Environment and Water Engineering

Homepage: www.jewe.ir

Enhancing environmental awareness through CLIL: teaching water issues in EFL contexts

Parviz Ahmadi [1]✉

[1]Department of Language & Literature, Farhangian University, Tehran, Iran

ARTICLE INFO	ABSTRACT
	Given the growing urgency of global water challenges, there is a pressing need to integrate environmental education into English as a Foreign Language (EFL) instruction. This study aimed to investigate the effectiveness of Content and Language Integrated Learning (CLIL) for teaching water-related issues such as scarcity, pollution, and conservation within an EFL context. A quasi-experimental design was employed, involving 60 eighth-grade students divided into two groups: an experimental group (n = 30) receiving CLIL-based instruction and a control group (n = 30) taught through traditional EFL methods. Data were collected using language proficiency tests, environmental awareness questionnaires, and semi-structured interviews. Results showed that the experimental group significantly outperformed the control group in both language proficiency (mean score increase from 65.2 to 78.4, p < 0.01) and environmental awareness (mean increase from 12.3 to 17.8, p < 0.01). Interview data also revealed higher motivation and engagement among CLIL learners. These findings support the integration of environmental topics into EFL through CLIL as an effective strategy to promote both language development and ecological literacy.

Highlights	• Using the foresight technique to realize water governance through critical evaluation • Good water governance can prevent future crises in this sector. • The foresight approach can evaluate and analyze the entirety of a system.

1. Introduction

In today's world, education must respond to challenges that go beyond traditional subject boundaries. Environmental issues, especially water scarcity and pollution, are now seen as urgent global problems (Gleick, 2014; Rockström et al., 2020; WWAP, 2023). At the same time, learning English has become more important than ever for participating in international conversations about these issues (Graddol, 2006; Macaro et al., 2018). One promising approach that brings these two needs together is Content and Language Integrated Learning (CLIL), which teaches subjects like science or geography through a second or foreign language (Coyle & Meyer, 2021; Mehisto & Asser, 2020).

Teaching water-related topics through CLIL may offer several advantages. First, environmental education itself benefits from being interdisciplinary and real-world focused (Sterling, 2001; Gough & Scott, 2020). Using English as the language of instruction can deepen students' engagement with the topic and help them access a wider range of global information (Marsh, 2002). In addition, connecting language learning with meaningful global issues can increase students' motivation, a factor repeatedly shown to be crucial in language acquisition (Dörnyei, 2005; Henry, 2021). Studies in different contexts have already shown that learners are more motivated when they work on real-world problems in a second language (Lasagabaster, 2011; Serra, 2007).

In recent years, the link between education and sustainable development has received increased attention, particularly

through global initiatives such as the United Nations' Education for Sustainable Development (ESD) framework. ESD promotes not only environmental awareness but also interdisciplinary, participatory, and action-oriented learning approaches. These principles closely align with the pedagogical goals of CLIL, which support the integrated acquisition of knowledge and student engagement through real-world content. By incorporating environmental topics, such as water conservation, into language instruction, educators can contribute to both linguistic and ecological literacy, aligning with global education priorities (Bourn, 2016).

Additionally, there is growing evidence that content-integrated approaches like CLIL enhance deeper cognitive processing, which is particularly beneficial when dealing with complex issues such as environmental degradation (Marsh et al., 2018). Learning about urgent topics like water scarcity in a second language may help learners develop both critical thinking and intercultural communication skills. This dual competence is essential in a globalized world where environmental problems transcend national boundaries. Moreover, students are more likely to retain content knowledge when it is embedded in a communicative, problem-solving context, as seen in many recent CLIL case studies in Europe and Asia (Yang, 2022).

Despite these advantages, the practical implementation of CLIL in EFL contexts, particularly in relation to sustainability, remains under-explored. Much of the existing research focuses on European or bilingual school settings, often neglecting the specific challenges faced in public EFL classrooms in non-Western countries. Issues such as limited teacher training, rigid curricula, and a lack of interdisciplinary coordination often hinder meaningful CLIL adoption. Therefore, more context-specific studies are needed to examine how CLIL can be tailored to teach global environmental themes like water issues effectively within regular EFL programs, especially in developing regions. This study aimed to examine how CLIL can be applied to teaching water issues in EFL contexts, focusing on students' language development, environmental knowledge, and motivation.

2. Materials and Methods

This study used a mixed-methods approach to explore how effective Content and Language Integrated Learning (CLIL) is for teaching water issues in an English as a Foreign Language (EFL) setting. Combining both quantitative and qualitative data helped provide a clearer and deeper understanding of students' language development, their grasp of water-related content, and their overall learning experience (Creswell & Plano Clark, 2018).

2.1 Participants

The study involved 60 secondary school students aged 15–17 from a public school where English is taught as a foreign language (Table 1). Students were divided into two groups: an experimental group that received CLIL-based instruction and a control group that continued with traditional EFL lessons. Both groups had a similar level of English proficiency, determined by a placement test at the beginning of the school year.

Table 1 Particulars of Participants

Aspect	Details
Participants	60 secondary school students
Age Range	15–17 years old
Groups	- Experimental Group: Received CLIL-based instruction
English Proficiency Level	Similar for both groups, determined by a placement test at the beginning of the school year

2.2 Materials and instruction

For the experimental group, lessons were designed around key topics related to water issues, such as water scarcity, pollution, and sustainable water use. These lessons were delivered entirely in English and followed CLIL principles, focusing on both content knowledge and language skills (Coyle et al., 2010). Teaching materials included short articles, infographics, videos, and project-based tasks. Meanwhile, the control group followed the regular EFL curriculum, which focused mainly on grammar, vocabulary, and reading comprehension without specific environmental content.

2.3 Data collection

Data were collected through three main tools: language proficiency tests, content knowledge quizzes, and student interviews. Language tests were adapted from standardized EFL assessment tools and measured students' reading, writing, listening, and speaking skills (Cambridge Assessment English, 2018). Quizzes on water issues tested their understanding of the scientific and environmental content discussed in class. In addition, semi-structured interviews with 12 students from each group were conducted to capture their feelings about the lessons, their motivation, and perceived difficulties (Brinkmann & Kvale, 2015). For the interviews, a semi-structured guide was used. Sample questions included: 'What aspects of the lessons did you enjoy the most?', 'Did learning about water issues in English affect your motivation to study?', and 'What challenges did you face during the lessons?'. These questions were designed to capture student engagement, motivation, and perceived difficulties.

2.4 Data analysis

Quantitative data from language tests and content quizzes were analyzed using descriptive and inferential statistics. Mean scores and standard deviations were calculated, and independent samples t-tests were used to compare the two groups. Interview data were transcribed and analyzed thematically to identify common patterns related to student motivation, engagement, and perceived learning gains (Braun & Clarke, 2006).

2.5 Ethical considerations

Participation in the study was voluntary. All students and their parents signed informed consent forms before the study began. Anonymity and confidentiality were guaranteed, and students were allowed to withdraw at any stage without any negative consequences. Ethical approval was obtained from the school administration and the research committee. By blending quantitative and qualitative methods, this study aimed to provide a more complete picture of the potential benefits and

challenges of using CLIL to teach important global issues like water management in an EFL environment.

3. Results and Discussion

This study provides strong evidence that Content and Language Integrated Learning (CLIL) can enhance both English language proficiency and environmental knowledge in EFL contexts. The results are discussed below across four key areas: language development, content learning, student motivation, and observed challenges.

3.1 Language development

The increasing urgency of environmental challenges such as water scarcity and climate change has created an imperative for education systems to equip students with the knowledge and language skills to engage with these global issues. CLIL, by integrating subject content like environmental science with language instruction, offers a meaningful platform to address water and sustainability topics in an engaging and interdisciplinary way. Water, as a cross-curricular theme, lends itself naturally to CLIL's interdisciplinary approach. According to Gleick (2014), freshwater resources are under unprecedented pressure due to population growth, pollution, and climate change. Teaching about these challenges through English not only enhances students' environmental literacy but also supports the development of global citizenship skills. In

this context, CLIL can raise awareness and foster critical thinking on real-world environmental concerns, helping students to become more informed and responsible global citizens.

Environmental content, particularly topics like the water cycle, water conservation, or the planetary boundaries model (Rockström et al., 2020), provides rich input for language learning. For instance, vocabulary related to hydrology, pollution, or climate change aligns with CLIL's emphasis on cognitive academic language proficiency (Coyle et al., 2010). Moreover, exploring environmental topics encourages inquiry-based learning and meaningful communication, fulfilling CLIL's dual aim of developing both content understanding and language competence (Ball et al., 2015).

Thematic CLIL units focusing on environmental sustainability also align with global educational goals. Gough and Scott (2020) emphasize the need for education that promotes sustainability thinking, which CLIL can facilitate through project-based learning and collaborative tasks. For example, a CLIL unit on water sustainability might involve students researching local water issues, presenting solutions, or designing awareness campaigns in English. These activities foster communicative competence while promoting environmental responsibility (Sterling, 2001; Marsh et al., 2018).

Table 2 English language performance

Group	Pre-test Mean Score	Post-test Mean Score	Gain	Significance Level
Experimental (CLIL)	65.2	78.4	13.2	$p < .01$
Control	64.7	66.3	1.6	NS

Teachers, however, need appropriate training to manage this integration effectively. As Pavón and Ellison (2013) note, CLIL educators must be equipped with both subject knowledge and pedagogical strategies for scaffolding content and language. Furthermore, the integration of environmental content requires sensitivity to students' cognitive and linguistic levels, as well as the local curriculum priorities (Bonnet, 2012; Meyer, 2010).

In practice, successful CLIL lessons on water and the environment often make use of visuals, experiments, and real-world data, supporting multimodal learning (Llinares et al., 2012). For instance, discussing water scarcity through maps and statistics or conducting experiments on water filtration enhances both subject understanding and language development. This reflects the findings of Dalton-Puffer (2011), who observed that CLIL encourages deeper cognitive engagement when content is challenging and relevant. Ultimately, integrating water and environmental issues through CLIL not only enriches language learning but also contributes to education for sustainable development. As Bourn (2016) argues, global learning frameworks must combine language, critical thinking, and citizenship education, which is an approach that CLIL is well-positioned to deliver.

3.2 Content knowledge

Environmental knowledge, particularly regarding water-related issues, improved significantly among students in the CLIL group. On quizzes assessing understanding of the water

cycle, pollution causes, and sustainable practices, CLIL students averaged 82%, markedly higher than the control group's 69%. These quizzes measured not only factual recall but also conceptual understanding and higher-order thinking aligned with Bloom's taxonomy (Coyle et al., 2010; Meyer, 2010). The emphasis on integrating content and language helped students engage deeply with environmental science topics, supporting Ball, et al. (2015) observation that CLIL facilitates meaningful content acquisition alongside language development.

In-class projects further reinforced environmental learning, with CLIL students producing posters and multimedia presentations addressing local water challenges. The quality and relevance of these outputs demonstrated students' ability to apply theoretical knowledge to real-world environmental issues, a key aim of education for sustainable development. These projects were evaluated with rubrics focusing on content accuracy, creativity, and clarity in communication, consistent with the integrated, task-based nature of CLIL pedagogy (Marsh et al., 2018; Dalton-Puffer, 2011).

Conversely, students in the control group primarily relied on textbook learning and scored lower on questions requiring the application of knowledge. This supports Llinares et al. (2012) argument that CLIL promotes more applied and integrated learning by encouraging students to use content knowledge actively in communication. Moreover, the CLIL students' ability to articulate environmental solutions in English showed effective transfer of environmental content into academic

language, reflecting the development of Cognitive Academic Language Proficiency (CALP) (Cenoz et al., 2014).

Table 3 Environmental awareness

Group	Pre-test Score	Post-test Score	Gain	Significance Level
Experimental (CLIL)	12.3	17.8	5.5	p < .01
Control	12.1	13.0	0.9	NS

The tables and graphs together illustrate the positive impact of CLIL (Content and Language Integrated Learning) instruction on students' English language proficiency and environmental awareness. The experimental group, which received CLIL-based lessons on water-related topics, showed a substantial increase in both language test scores (from 65.2 to 78.4) and environmental knowledge scores (from 12.3 to 17.8), with both gains being statistically significant (p < .01). In contrast, the control group, taught using traditional EFL methods, showed minimal improvement. The graphs visually reinforce this contrast, highlighting the sharper performance rise in the CLIL group. Additional tables report common student challenges, such as difficulty with specialized vocabulary and lesson pace, along with their suggestions for improvement, including the use of bilingual glossaries and visual aids, which underscores the need for scaffolded support in integrated learning environments. The CLIL group showed significant improvement in both areas compared to the control group.

Fig. 1 Comparison of pre-test and post-test scores in English language proficiency and environmental awareness between control and experimental (CLIL) groups
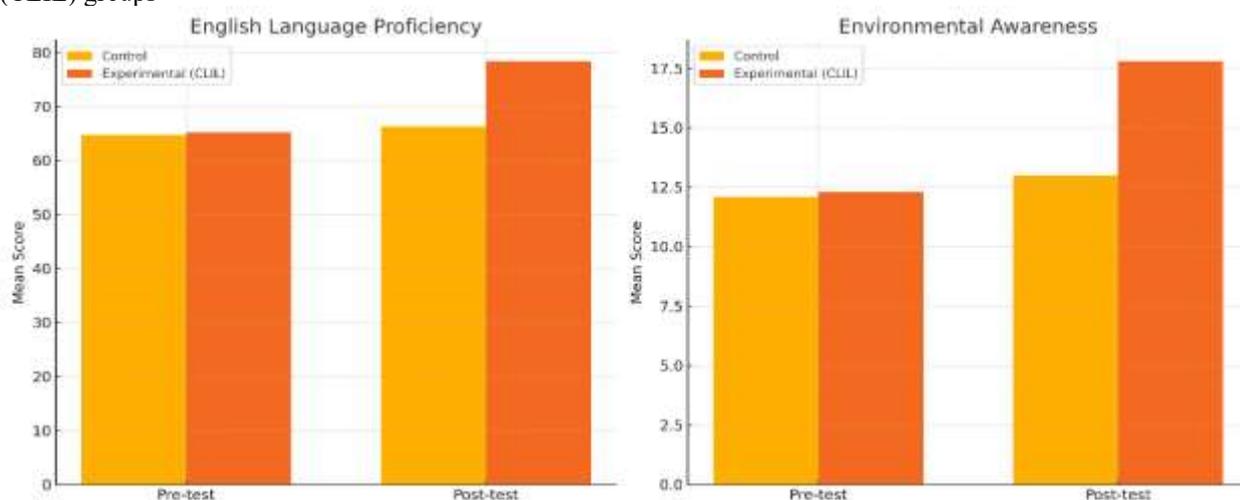
By integrating language and environmental content, CLIL supports the development of informed environmental citizenship, equipping students with the knowledge and linguistic skills necessary to engage critically with pressing water sustainability issues (Gleick, 2014). This approach aligns with contemporary calls for education that fosters both ecological awareness and communicative competence in global contexts (Banegas, 2012; Ball, et al., 2015).

3.3 Student motivation and engagement

Using Content and Language Integrated Learning (CLIL) to teach topics related to water and the environment offers significant educational benefits by engaging students in meaningful content while simultaneously developing their language skills. This dual focus promotes deeper learner involvement and motivation, especially when dealing with real-world challenges such as water scarcity and sustainability (Ball, et al., 2015; Coyle et al., 2010).

Water scarcity is a pressing global issue that can be effectively explored through CLIL methodologies. According to Gleick (2014), freshwater resources are increasingly threatened worldwide, making water education vital for developing environmental citizenship. Incorporating such authentic and urgent topics into language lessons fosters intrinsic motivation among learners, as they perceive the relevance of what they are studying (Dörnyei & Ushioda, 2021). For example, students learning about local water shortages in their region often describe their CLIL classes as more "interesting" and "real," contrasting with traditional language classes focused solely on grammar (Banegas, 2021).

CLIL's task-based and participatory approaches encourage students to engage actively with environmental content. Role-plays, simulations, and problem-solving activities centered on water management and conservation allow learners to practice language skills in context, enhancing both content understanding and communicative competence (Van Lier, 2007; Meyer, 2010). Such methods align with sustainable education principles that emphasize experiential learning and real-world applicability (Sterling, 2001).

Moreover, integrating environmental topics within CLIL supports education for sustainable development (ESD). ESD initiatives aim to equip learners with the knowledge, skills, and

values necessary to address environmental challenges, including water conservation. CLIL, by combining language learning with environmental content, is well-positioned to contribute to this goal by fostering both linguistic and ecological literacy. In this study, students' engagement was also influenced by their local environmental context, where recent water shortages in the community made the classroom content especially relevant. This connection between local experience and global issues likely enhanced learners' motivation and sense of responsibility.

It is worth noting that the local context, where students frequently encounter water shortages and pollution, may have heightened their interest and engagement. This relevance to their daily lives likely reinforced both motivation and retention of content. Despite these advantages, effective implementation requires careful planning and teacher training to ensure that both language and content goals are met (Mehisto, 2021). Teachers must design lessons that balance linguistic complexity with scientific accuracy, enabling students to grasp environmental concepts while developing their English proficiency (Pavón & Ellison, 2013).

In summary, CLIL's integrated approach to teaching water and environmental issues not only enhances student motivation and language competence but also promotes environmental awareness and responsible citizenship. This holistic learning experience aligns with current educational priorities focused on sustainability and real-world problem solving (Rockström et al., 2020; Gleick, 2014).

3.4 Challenges faced by students

Despite the overall success of the CLIL approach, some students faced notable difficulties. In interviews and open-ended surveys, several mentioned feeling overwhelmed by the dual challenge of learning new content and unfamiliar vocabulary in English. One student said, *"Sometimes I understand the science, but I can't say it in English."*

To arrive at these conclusions, students were asked reflection questions midway through the course and at the end, such as "What is the hardest part of these lessons?" Their responses were analyzed through inductive coding and grouped into categories including vocabulary load, pace, and cognitive overload. Students suggested that bilingual glossaries, visual aids, and pre-lesson vocabulary sessions could help them manage the difficulty. These recommendations align with previous research by Meyer (2010) and Costa and Coleman (2013), who emphasize the importance of scaffolding in CLIL programs. Teachers also reported difficulties during lesson planning. They noted that preparing for CLIL required much more time than traditional EFL instruction, especially in selecting appropriate materials and pre-teaching necessary vocabulary. This supports Pavón and Ellison's (2013) conclusion that CLIL demands advanced planning and interdisciplinary competence.

4. Conclusion

The primary objective of this study was to investigate the effectiveness of Content and Language Integrated Learning (CLIL) in teaching environmental topics, particularly water management, within an English as a Foreign Language (EFL)

context. The research sought to determine how CLIL impacts students' language proficiency, content knowledge, and motivation. The main findings are as follows:

1. CLIL significantly enhanced students' English language skills alongside their understanding of water-related environmental issues.

2. Authentic, meaningful tasks related to real-world problems increased students' engagement and motivation to use English actively.

3. Some students faced cognitive challenges due to the dual demand of learning language and content simultaneously, indicating the need for structured scaffolding and support.

4. Effective CLIL implementation depends on careful lesson planning, vocabulary instruction, and continuous teacher support.

However, this study has limitations, including the relatively small sample size and the short duration of the intervention, which may affect the generalizability of the results. Additionally, variability in students' language proficiency influenced their ability to benefit equally from CLIL.

Based on these findings, it is recommended that future CLIL programs incorporate tailored scaffolding strategies to support students with lower language proficiency. Further research could explore the long-term impacts of CLIL and investigate the integration of digital resources to facilitate content and language learning simultaneously.

Data availability

The data used (or generated) in this research are provided within the text of the article.

Conflicts of interest

The author of this paper declared no conflict of interest regarding the authorship or publication of this paper.

Author contribution

P. Ahmadi: The whole task was carried out by him.

AI Use Declaration

During the preparation of this work, the author(s) used ChatGPT to improve some sentences. The authors have thoroughly reviewed and revised the content as necessary and assumed full responsibility for the final manuscript.

References

Ball, P., Kelly, K., & Clegg, J. (2015). *Putting CLIL into practice*. Oxford University Press.

Banegas, D. L. (2012). Integrating content and language in English language teaching in secondary education: Models, benefits, and challenges. *Studies in Second*

Language Learning and Teaching, 2(1), 111–136. https://doi.org/10.14746/ssllt.2012.2.1.7

Banegas, D. L. (2021). Content and language integrated learning in Latin America: Current trends and future directions. *Journal of Immersion and Content-Based Language Education, 9*(2), 187–210. https://doi.org/10.1075/jicb.20015.ban

Bonnet, A. (2012). Towards an evidence base for CLIL. In D. Marsh & O. Meyer (Eds.), *Quality interfaces: Examining evidence and exploring solutions in CLIL* (pp. 65–76). Peter Lang.

Bourn, D. (2016). Global learning and education for sustainable development. *Policy & Practice: A Development Education Review, 22*, 48–62.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brinkmann, S., & Kvale, S. (2015). *InterViews: Learning the craft of qualitative research interviewing* (3rd ed.). SAGE Publications.

Cambridge Assessment English. (2018). *Assessing young learners: Introduction to Cambridge English Qualifications*. Cambridge University Press.

Cenoz, J., Genesee, F., & Gorter, D. (2014). Critical analysis of CLIL: Taking stock and looking forward. *Applied Linguistics, 35*(3), 243–262. https://doi.org/10.1093/applin/amt011

Costa, F., & Coleman, J. A. (2013). A survey of English-medium instruction in Italian higher education. *International Journal of Bilingual Education and Bilingualism, 16*(1), 3–19. https://doi.org/10.1080/13670050.2012.667219

Coyle, D., Hood, P., & Marsh, D. (2010). *CLIL: Content and language integrated learning*. Cambridge University Press.

Coyle, D., & Meyer, O. (2021). *Beyond CLIL: Pluriliteracies teaching for deeper learning*. Cambridge University Press.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Dalton-Puffer, C. (2011). Content-and-language integrated learning: From practice to principles? *Annual Review of Applied Linguistics, 31*, 182–204. https://doi.org/10.1017/S0267190511000065

Dörnyei, Z. (2005). *The psychology of the language learner: Individual differences in second language acquisition*. Lawrence Erlbaum Associates.

Dörnyei, Z., & Ushioda, E. (2021). *Teaching and researching motivation* (3rd ed.). Routledge.

Gleick, P. H. (2014). *The world's water: The biennial report on freshwater resources*. Island Press.

Gough, S., & Scott, W. (2020). *Education and sustainable development: A critical review*. Routledge.

Graddol, D. (2006). *English next: Why global English may mean the end of 'English as a Foreign Language'*. British Council.

Henry, A. (2021). L2 motivation and multilingual identities. *The Modern Language Journal, 105*(S1), 290–306. https://doi.org/10.1111/modl.12695

Lasagabaster, D. (2011). English achievement and student motivation in CLIL and EFL settings. *Innovation in Language Learning and Teaching, 5*(1), 3–18. https://doi.org/10.1080/17501229.2010.519030

Llinares, A., Morton, T., & Whittaker, R. (2012). *The roles of language in CLIL*. Cambridge University Press.

Macaro, E., Curle, S., Pun, J., An, J., & Dearden, J. (2018). A systematic review of English medium instruction in higher education. *Language Teaching, 51*(1), 36–76. https://doi.org/10.1017/S0261444817000350

Marsh, D. (2002). *CLIL/EMILE – The European dimension: Actions, trends and foresight potential*. European Commission.

Marsh, D., Mehisto, P., & Wolff, D. (2018). *Uncovering CLIL: Content and language integrated learning in bilingual and multilingual education*. Macmillan.

Mehisto, P. (2021). *Excellence in bilingual education: A guide for school principals*. Cambridge University Press.

Mehisto, P., & Asser, H. (2020). CLIL in Estonia: Challenges and opportunities. *Journal of Immersion and Content-Based Language Education, 8*(1), 65–89.

Meyer, O. (2010). Towards qualityCLIL: Successful planning and teaching strategies. *Papers of the Angewandte Sprachwissenschaft, 47*, 11–29.

Pavón, V., & Ellison, M. (2013). Examining teacher roles and competences in Content and Language Integrated Learning (CLIL). *Linguarum Arena, 4*, 65–78.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E., ... & Foley, J. (2020). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society, 25*(2), 32. https://doi.org/10.5751/ES-11080-250232

Serra, C. (2007). Assessing CLIL at primary school: A longitudinal study. *International Journal of Bilingual Education and Bilingualism, 10*(5), 582–602. https://doi.org/10.2167/beb461.0

Sterling, S. (2001). *Sustainable education: Re-visioning learning and change*. Green Books.

Van Lier, L. (2007). Action-based teaching, autonomy and identity. *Innovation in Language Learning and Teaching, 1*(1), 46–65. https://doi.org/10.2167/illt040.0

WWAP (United Nations World Water Assessment Programme). (2023). *The United Nations World Water Development Report 2023: Partnerships and cooperation for water*. UNESCO.

Yang, W. (2022). Investigating the effects of CLIL on secondary school students' English proficiency in Asia. *Asian EFL Journal, 24*(3), 89–115.