require them to mobilize language as a tool for action, reflection, and negotiation. Such an approach aligns with educational perspectives emphasizing the need to address “wicked problems” whose complexity resists linear solutions and demands interdisciplinary and reflective engagement.

At the same time, positioning sustainability as a curricular driver raises the risk of pedagogical greenwashing, whereby sustainability may be reduced to a buzzword or treated superficially without transforming teaching practices or learning objectives. The initiatives presented here thus seek to mitigate this risk by anchoring sustainability in authentic

professional scenarios and by requiring learners to engage critically with disciplinary knowledge rather than merely expressing general opinions or values. However, this alignment cannot be taken for granted and depends heavily on instructors' capacity to design, scaffold, and mediate such learning environments, which highlights the importance of sustained teacher education and professional development in sustainability-oriented LSP curricula (Sterling, 2011; UNESCO, 2017). In this regard, without such support, sustainability risks remaining at a declarative level, thereby weakening both its educational impact and its credibility.

Finally, positioning sustainability as a curriculum driver contributes to aligning LANSOD courses with broader institutional objectives related to professionalization and internationalization. By framing language learning around globally shared challenges, sustainability-oriented curricula encourage learners to situate their professional identities within international communities of practice, thus reinforcing the social responsibility dimension of language education.

Supporting Professionalization and Internationalization

Supporting professionalization and internationalization in LANSOD contexts entails rethinking language learning as preparation for participation in international communities of professional practice rather than as the acquisition of decontextualized linguistic competences. In this vein, the three initiatives presented above illustrate how sustainability-oriented tasks can contribute to this shift by situating learners in professional scenarios that mirror the communicative, ethical, and collaborative demands of contemporary workplaces.

From a professionalization perspective, these initiatives foreground language as a tool for action within complex professional environments as learners are required to negotiate meaning, justify decisions, and articulate expertise in situations where disciplinary knowledge, communication strategies, and transversal competencies are tightly interwoven. As such, rather than claiming measurable professional impact, these initiatives are best understood as creating conditions for professional socialization by exposing learners to forms of discourse and decision-making characteristic of their domains of expertise.

In these initiatives, internationalization is supported not only through the use of English as a working language but also through task design reflecting transnational professional realities. Simulated cross-border negotiations, global supply chains, or internationally shared sustainability challenges encourage learners to engage with diverse perspectives and standards, thereby contributing to forms of internationalization at home (Beelen & Jones, 2015). Sustainability acts here as a catalyst that strengthens the link between professionalization and internationalization, as global challenges such as climate change, environmental regulation, or social responsibility inherently transcend national and disciplinary boundaries. As such, by engaging with these issues through language-mediated tasks, learners are invited to position themselves as professionals operating in a globalized and ethically charged environment. Nevertheless, the transferability of such approaches depends on institutional support and on instructors' capacity to design tasks that balance linguistic objectives, disciplinary relevance and sustainability concerns. These initiatives should therefore be viewed as context-sensitive pedagogical propositions, rather than ready-made models, opening avenues for adaptation across languages, disciplines, and higher education systems.

LANSOD Programs and Language Centers as Institutional Levers for Change

Beyond their pedagogical scope, the initiatives discussed in this article invite a broader reflection on the institutional role of LANSOD programs and language centers within higher

education because, when sustainability is approached not merely as thematic content but as a curricular principle, language departments can function as strategic interfaces between disciplines, professional practices, and institutional priorities.

Indeed, in many higher education systems, LANSOD programs occupy a transversal position; they serve diverse student populations, engage with multiple disciplinary fields, and often align closely with institutional agendas related to internationalization, employability, and innovation. This positioning enables language centers to act as testing grounds for pedagogical experimentation, particularly in areas such as sustainability education, where interdisciplinary dialogue and global perspectives are essential. In this regard, the three initiatives presented here suggest that language departments can contribute meaningfully to institutional sustainability strategies by designing learning environments that foster dialogue across disciplines and professional domains. However, this role requires institutional recognition, cross-departmental collaboration, and alignment with strategic frameworks. The potential of LANSOD programs as levers for change therefore depends as much on governance and institutional culture as on pedagogical design.

Teacher Development and Pedagogical Sustainability

The sustainability-oriented initiatives discussed in this article highlight the extent to which teacher development constitutes a key lever for pedagogical sustainability in LANSOD and LSP contexts. Indeed, designing curricula that meaningfully articulate languages-cultures, disciplinary knowledge, and transversal competencies presupposes educators who are equipped to work across disciplinary boundaries and to engage with complex societal issues. As such, within a transductive pedagogical framework, language teachers are positioned as pedagogical mediators rather than mere transmitters of linguistic knowledge; this role entails the ability to design task-based, project-based, and technology-enhanced learning environments in which sustainability-related issues are addressed through professional scenarios and authentic communicative practices. Such demands reinforce the need for continuous professional development, particularly in areas such as interdisciplinary collaboration, curriculum design, and reflective pedagogy. In this vein, language centers and LANSOD departments can play a structuring role by supporting communities of pedagogical practice that allow teachers to share resources, align objectives, and critically reflect on how sustainability is framed and operationalized. Teacher development also extends to the critical use of educational technologies, as illustrated by the AI-supported pathway, where instructors must guide learners in interpreting and questioning automated feedback rather than delegating pedagogical judgment to digital tools.

By foregrounding teacher development as an integral component of sustainability-oriented LANSOD and LSP education, this section emphasizes that pedagogical sustainability depends on sustained institutional investment in lifelong and lifewide learning if sustainability is to remain a structuring principle of LSP education and if the transductive approach proposed here is to be transferable beyond specific contexts.

Assessment, Evaluation, and Limitations

Assessing learning outcomes in sustainability-oriented LSP and LANSOD curricula raises significant methodological and conceptual challenges. In the initiatives discussed in this article, no systematic empirical evaluation or controlled study was conducted, which limits the extent to which claims about effectiveness can be substantiated. These initiatives should therefore be understood as exploratory pedagogical propositions rather than as empirically validated models.

More broadly, the articulation between language development, disciplinary engagement, and sustainability-related competencies poses persistent challenges for assessment design. While task-based and project-based pedagogies foreground authentic performance and learner engagement, they also raise questions regarding how learning outcomes might be captured in ways that remain both pedagogically meaningful and methodologically robust. In sustainability-oriented contexts, this difficulty is compounded by the fact that competencies such as systems thinking, ethical reasoning, or future-oriented decision-making do not lend themselves easily to discrete or standardized measurement, particularly within language-focused curricula.

This tension points to a structural gap between existing language assessment frameworks and the broader learning objectives associated with sustainability education. On this topic, reference tools such as the Common European Framework of Reference (CEFR) Companion Volume (Council of Europe, 2020) or the European GreenComp Framework (Bianchi et al., 2022) offer valuable descriptors, yet they only partially address the complex interplay between linguistic performance, disciplinary reasoning, and sustainability-oriented reflection that characterizes LSP and LANSOD contexts. Further research is therefore needed to explore how such frameworks might be adapted, combined, or complemented in order to support more holistic evaluation practices.

Finally, the initiatives discussed here are strongly context dependent. They are anchored in a specific institutional setting characterized by adult learners, professional orientations, and strong links to lifelong and lifewide learning. While this context offers fertile ground for sustainability-oriented pedagogy, it also limits direct transferability. These constraints further reinforce the exploratory nature of the projects and underscore the importance of viewing them as starting points rather than prescriptive models, opening avenues for comparative studies and empirical investigations in other educational, linguistic, and cultural contexts.

Institutional Positioning and Epistemological Implications

Beyond pedagogical design and assessment considerations, embedding sustainability in LSP and LANSOD curricula also raises institutional and epistemological questions. Sustainability, when approached as a curricular principle rather than a thematic topic, challenges traditional disciplinary boundaries and calls for renewed forms of academic coordination. In this respect, language departments occupy a strategic yet often underestimated position within higher education institutions as, by operating at the crossroads of languages, cultures, and subject-based contents, LSP curricula are particularly well suited to address complex, transdisciplinary challenges such as sustainability, which cannot be meaningfully approached from a single disciplinary perspective. This positioning therefore invites a re-examination of the epistemological status of language education, not as a service component but as a site of knowledge production and critical inquiry. At an institutional level, this perspective aligns with broader policy orientations promoting responsibility, social engagement, and sustainable development in higher education. However, this expanded role requires institutional recognition, particularly in terms of curricular integration, workload allocation, and support for pedagogical innovation.

Finally, adopting a sustainability-oriented transductive approach implies acknowledging the normative dimension of educational choices, as selecting which sustainability issues are addressed, how they are framed, and which professional practices are valorized inevitably reflects underlying values. Making explicit how sustainability issues are selected and framed is therefore essential to maintaining academic rigor and avoiding purely

declarative uses of sustainability. In this sense, the model proposed here functions not as a prescriptive framework but as a reflective tool for educators.

Conclusion

This article has argued that sustainability can function as a structuring principle supporting the integration of LSP, disciplinary knowledge, transversal competencies, and intercultural awareness in higher education. Drawing on a revised version of the transductive relationship model (see Figure 2), the three pedagogical initiatives presented here have illustrated how sustainability-oriented designs can foster meaningful, contextualized, and potentially transferable learning experiences at the intersection of language development, professionalization, and global citizenship.

Taken together, these initiatives demonstrate that embedding sustainability in LSP and LANSOD courses is both feasible and pedagogically relevant when language learning is framed through authentic tasks and professional scenarios. As such, rather than treating sustainability as a thematic add-on, the projects show how language instruction can become a space for engaging with real-world issues, encouraging learners to reflect critically, think systemically and act responsibly in complex professional environments. Linguistic development is thus closely intertwined with broader educational aims related to ethical reasoning, collaboration, and societal awareness.

The discussion has also highlighted the extent to which sustainability-oriented LSP and LANSOD curricula can contribute to broader institutional missions, particularly professionalization and internationalization. By mirroring professional practices, mobilizing English as a working language, and addressing global challenges, LANSOD and other LSP programs can prepare students for diverse career trajectories and transnational work environments. At the same time, such approaches offer a means of revitalizing language education in higher education by repositioning it as a strategic component of institutional development rather than a peripheral service.

Nevertheless, the initiatives discussed in this article remain exploratory in nature and open several avenues for further development. In this regard, scaling up such projects requires sustained institutional support, including adequate resources, coordination, and recognition of pedagogical innovation. Similarly, the operationalization of a sustainability-oriented transductive model raises important questions regarding assessment, as existing evaluation practices need to be adapted to capture not only language proficiency but also transversal competencies such as systems thinking, intercultural dialogue, and ethical reasoning.

More broadly, adopting a holistic approach to curriculum design implies strengthening interdisciplinary collaboration between language educators, subject specialists, and educational technologists, while ensuring that issues of equity, access, and inclusion remain central to sustainability agendas. From a research perspective, further studies are thus now needed to investigate the longer-term effects of sustainability-driven language curricula on learner engagement, professional trajectories, and civic awareness. In this regard, comparative research across countries, disciplines, and institutional settings would be particularly valuable in identifying transferable strategies and contextual constraints. Examining practices developed in other European contexts where language centers are, for instance, closely aligned with sustainability policies could also yield important insights into the role of governance structures and institutional cultures in shaping sustainability-oriented LSP curricula. The development of international networks among language centers (Brudermann, 2025) represents a promising avenue for driving innovation in this field. European frameworks and funding schemes already encourage transnational collaboration, and sustainability-oriented LSP initiatives provide fertile ground for shared curriculum design,

joint material development, and comparative evaluation. Such cooperation could thus enhance the visibility of sustainability within language education and contribute to the emergence of a more coherent European agenda for sustainable higher education.

In a context marked by climate change, social inequalities, and digital transformation, higher education is increasingly called upon to produce graduates who are not only skilled but also critically aware and socially engaged. This study suggests that language educators are uniquely positioned to contribute to this mission by embedding sustainability into language learning. However, achieving this ambition within a lifelong and lifewide learning perspective also presupposes sustained investment in teacher education and professional development (Brudermann, 2024; Brudermann, forthcoming), so that educators themselves are equipped to design, implement, and critically reflect on sustainability-oriented pedagogies. Only under these conditions can language education fully play its role in fostering a multilingual, ethical, and holistic understanding of the global challenges learners will be required to address (Grosbois et al., 2022).

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