

Integrating Environmental Education into English Language Teaching: An AI-Supported Approach

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ABSTRACT

This conceptual paper explores the framework of a "Dual Learning Path" for English language instruction, which integrates environmental themes with AI-powered tools to enhance learner engagement and outcomes. It argues that anchoring language learning in real-world issues like plastic pollution fosters motivation, critical thinking, and social awareness by providing a meaningful context for communication, aligning with CLIL principles. Simultaneously, AI tools are presented as crucial for personalizing learning and promoting autonomy. While the synergy of content and technology offers a transformative approach to L2 education, the paper acknowledges that its success depends on overcoming challenges related to teacher readiness and institutional support.

Keywords: Content and Language Integrated Learning (CLIL), AI-powered language learning, Dual Learning Path.

INTRODUCTION

Learners require a positive learning environment to sustain their motivation—for instance, it is an advantage when learners can learn in psychological safety and a respectful environment, in a supportive structure, and through relevance and autonomy (Hosseini et al., 2022). In relation to learning through relevance and autonomy, learners are to be exposed to content that is connected to the real-world context, and they will be given opportunities to participate in activities that encourage collaboration, creativity, and critical thinking (Wei, 2023; Vo, 2023).

Hence, English instruction can be more meaningful not only when learners are exposed to learning grammatical skills, syntactic structure, and comprehension skills, but also when the lessons are integrated with the real-world content (Vo, 2023). Themes such as environments, social issues, current trends, professional communication, and so forth can be integrated into English instruction, which can boost learners' motivation and foster a deeper connection to the learning process (Hosseini et al., 2022). Learners will benefit from the lesson when they achieve both knowledge and skills—for example, language accuracy and the real-world content that has been discussed during the English lesson (Wang & Yeh, 2024). For instance, during the classroom activities, learners will have the opportunity to discuss topics that are within their prior knowledge. Environmental issues are one of the themes that encourage learners to speak up, to engage in argumentation, to offer comments, or even to propose solutions, as they are closely connected to learners' personal and social realities (Hosseini et al., 2022). As a result, learners' motivation and engagement can be reinforced meaningfully (Wang et al., 2023). Hence, Rezaei and Salehi (2022) support this instructional concept when mentioning that this instructional approach is beneficial, as it can promote communicative competence and also nurture learners' critical thinking and social awareness. Learners are also equipped to apply the English language outside the classroom setting naturally—without fear—when they engage with meaningful real-world content (Lee & Lee, 2020). In light of this, Wang et al. (2023) support the idea that learners will gain confidence with this approach when they can express themselves, reflect, and solve problems outside the classroom independently.

Language learning can be natural, fun, and successful when the instruction is designed and organized systematically (Lăpădat & Lăpădat, 2024). Some motivational factors are, in fact, key sources to help L2 language learners to proceed with the learning and stay motivated to continue learning (Tai & Zhao, 2022). The learning can be beyond the learners' expectation when the content delivered involves their background knowledge and experiences that connect to the real world (Thohir, 2017). Learners experience a sense of openness during classroom discussion, in which they can predict that the learning can become manageable along the way. Hence, language instructors may use their creativity to include the discussion topics that are within the learners' knowledge to enhance the language lessons. With topics such as environmental themes, learners are able to discuss naturally and may have ideas to interrogate, argue, or share their experiences (Hasrina et al., 2024). This task boosts learners' motivation, as they have no fear of voicing out their thoughts (Thanya & Suganthan, 2023). When learners gain confidence during the discussion, they will think that language learning, for example the learning of grammar, is manageable and within their ability (Thanya & Suganthan, 2023). The comfort that they feel during the discussion can help them to be ready to accept the new lesson. In addition, these learners may be more excited and motivated when the delivery mode and the classroom instructions are integrated with AI-powered learning tools (Wei, 2023; De La Vall & Araya, 2023). This effort connects to and matches the new generations in terms of adapting to their lifestyles as well as their learning preferences (Wei, 2023). The normal classroom settings can be improved when such efforts are fulfilled, whereby learners will have the opportunity to apply language skills while understanding better the issues that they have discussed without stress.

However, not all classroom settings may share the same opportunities and benefits. Challenges and obstacles along the instructional process are the limitations to making it a success. Learning readiness is essential, as learners may disengage from the learning and become passive when they are uncertain about their abilities or perceive the content as irrelevant (Hamzah et al., 2021). Hence, language instructors should play crucial roles in designing an engaging and appropriate lesson for these learners (Nor et al., 2022). This instructional stage should be the main focus to ensure that learners are comfortable participating during the learning session (Hamzah et al., 2021). Moreover, language instructors may have problems in designing learner-centered lessons that can incorporate environmental themes and AI tools into their language lessons (Sujatna et al., 2024). Sujatna et al. (2024) added that this issue is often due to limited technological resources and instructors' expertise and skills. The instructors too may lack access to materials that effectively integrate real-world content with the grammar or language instructions—making the lesson plans become more complex. This pressure becomes more critical when the learning institutions have constraints over their rigid curricula or perhaps insufficient professional development that can hinder the integration of learner-centered approaches and technological advancements (Nurassyl et al., 2023).

Hence, further investigation is needed to explore how environmental themes, for instance, the plastic pollution topic, can be systematically embedded into language instruction to enhance critical thinking and social awareness. It is equally important to examine how AI-powered tools can be effectively utilized to support language classroom instruction that promotes learners' autonomy. The investigation should also consider the necessity and the effectiveness of adopting a dual learning path to cater to learners' preferences and to improve the current language instructions.

LITERATURE REVIEW

Integrating Environmental Themes into Language Education

One of the most pressing environmental themes today is pollution—specifically, plastic pollution (Kumar et al., 2021; Bidashimwa et al., 2023). This issue directly affects people of all ages (Thushari & Senevirathna, 2020), as plastics are often seen polluting beaches, rivers, and even public spaces (Azevedo-Santos, 2021). Such pollution harms wildlife and threatens human health (Wang, 2021) while also disrupting ecosystem stability by jeopardizing species survival (Windsor, 2019). This is a distressing and heartbreaking reality (Bidashimwa et al., 2023). Learners, too, may have encountered this issue and can share thoughts and opinions during classroom discussions (Prata et al., 2019). According to Prata et al. (2019), such discussions often involve argument, interpretation, reflection, critique, and justification. Building on this idea, Kazazoglu (2025) argues that these forms of engagement improve learners' critical thinking and deepen their awareness of real-

world challenges. Consequently, discussion provides opportunities to enhance learners' English language competency through the purposeful use of vocabulary, grammar, and syntactic structures (Yu et al., 2024). Moreover, classroom discussions can be extended into other effective activities such as reading, writing, and listening tasks (Kazazoglu, 2025). These follow-up activities enrich learners' language skills while encouraging them to generate more insightful ideas for addressing pollution (Yu et al., 2024). Learners thus gain experience in language classes not only to become linguistically proficient but also to develop social and environmental responsibility, particularly when English lessons are integrated with environmental themes (Kazazoglu, 2025). Through this pairing of language and environmental content, learners may be more motivated to apply their language skills outside the classroom and contribute ideas more effectively and professionally.

Learners are observed to prefer personalized learning environments (Wang et al., 2024). As Wang et al. (2024) explain, learning should shift toward a more learner-centered rather than teacher-centered approach (Chen et al., 2020). Preferences such as learning at one's own pace, place, and time should be taken seriously, as they improve learners' autonomy, confidence, and engagement (Kamalov et al., 2023). In today's context, the inclusion of technology in everyday life is undeniable (Chen et al., 2020; Kamalov et al., 2023). Technology benefits educators, content developers, learning institutions, and education-related agencies (Hamal et al., 2022; Bulathwela et al., 2024). With the rise of Artificial Intelligence (AI) in education, technology has once again become central to teaching and learning (Bulathwela et al., 2024). AI-powered tools benefit language learning by enabling rapid material development, designing and facilitating learning activities, and personalizing instruction to meet learners' needs (Zhang & Aslan, 2021). Hence, educators—particularly language practitioners—need to seize this opportunity not only to access ready-made materials but also to develop and enhance their own technological skills (Walter, 2024). They must not be left behind as learners increasingly integrate AI-generated technology into their daily routines (Dogan et al., 2023).

Content and Language Integrated Learning (CLIL) – The Theory (Dual Learning)

Content-based instruction involves teaching language through meaningful topics (e.g., pollution, war, poverty, world hunger, water crisis) rather than through isolated grammar drills. Environmental themes can be embedded into any subject—arts, science, or humanities—and encourage natural acquisition, as students focus on understanding content while actively using language. Environmental issues are particularly suitable for language classes because they are current, global, and interdisciplinary. When students read, listen, and speak about these topics, they acquire vocabulary, grammar, and structures in context while also being encouraged to think analytically.

By integrating environmental literacy with English Language Teaching (ELT), students are prepared not only to use English but also to develop social awareness as global citizens who strive to make the world a better place. This supports the United Nations' Sustainable Development Goals, particularly Goal 13 on climate action, and aligns with the principles of Content and Language Integrated Learning (CLIL). CLIL is defined as both the learning of another subject such as physics or geography through a foreign language, and the learning of a foreign language through the study of a content-based subject (Darn, n.d.).

Teaching Strategies/Approaches Using Real-world Topics for English Language Instruction

Educators around the world have increasingly integrated technology into English language instruction, acknowledging the benefits of digital resources in supporting second language learning. Research on Computer-Assisted Language Learning (CALL) and Mobile-Assisted Language Learning (MALL) consistently shows that these approaches yield superior L2 learning outcomes compared to traditional or non-digital methods (Chen et al., 2020). Studies have further highlighted that educational apps and digital platforms play a significant role in enhancing vocabulary acquisition, a key aspect of language proficiency (Chen et al., 2019; Dağdeler 2023). The widespread use of mobile devices in everyday life has contributed to the growth of MALL, allowing learners to practice language skills anytime and anywhere. This flexibility and accessibility foster higher levels of learner motivation and engagement, which, as Dağdeler (2023) notes, are crucial to successful language acquisition.

AI can also serve as an effective teaching partner, and the notion that AI will replace teachers is largely unfounded. Instead, AI tools assist teachers in a wide array of areas, from material creation to adapting content for multiple proficiency levels, while also sparking teacher creativity. They can quickly adjust lessons, generate varied activities, and free teachers to focus on facilitating learning. Some examples of AI tools for lesson creation include ChatGPT for instant educational content (texts, practice activities, Q&A); Quizizz and Quizlet for gamified learning; Canva for visually engaging presentations and collaborative projects; and Edpuzzle for transforming videos into interactive lessons with embedded quizzes and progress tracking.

AI-Powered Tools in Supporting English Language Instruction

The integration of Artificial Intelligence (AI) into education has moved from a futuristic concept to a practical reality, offering transformative potential for English Language Teaching (ELT). AI-powered tools are not merely digital supplements but are redefining pedagogical approaches by enabling unprecedented levels of personalization, interactivity, and efficiency. These tools align perfectly with the learner-centered paradigm shift, addressing the demand for learning that is adaptable to individual paces, preferences, and proficiency levels (Wang et al., 2024; Kamalov et al., 2023).

The core strength of AI in ELT lies in its ability to provide personalized learning experiences. As Zhang et al. (2021) note, AI systems can analyze a learner's performance in real-time, identifying strengths and weaknesses in specific areas such as vocabulary acquisition, grammatical accuracy, or pronunciation. This allows for the automatic generation of customized exercises and remedial activities, ensuring that each learner is appropriately challenged and supported. This personalization is a key factor in fostering learner autonomy and maintaining motivation, as students engage with material that is directly relevant to their needs (Hosseini et al., 2022). Furthermore, AI-powered platforms can facilitate immersive practice through conversational agents and chatbots, providing learners with a low-anxiety environment to practice speaking and receive instant, non-judgmental feedback, thereby building confidence for real-world communication (Dogan et al., 2023).

For educators, AI acts as a powerful assistant, alleviating administrative burdens and enhancing instructional design. Tools like ChatGPT can rapidly generate reading passages, dialogue scenarios, and comprehension questions on any topic, including specific environmental themes like plastic pollution, tailored to different language levels. This capability directly supports the integration of real-world content advocated by Vo (2023) and Wei (2023). Similarly, platforms like Quizlet use AI to create adaptive flashcards and games, while Edpuzzle can help teachers quickly develop interactive video lessons. This efficiency frees up instructors to focus on higher-order teaching activities, such as facilitating critical discussions and collaborative projects, thus moving from a knowledge-deliverer to a learning-facilitator role (Walter, 2024).

However, the effective implementation of these tools is contingent upon addressing significant challenges. Issues of equitable access to technology, data privacy, and the risk of over-reliance on AI-generated content must be carefully considered. Most critically, as Walter (2024) emphasizes, there is a pressing need for professional development to equip teachers with the digital literacy and pedagogical skills necessary to critically evaluate and effectively integrate AI tools into their curriculum. The success of AI in language instruction ultimately depends on the teacher's ability to guide, contextualize, and complement the technology with human interaction and empathy.

In the context of the "Dual Learning Path," AI-powered tools provide the essential technological scaffold. They operationalize the personalization and autonomy required to explore complex environmental content deeply. By handling differentiated instruction and skill practice, AI allows the classroom to become a space where learners can fully engage in the critical thinking and meaningful communication that the environmental themes provoke, creating a cohesive and powerful learning ecosystem.

DISCUSSION

The findings of this inquiry affirm the significant potential of integrating environmental themes with AI-powered tools to create a dynamic and effective "Dual Learning Path" for English language instruction. This

discussion synthesizes the pedagogical implications, practical applications, and inherent challenges of this approach, as illuminated by the existing literature.

First, the integration of a real-world theme like plastic pollution serves as a powerful catalyst for engagement and critical thinking, directly addressing the learner's need for relevance and psychological safety (Hosseini et al., 2022; Wang et al., 2023). As Prata (2019) and Kazazoglu (2025) suggest, discussing a tangible issue like pollution transforms the language classroom from a place of abstract skill practice into a forum for genuine communication. Learners are not merely constructing grammatically correct sentences; they are arguing, justifying, and proposing solutions to a problem they recognize from their own lives. This process naturally fosters the deeper connection to learning that Vo (2023) and Wei (2023) advocate, moving beyond syntactic mastery to develop social awareness and critical thinking, as supported by Rezaei et al. (2022). This alignment with Content and Language Integrated Learning (CLIL) principles ensures that students acquire language competencies through engaging with meaningful content, thereby preparing them to act as informed global citizens.

Second, the role of AI-powered tools in operationalizing this integration is paramount. The literature consistently highlights the shift towards learner-centered education and the demand for personalized learning (Wang et al., 2024; Chen et al., 2020). AI tools, as discussed by Zhang and Aslan (2021) and Bulathwela et al. (2024), are uniquely positioned to meet this demand. They are not merely technological novelties but essential partners in creating the supportive structure necessary for autonomy and motivation (Hosseini et al., 2022; Kamalov et al., 2023). For instance, tools like ChatGPT can instantly generate differentiated reading passages on plastic pollution tailored to various proficiency levels, while platforms like Quizizz and Edpuzzle can gamify comprehension checks. This aligns with the proven benefits of CALL and MALL (Chen et al., 2018), demonstrating that technology can make learning more accessible, engaging, and efficient, thereby boosting learner confidence and autonomy (Wang et al., 2023; Dağdeler, 2023).

However, the successful implementation of this dual path is not without challenges, as preliminarily noted. The promise of AI and content integration is contingent upon instructor readiness and institutional support. The concerns about limited technological resources, instructor expertise, and rigid curricula are significant barriers (Walter, 2024). For the dual path to be viable, professional development for educators is crucial. Teachers must transition from being sole knowledge providers to becoming designers of learning experiences who can effectively curate and manage AI-generated content. This requires a shift in pedagogical mindset and sustained institutional investment in training and resources, ensuring that instructors are equipped to overcome the complexity of lesson planning and fully harness the potential of these tools.

The integration of environmental education with English Language Teaching (ELT) through an AI-supported approach presents a promising pedagogical model. However, its successful implementation is contingent upon overcoming several instructor-level challenges. This discussion synthesizes the literature to address three critical issues: the difficulty in designing for learner autonomy, the preparedness of instructors, and the complexity of assessment within a dual learning path.

Issue 1: Designing for Learner Autonomy and the Need for Strategic Guidance

A central tenet of this integrated approach is fostering learner autonomy, where students take charge of their learning process (Wang et al., 2024; Kamalov et al., 2023). However, promoting autonomy is often misinterpreted as a hands-off approach from the instructor, which can lead to learner uncertainty and disengagement (Hamzah et al., 2021). The literature suggests that autonomy is not innate but must be carefully scaffolded within a "supportive structure" that provides psychological safety and relevance (Hosseini et al., 2022, p. 1). Vo (2023) clarifies that making tasks relevant is a key classroom practice for fostering engagement, which is a precursor to genuine autonomy. When tackling complex, real-world themes like plastic pollution—a crisis that harms freshwater biodiversity (Azevedo-Santos et al., 2021) and is a pressing global health concern (Bidashimwa et al., 2023)—learners require clear guidelines and structured tasks to channel their critical thinking and argumentation effectively (Prata et al., 2019; Kazazoglu, 2025).

This is where AI-powered tools can be instrumental in operationalizing guided autonomy. Tools like ChatGPT can generate leveled reading materials on these urgent issues, allowing learners to explore content at their own pace, thereby promoting "relevance and autonomy" (Hosseini et al., 2022; Wei, 2023). Similarly, platforms like Quizizz or Edpuzzle can provide immediate, personalized feedback on language exercises, enabling students to self-correct and learn independently (Zhang & Aslan, 2021). Therefore, the instructor's challenge is not to relinquish control but to strategically design lessons where AI tools handle personalized practice, freeing the instructor to provide the essential human guidance. This includes facilitating deeper discussions, modeling how to critically evaluate solutions to plastic pollution (Prata et al., 2019), and offering targeted support that transforms autonomous activity into meaningful learning (Nor et al., 2022). This balanced approach helps develop crucial self-regulated learning skills, which Wei (2023) identifies as a key outcome of effective AI-integrated instruction.

Issue 2: The Preparedness of Instructors for a Dual-Path and Technology-Integrated Pedagogy

A significant barrier identified in the literature is the preparedness of language instructors to simultaneously teach content (environmental themes) and language, while also integrating advanced technology (Sujatna et al., 2024). This dual learning path, aligned with CLIL principles (Darn, n.d.), demands a diverse skill set that many instructors may not have developed. The challenges are twofold: first, a lack of expertise in designing learner-centered lessons that effectively embed real-world content; and second, limited technological proficiency and resources (Sujatna et al., 2024; Nurassyl et al., 2023).

As Walter (2024) and Dogan et al. (2023) emphasize, educators must not be left behind as AI becomes ubiquitous. The notion of AI as a teaching partner is key here. Instructors do not need to be environmental science experts, but they must be skilled at using AI tools to access and adapt relevant content. For instance, they can use AI to quickly generate texts about the impacts of plastic pollution on ecosystem services (Kumar et al., 2021) or create vocabulary lists from specific articles (Zhang & Aslan, 2021). However, this requires targeted professional development that moves beyond basic digital literacy. Instructors need a pedagogical understanding of how to critically evaluate AI-generated materials and integrate them into a coherent CLIL framework, while also being aware of broader concerns like educational inequality and "techno-solutionism" (Bulathwela et al., 2024). Without institutional support through "sufficient professional development" (Nurassyl et al., 2023), instructors will struggle to transition from being knowledge deliverers to becoming designers of complex, technology-enhanced learning experiences that promote both linguistic proficiency and the social awareness needed to tackle global challenges (Chen, Chen, & Lin, 2020).

Issue 3: Designing Assessments for the Dual Learning Path

Finally, the integration of environmental themes and AI support complicates the process of assessment. Traditional language assessments often focus narrowly on grammatical accuracy and vocabulary recall, which are insufficient for measuring the dual objectives of this approach. The goal is for learners to achieve both "language accuracy and the real-world content" (Wang et al., 2024), and to develop critical thinking and social awareness (Rezaei & Salehi, 2022). Designing assessments that validly and reliably measure these integrated outcomes is a complex task for instructors.

The literature points towards alternative assessment strategies that are more aligned with this pedagogy. For example, classroom discussions on environmental issues like marine plastic pollution (Thushari & Senevirathna, 2020) naturally lend themselves to assessment of speaking skills, but the focus can shift from mere fluency to the ability to "interrogate, argue, or share their experiences" using appropriate vocabulary and structures (Hasrina et al., 2024; Yu et al., 2024). Follow-up activities like writing tasks, where learners propose integrated strategies for mitigating plastic pollution (Prata et al., 2019), can assess both writing competency and the depth of critical thought (Kazazoglu, 2025). AI tools can support this by helping instructors create differentiated assessment materials; for instance, generating different sets of comprehension questions for the same reading passage to cater to varying proficiency levels (Zhang & Aslan, 2021). However, the onus remains on the instructor to design the assessment criteria that equally value content understanding, critical engagement, and language use. This ensures that the assessment truly reflects the dual learning path and

reinforces the lesson's goal of preparing learners to be both proficient English users and socially responsible citizens who are equipped to contribute to sustainability, as emphasized by Yu et al. (2024).

Therefore, the "Dual Learning Path" emerges not as a simple combination of two trends, but as a synergistic framework. The environmental content provides the *why*—the compelling reason for communication—while AI tools provide the *how*—the means to personalize and scaffold the learning journey. This synergy addresses the core motivational factors for L2 learners by creating a learning environment that is simultaneously relevant, supportive, autonomous, and aligned with 21st-century digital literacies.

CONCLUSION

This paper has explored the conceptual framework of a "Dual Learning Path" that synergistically merges the teaching of English language skills with environmental education, strategically enabled by AI-powered technologies. The analysis confirms that this approach enhances L2 instruction by making it more meaningful and effective. Here, the compelling "why"—anchoring learning in critical real-world issues like plastic pollution—provides the motivation for communication, while the AI tools offer the "how," delivering the personalization and scaffolding that make complex content accessible. This synergy fosters not only linguistic proficiency but also essential skills such as critical thinking and global citizenship, fully aligning with CLIL methodologies.

The incorporation of AI is thus a key enabler, facilitating the interactivity and learner autonomy that modern students expect. However, the full realization of this model's potential is contingent upon a prerequisite: successfully addressing the practical challenges of implementation. The role of the instructor remains irreplaceable, but it must be robustly supported by adequate professional development and institutional flexibility to move beyond traditional curricula.

In conclusion, the "Dual Learning Path" offers a promising direction for the future of English language education. It represents a move towards a more holistic form of instruction that prepares learners to use English confidently in real-world contexts. Future research is crucial, particularly empirical studies measuring the impact on language acquisition and learner motivation, alongside action research into effective professional development models. Ultimately, by embracing the powerful synergy of meaningful content and innovative technology, language education can truly empower learners to communicate effectively about the issues that matter most.

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