

CULTIVATING SYSTEMIC THINKING THROUGH EDUSEMIOTICS AND HOLISTIC LANGUAGE EDUCATION

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Abstract. *The increasing complexity of global ecological challenges necessitates the development of systemic thinking and relational awareness in education, particularly in disciplines connected to life sciences. This paper explores how holistic language education, grounded in the principles of edusemiotics, can foster ecological literacy and cultivate learners' capacity to understand interconnected systems. The paper highlights the need to develop a systemic and relational understanding as the basis underlying the domain of language interactions for the purpose of better integrating sustainable concepts related to the life sciences. Ecological issues and the need to develop critical skills such as ecoliteracy and ecological awareness have become relevant topics in academic environments across disciplines of study, especially in the Life Sciences. Students from the University of Life Sciences 'King Mihai I' from Timisoara specializing in fields related to this area of study (agriculture, horticulture, genetics, biology, biotechnologies, food and animal science, veterinary medicine, etc.) are encouraged to grasp the fact that we are not independent of the world around us and we have to take into account that social/cultural/biological entities and phenomena are interrelated at many levels in highly dynamic processes. It is through language and communication that we become capable of making these connections and understanding the relevance of these aspects from a holistic point of view in order to study and to live sustainably. In this context, we infer the need to develop systemic thinking and a relational approach underlying linguistic interactions while learning English for the Life Sciences.*

Keywords: *English for Specific Purposes (ESP), ecolinguistics, semiotics, teaching, humanities, life sciences.*

INTRODUCTION

Education is increasingly recognized as a critical vector for cultivating ecological literacy and promoting sustainable living. As Stone and Barlow (2005) note, a meaningful, enduring relationship between human societies and the natural environment requires that learners acquire not only factual knowledge, but also a deep awareness of the processes governing living systems and the ways humans can engage with them responsibly. In this sense, ecological literacy involves understanding interdependencies among biological, social, and cultural phenomena, and appreciating the dynamic processes through which these systems operate (CHARDIN, 1999; MATURANA, 2000). The failure to instill such systemic awareness contributes to ongoing ecological crises, underscoring the need to reform educational models to emphasize relational thinking, critical reflection, and systems-oriented reasoning.

Within this context, language emerges as a powerful medium for cultivating understanding and fostering sustainable attitudes (REȘEANU, 2020; RECEANU & TILEA, 2020). By engaging with linguistic structures and communicative practices, learners develop the cognitive and interpretive tools necessary to identify connections among diverse phenomena and to act with ecological mindfulness. Holistic language education, informed by edusemiotics, positions learning as a relational and systemic process rather than a linear acquisition of facts.

Edusemiotics, grounded in the semiotic philosophy of Charles Sanders Peirce, reconceptualizes learning as a continuous process of meaning-making (PEIRCE, 1998). Knowledge emerges through semiosis, the fundamental process of interpreting signs within social, cultural, and ecological networks. From an edusemiotic perspective, learning is inherently relational and situated. Meaning emerges through interaction within communities and engagement with broader ecological contexts, reinforcing the dialogic and systemic nature of educational processes (SEMETSKY, 2010).

Edusemiotics frames learning and living as deeply interconnected processes, both of which can be understood as continuous semiotic activity (STABLES, 2006). In this view, individuals constantly engage with signs and signals by interpreting, responding to, and utilizing them through both conscious and unconscious mechanisms. Such a perspective shifts educational thinking away from reductionist or dualist frameworks, emphasizing that cognition and bodily experience are inseparable. As Stables and Semetsky (2015) argue, if life itself is a process of semiosis, then reality is simultaneously meaning-laden; there is no strict division between an external, objective world and an internal, subjective one. This insight aligns with biosemiotic principles, which propose that semiosis and the processes of life are coextensive (HOFFMEYER, 2008), reinforcing the idea that learning, understanding, and living are mutually constitutive phenomena.

Drawing on edusemiotic theory, the paper argues that learning emerges through meaning-making processes embedded in ecological and biological contexts, challenging long-standing dichotomies such as human versus non-human and culture versus nature. Methodologically, the study employs a conceptual and integrative literature analysis to synthesize insights from semiotics, educational theory, and ecolinguistics (BOGUSŁAWSKA-Tafelska, 2016). The discussion highlights how ESP can benefit from ecologically grounded didactic strategies that recognize learners as active interpreters situated within dynamic environments. Furthermore, the article proposes that integrating perspectives from the life sciences enhances pedagogical approaches by emphasizing continuity, adaptation, and interaction. Ultimately, this study concludes that rethinking education as a system designed to facilitate ongoing semiosis allows for more inclusive, adaptive, and context-sensitive teaching practices (CAPRA, 2005). Such an approach not only broadens the scope of language education but also contributes to a more holistic understanding of learning as a universal and life-sustaining phenomenon. This perspective frames learning as an inherent characteristic of all living systems, thereby positioning education as a structured support mechanism that operates in service of learning. This article explores the implications of such a reconceptualization for English for Specific Purposes (ESP), language education, and interdisciplinary pedagogy across the humanities and life sciences.

MATERIAL AND METHODS

A qualitative methodology informed by biosemiotics and ecolinguistics is proposed to examine pedagogical strategies that integrate systemic thinking and relational understanding into English language instruction for students in the life sciences (DRAGOESCU URLICA & STEFANOVIĆ, 2018). Data collection would include classroom observations, learner interviews, and analysis of language production in context. This approach allows for the examination of semiotic interactions and relational reasoning as students engage with ecological content in the target language. The study emphasizes interpretive and reflective methodologies, consistent with the principles of edusemiotics and systemic learning (SEMETSKY, 2013; HOFFMEYER, 2008).

RESULTS AND DISCUSSIONS

This paper inquires into the possibilities of pursuing the educational need of developing ecological literacy through ecolinguistics and edusemiotics. Rooted in the semiotic philosophy of Charles Sanders Peirce, edusemiotics reconceptualizes learning as an open-ended, interpretive process grounded in the continuous production and transformation of meaning. Rather than viewing knowledge as a stable body of information to be transmitted, this approach understands learning as semiosis, i.e. an ongoing activity in which individuals engage with signs, generate interpretations, and refine them through experience and reflection. Within this framework, reasoning is not limited to deduction or induction but is fundamentally driven by abduction, the creative inferential process through which learners explore new possibilities of understanding (PEIRCE, 1998). At the same time, the principle of fallibilism underscores that all knowledge remains provisional and subject to revision, positioning error correction as a productive strategy of learning (PEIRCE, 1998).

Developing “ecological literacy” has become an essential as part of the ecolinguistic endeavour, as the pursuit of sustainability depends fundamentally on education (URLICA, COROAMA-DORNEANU, KAMBERI, MALENKO, 2019). A viable and enduring relationship between human societies and the natural world can only be achieved if younger generations learn to understand and cooperate with natural systems in ways that benefit both. This ability draws on “ecological literacy,” which refers not simply to knowledge about the environment, but to a deeper awareness of how living systems function and how humans can responsibly participate in them. From this viewpoint, the current ecological crisis is also, to a significant extent, a failure of education and an indication that prevailing educational models have not adequately prepared individuals to think systemically or act sustainably. As a result, education must be reimagined so that both teaching practices and our interactions with the natural environment are grounded in an understanding of complex systems. This approach fosters the recognition that actions in one domain often have cascading effects across multiple levels of a system, a principle central to sustainability education (Capra & Luisi, 2014; Sterling, 2001). Also, language education encourages learners to recognize patterns of interdependence, and students are encouraged to apply systemic reasoning in decision-making (Stibbe, 2015).

From an edusemiotic standpoint, learning is a relational and situated process that unfolds within social, cultural, and ecological contexts, rather than an isolated cognitive act (URLICA, STEFANOVIC, KAMBERI, BOGUSLAWSKA-Tafelska, 2021). Meaning emerges through interaction among individuals, within communities and the broader environment, which highlights the fundamentally systemic nature of education (STABLES, 2012; SEMETSKY, 2010). Consequently, edusemiotics advances a holistic vision of pedagogy that prioritizes inquiry, interpretation, and responsiveness over traditional acquisition. It encourages learners to become active participants in the co-construction of knowledge, capable of navigating complex networks of signs and adapting their understanding in response to changing conditions. In doing so, it aligns education with the dynamics of living systems, fostering not only intellectual development but also a deeper awareness of the interconnected processes that shape human experience and the world at large.

Understanding learning as a semiotic process offers a conceptual framework for reconsidering its role beyond formal educational settings. From this perspective, learning holistically re-framed, goes beyond institutionalized instruction, allowing education itself to be reconceptualized as a structured system designed to support and facilitate learning processes (OLTEANU & CAMPBELL, 2018:254). Such an approach promotes an ecological and biologically informed view of education, challenging traditional dichotomies between humans

and other conscious participants in nature, as well as between culture and nature. It emphasizes the continuity of learning across all forms of life, suggesting that every specific living environment or the subjective perceptual world of an organism, possesses inherent educational potential (OLTEANU, 2016).

Furthermore, the emergence of ecolinguistics also strives to “bridge the gap between linguistics and life sciences” (KRAVCHENKO, 2016), leading to a more integrated perspective in which language is no longer treated as an isolated system, but deeply embedded within ecological interactions (Cowley, 2014). Furthermore, language is not merely a tool for communication, but it becomes part of a broader, dynamic network of life, contributing to and shaped by the same principles that govern living systems. Expanding on this view, Kravchenko (2020a:26) characterizes linguistic interaction as a crucial ecological force that both influences and sustains the development of individuals and societies understood as evolving living systems. In this sense, language plays an active, constitutive role in human existence, rather than functioning as a passive medium, and the study of languages in relation to ecology is seen as essential. Consequently, by situating language within an ecological framework, the study of language itself gains new significance, emerging as a central component of human ecology (FILL & STEFFENSEN, 2014). This perspective highlights how linguistic practices are intertwined with environmental, cultural, and social conditions, shaping how we perceive, interpret, and engage with the world around us.

The importance of recognizing interconnectedness is further emphasized by Bateson (2000), who underscores the systemic nature of relationships between organisms and their environments. He argues that a failure to understand and respect these systemic relationships inevitably leads to negative consequences, noting that any species that comes into conflict with its ecological context will ultimately face repercussions. His notion of “systemic wisdom” points to the necessity of perceiving the complex, interdependent patterns that sustain life, rather than viewing human activity as separate from or dominant over nature. Reflecting on the interdependence of biological systems at the level of individuals, culture, and ecology, Bateson (2000) reflects how important it is to perceive the systemic character of relationships unfolding between us and the environment: “Lack of systemic wisdom is always punished; [...] the systems are nonetheless punishing of any species unwise enough to quarrel with its ecology”. KRAVCHENKO (2020a:26) extends this argument to the domain of language, addressing this very situation, as humans have been “quarreling with their ecology defined by the relational domain of language” by neglecting the systemic aspects we are part of. For that reason, ignoring the ecological nature of language as a relational domain obscures our understanding of the processes that shape both individual and social cognition.

In neglecting to see language as part of a larger ecological system, we risk misunderstanding how meaning, cognition, and social organization emerge. Ignoring the ecological dimension of language thus obscures the processes through which both individual thought and collective knowledge are formed and evolve. On the contrary, recognizing the relevance of ecoliteracy, as well as the relevance of language as an ecological phenomenon allows for a more comprehensive understanding of how humans coexist within and co-create their environments.

In conclusion, we summarize the pedagogical Implications of implementing edusemiotics and ecoliteracy in language instruction, which involves creating learning environments that prioritize dialogue and active meaning-making. Thus, educators are encouraged to:

1. Integrate ecological content into language activities to cultivate ecological literacy.

2. Foster interpretive skills through collaborative exercises and reflective discussions.
3. Encourage learners to generate hypotheses and critically evaluate information, promoting abduction as a core reasoning skill.
4. Highlight the relational and systemic aspects of human-environment interactions to reinforce interconnected thinking.

Developing language competence within this framework involves several dimensions. First, learners must acquire disciplinary literacy, including the specialized terminology, textual structures, and discourse conventions of the life sciences. Mastery of these linguistic tools enables precise and nuanced communication about biological, ecological, and technological systems (LEMKE, 2000; KRESS, 2010). Second, learners must cultivate interpretive competence, the ability to decode and analyze the semiotic complexity of scientific texts, images, graphs, and models. EDUSEMIOTICS emphasizes that understanding meaning is always situated within relational contexts; thus, learners are encouraged to link linguistic signs to broader social, cultural, and ecological networks (HOFFMEYER, 2008; SEMETSKY, 2013).

Such pedagogical strategies are likely to enhance the learners' language competence and also develop their capacity for holistic reasoning and sustainable decision-making. By engaging in hypothesis generation and problem-solving discussions, learners expand their expressive and analytical capacities, exploring new ways of connecting concepts and communicating their insights (PEIRCE, 1998). This process enhances both cognitive flexibility and linguistic adaptability, fostering the ability to articulate complex ideas in multiple modes of representation, including oral, written, and visual semiotic forms (KRESS, 2010; LEMKE, 2000).

Finally, developing language competence within an ecologically oriented curriculum contributes directly to ecolinguistic awareness. Learners become capable of recognizing how language choices reflect and shape human interactions with the environment, enabling them to critique unsustainable narratives and promote ecological responsibility through communication (KRAVCHENKO, 2020b; STIBBE, 2015). In this sense, language competence is inseparable from systemic thinking: learners who can navigate and produce complex linguistic and semiotic networks are better equipped to understand and act within the interconnected systems of the life sciences.

Reconceptualizing (language) learning as a semiotic and continuous process has profound implications for education. By integrating linguistic, semiotic, and ecological dimensions into language education, educators can foster learners who are not only proficient in English for the Life Sciences but also capable of interpreting, reflecting, and communicating in ways that advance sustainability, critical thinking, and relational awareness. This holistic approach positions language competence as a dynamic skill set, enabling learners to participate meaningfully in scientific, social, and ecological discourse while reinforcing systemic thinking.

As it has been shown, ESP provides a particularly suitable context for applying edusemiotic principles. Because it focuses on language use in specific domains, ESP inherently involves meaning-making within specialized environments. By adopting a semiotic perspective, educators can move beyond rigid curricula and encourage learners to actively interpret and negotiate meaning. Didactic strategies informed by edusemiotics might include task-based learning, problem-solving activities, and collaborative projects that simulate real-world scenarios. These approaches emphasize the dynamic and context-dependent nature of language, aligning with the view of learning as continuous and adaptive. For ESP and language education in particular, this perspective opens new possibilities for developing adaptive, context-sensitive teaching strategies. By recognizing learners as active participants in dynamic environments, educators can create more engaging and effective learning experiences.

Furthermore, integrating insights from the humanities and life sciences enriches educational practice by emphasizing interconnectedness and continuity. Ultimately, this approach fosters a more inclusive and holistic understanding of learning, transcending disciplinary boundaries and acknowledging the complexity of the learning experience.

In conclusion, bridging the humanities and life sciences offers additional opportunities for innovation. The humanities contribute insights into meaning, culture, and interpretation, while the life sciences provide an understanding of biological processes and ecological systems. Together, they present us with a comprehensive framework for understanding learning as both a cultural and natural phenomenon. This integration can lead to more holistic educational practices that address cognitive, emotional, and environmental dimensions of learning. It also supports the development of critical thinking skills by encouraging learners to consider multiple perspectives and disciplines. It shifts the focus from institutional structures to the broader processes of meaning-making that characterize all forms of life. In doing so, it redefines education as a system designed to support and enhance these processes rather than to control or contain them.

CONCLUSIONS

The paper has demonstrated that ecolinguistics complements edusemiotics in the educational endeavour we have advanced, by exploring the relationship between language and ecological systems. We have highlighted the importance of language and interdisciplinary systemic thinking, in that linguistic practices shape, reflect, and influence human interactions with the environment. Through critical engagement with language, learners become aware of the ecological consequences of communication, including the propagation of narratives that either support or undermine sustainability. Developing ecological literacy through language education encourages learners to recognize patterns of interdependence, both human and non-human, and to apply systemic reasoning in decision-making.

Thus, students in life sciences, such as agriculture, horticulture, biology, veterinary medicine, and biotechnology, are encouraged to comprehend the intricate interconnections among biological, social, and cultural systems. Beyond disciplinary knowledge, understanding the relational dynamics of ecosystems and human practices requires systemic thinking. Language, particularly through English for the Life Sciences, functions as a tool for articulating these relationships and fostering a holistic awareness of the interdependence of natural and human systems. Building sustainable communities, therefore, calls for a profound transformation in what is taught, how it is taught, and the broader aims of education. Only by fostering ecological literacy at all levels can education equip individuals to engage constructively with the environment and contribute to a more balanced and sustainable future.

In sum, edusemiotics and ecolinguistics provide complementary frameworks for integrating systemic thinking into language education. By positioning learning as a relational, interpretive, and situated process, educators can cultivate ecological literacy and foster the development of learners capable of understanding and responding to complex socio-ecological systems. In life sciences education, this approach equips students with the cognitive tools necessary to navigate interdependent systems, make informed ethical choices, and engage in sustainable practices. Future research should continue to explore empirical applications of edusemiotic pedagogy across disciplines, emphasizing the dynamic relationship between language, pedagogy, and ecological awareness.

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