

A PROCESS FOR TEACHING PRIMARY SCIENCE THROUGH CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL)

Pham Viet Quynh¹, Phan Thanh Ha²

¹ *Hanoi Metropolitan University, Hanoi, Vietnam*

² *Hanoi National University of Education, Hanoi, Vietnam*

*Corresponding author: Phan Thanh Ha, e-mail: phanthanhha@hnue.edu.vn

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Abstract: In the context of implementing English as a second language in schools, investigating Content and Language Integrated Learning (CLIL) is essential for enhancing the quality of subject teaching and learning at the primary level. This study aims to propose a process for teaching Primary Science through the CLIL approach. The research employed document analysis and synthesis, a questionnaire survey, and a pedagogical experiment. Based on the theoretical framework of CLIL and the characteristics of primary science education, a five-step teaching process was developed: (1) analyzing the curriculum and selecting appropriate content; (2) identifying dual objectives for both subject content and language development; (3) preparing teaching resources and language support; (4) designing and implementing learning activities based on the 4Cs framework; and (5) assessing learning outcomes. The findings of the pedagogical experiment conducted with Grade 5 students provide preliminary support for the application of the proposed CLIL-based teaching process in Primary Science.

Keywords: Content and Language Integrated Learning (CLIL); primary science; primary education; 4Cs framework, English language

1. Introduction

In the context of globalization, bilingual education and the use of English in subject teaching have become increasingly prevalent. Research on the internationalization of education has documented the implementation of various models of English-medium teaching across different educational levels. Among these, Content and Language Integrated Learning (CLIL) has been considered a suitable approach for countries where English is not the first language (Hoang, 2025). Previous studies have shown that CLIL can support the learning of subject content while providing opportunities for students to use a foreign language in meaningful classroom contexts (Hendra et al., 2024; Ruiz-Cecilia et al., 2023; Graham et al., 2018). In primary science, CLIL provides opportunities for students to learn scientific concepts and develop subject-related language through observation, inquiry, and discussion (Hoang, 2025).

In Vietnam, teaching subjects through English as a second language has been implemented for several years in schools with appropriate conditions and resources (Nguyen, 2024; Hoang, 2025). Since 2025, the promotion of English as a second language has become a national strategy. Recent government regulations and policy documents, including Government Decree No. 222/2025/NĐ-CP on teaching and learning in foreign languages in educational institutions and Prime Minister Decision No. 2371/QĐ-TTg approving the project “Making English a Second Language in Schools for the 2025–2035 Period, with a Vision to 2045,” have established a legal framework for schools to integrate English into educational activities (Government of Vietnam, 2025; Prime Minister of Vietnam, 2025).

Although interest in CLIL has increased in recent years, research in Vietnam and other countries has identified several challenges in teaching science, mathematics, and other subjects through English (Graham et al., 2018; Le & Dang, 2024; Nguyen & Huynh, 2023; ; Nguyen & Nguyen, 2024; Pham, 2017). These challenges include teachers' limited proficiency in subject-specific English, the shortage of standardized teaching materials, and the absence of clear procedures for applying CLIL in subject teaching. As a result, teachers may encounter difficulties in designing and implementing CLIL-based lessons (Hoang, 2025; Le & Dang, 2024). These challenges are particularly evident at the primary level, where students are still developing their cognitive skills and mother tongue.

Based on this context, this study aims to propose a process for teaching primary science through the CLIL approach at the primary school level. Specifically, the study addresses the following research question: (1) What teaching process can be proposed to support the implementation of CLIL in primary science at the primary school level? (2) The proposed process is intended to support teachers in implementing CLIL and provide a basis for its application in primary science teaching.

2. Methodology

The study employed a combination of theoretical and empirical research methods. The theoretical methods involved reviewing, analyzing, and synthesizing literature related to CLIL, the primary science curriculum, and relevant studies to provide theoretical foundation for the proposed CLIL-based teaching process. A questionnaire survey was conducted to collect feedback from 68 primary school teachers from several schools in Hanoi regarding the suitability of the proposed CLIL-based process for teaching primary science. In addition, a pedagogical experiment was conducted with Classes 5C and 5G at Be Van Dan Primary School in Hanoi to evaluate the application of the proposed CLIL-based teaching process in primary science teaching. All participants agreed to participate in the study, and participation was voluntary and anonymous. The collected data were analyzed using statistical methods with the support of IBM SPSS Statistics 20.0 software. During manuscript preparation, artificial intelligence (AI) tools were used to support translation, English language editing, and the generation of illustrative images.

3. Literature Review

3.1. An Overview of The CLIL Approach

CLIL has been investigated by researchers from various perspectives, leading to several conceptual definitions. Coyle et al., (2010) define CLIL as an integrated teaching and learning approach in which learners simultaneously develop subject knowledge and language competence through the integration of content and language learning. This integration requires attention to both content and language during the teaching and learning process. Dalton-Puffer (2011) argues that, in CLIL, language is not the sole objective of learning but serves as a means of accessing subject knowledge. As Bailey (2015) points out, CLIL involves the instruction of various school subjects through a foreign or second language (L2), which can be implemented either by an L2 teacher or a subject-matter teacher utilizing L2. Sharing this perspective, Le and Dang (2024) define CLIL as a teaching method in which a language other than the learners' first language is used to teach subject content, with language serving both as the medium of instruction and as a learning objective. Although these definitions differ in emphasis, they all highlight the integration of content and language as the central feature of CLIL. This principle is often reflected in the idea of learning language through content and learning content through language. CLIL can be understood as a teaching approach in which subject content and language are closely integrated to support the simultaneous development of subject knowledge and language competence.

CLIL-based teaching has two key characteristics. First, CLIL adopts a dual-focus approach in which teaching and learning aim to develop both subject content and language. With content at the center of the learning process, language functions both as a medium of learning and as a learning objective (Coyle et al., 2010). Learners acquire language through subject content and use language to access knowledge, thereby developing academic language competence. In practice, achieving this dual focus requires teachers to appropriately balance subject content and language support, particularly for learners with limited L2 proficiency. Second, CLIL is organized around the 4Cs framework: Content, Communication, Cognition, and Culture. Content refers to the acquisition of subject-specific knowledge and skills, which provides the basis for language development. Communication involves the use of language in learning activities and real-life situations. Cognition emphasizes the development of language in relation to cognitive processes, progressing from lower-order thinking skills (remembering and understanding) to higher-order thinking skills (analyzing, evaluating, and creating). Culture focuses on understanding personal identity, community cultural contexts, and broader global perspectives. The interaction between content and language through the 4Cs framework provides a basis for designing integrated learning activities and supports learners' overall development (Bentley, 2010; Coyle, et al., 2010;; De Zarobe, 2025). Thus, the 4Cs provide not only a description of CLIL but also a framework for organizing integrated learning activities.

As De Zarobe (2025) and Zhaukira et al. (2024) observe, CLIL can be divided into two main models, depending on the focus of instruction: Hard CLIL and Soft CLIL. In Hard CLIL, subject content is taught mainly through the target language (e.g., English). In this form, greater emphasis is placed on subject content, while English serves as the medium of learning and teaching the subject. In Soft CLIL, subject content is incorporated into language classes. In this form, greater emphasis is placed on language development than on subject knowledge. Soft CLIL is often adopted at the initial stage of implementation or with learners who have a limited language proficiency. According to these authors, the choice of different CLIL models is influenced by a range of contextual factors, including curriculum goals (content-oriented or language-oriented), course type (English-medium or language-oriented), instructional intensity (teaching time), learners' age, and other contextual conditions. This suggests that the choice of a CLIL form needs to be considered in relation to learners' language proficiency and the specific teaching context.

To support the implementation of CLIL, teachers have adopted a range of strategies to encourage students' active participation in learning and to accommodate different levels of language proficiency (Villabona et al., 2021). A key aspect of CLIL teaching is the use of scaffolding, which helps learners overcome language-related difficulties and supports their learning process (Bailey, N., 2015; De Zarobe, 2025; Georgiou-Ioannou & Pavlou et al., 2011;; Kalogerakou et al., 2017;;). The literature commonly identifies three main types of scaffolding: (1) Language scaffolding: Subject-specific vocabulary, key concepts accompanied by visual illustrations, sentence frames, model sentences, and other language supports provided to assist students in individual and group activities; (2) Cognitive scaffolding: Visual aids, diagrams, worksheets, task segmentation, and questions at different cognitive levels. After each activity, teachers may use quick formative questions to check students' understanding and monitor their learning progress; (3) Technology scaffolding: Simulations, visual materials, and short videos with narration and subtitles that help students understand concepts and phenomena, even when they do not fully understand all subject-specific English terminology.

These studies suggest that CLIL implementation is flexible and depends on teachers' expertise, students' characteristics, and the conditions in which instruction takes place. In the Vietnamese primary school context, these conditions may include differences in teachers' English proficiency, students' language levels, and the availability of appropriate teaching materials (Hoang, 2025; Le & Dang, 2024; Nguyen & Huynh, 2023;; Nguyen & Nguyen, 2024;;). In a CLIL classroom, teachers are not expected to speak English like native speakers. More importantly, they need to be able to

design integrated learning activities and make effective use of scaffolding to support students in learning subject content through a second language.

3.2. Teaching Primary Science Through a CLIL Approach

The primary science curriculum is built upon three key principles: integrated teaching, thematic teaching, and the promotion of active student participation (MOET, 2018). These principles provide favorable conditions for CLIL in primary science teaching.

With regard to integrated and thematic teaching, the science curriculum is organized into topics related to natural objects and phenomena that are closely connected to everyday life (e.g., soil, water, air, plants, animals, human health, and the environment). Learning requirements focus on developing scientific competencies at an introductory level and using language to describe and provide initial explanations of natural phenomena. These characteristics are consistent with the principles of CLIL, particularly the integration of content and language, the dual focus on subject learning and language development, and the promotion of cognitive development in learning (Coyle et al., 2010). CLIL is commonly implemented through the 4Cs framework, which consists of Content, Communication, Cognition, and Culture (Coyle et al., 2010). For example, in the topic Soil, Lesson 2: Soil Pollution, Soil Erosion, and Soil Conservation - Science 5 (MOET, 2026, pp. 9–13), environmental education is integrated into the lesson content. Teachers may organize role-play activities or project-based tasks to encourage students to apply their learning to real-life situations. Students are required to investigate the causes and consequences of soil pollution and propose measures for soil protection (Content). During these activities, they discuss, exchange ideas, and present their findings in both Vietnamese and English at an appropriate level (Communication). They also analyze different solutions, select suitable options, and explain the reasons for their choices (Cognition). By relating the lesson to local environmental issues and responsibilities, students gradually develop awareness of environmental protection and a sense of responsibility toward their community (Culture).

About the principle of promoting active student participation, the science curriculum emphasizes students' active involvement in learning through inquiry, observation, experiments, practical activities, and group work. Teaching science through the CLIL approach can increase students' engagement by connecting scientific content with language development in subject-related learning situations (Coyle et al., 2010; De Zarobe, 2025). Learning activities designed within the 4Cs framework place emphasis on the suitability of subject content as well as students' ability to use Vietnamese and English flexibly for communication and learning. For example, in Lesson 1: *Components of Soil and the Role of Soil for Plants* (Science 5 Textbook, pp. 5–8), teachers may organize an inquiry activity on the role of soil in plant growth. Students observe Figure 6 in the Science 5 textbook (p. 7) and answer questions such as: "What do roots take from the soil?", "Why can plants stand firmly and not fall over?", and "What does soil contain?". Through these questions, students identify the role of soil in supplying water and minerals and in supporting plant growth.

To support CLIL activities, teachers provide bilingual worksheets, key vocabulary, and sentence frames for group work and discussion (see Figure 1). Students record ideas in a Vietnamese-English table and present conclusions using simple English sentences. In this process, language serves as a tool for describing and explaining scientific concepts rather than merely learning vocabulary. Consequently, students develop both scientific understanding and At the **Engage** stage, students are introduced to the topic through questions about changes in the state of a candle when it is heated. During **Explore**, students conduct a simple experiment by heating a candle and observing the change from a solid to a liquid state and vice versa, while using key terms such as "solid", "liquid", and "melt". At the **Explain** stage, students describe their observations using simple sentences such as "The candle melts when heated." During **Elaborate**, they relate their observations to familiar phenomena such as melting ice and freezing water.



WORKSHEET – LESSON 1
COMPONENTS AND ROLES OF SOIL FOR PLANTS



TASK: 1. Observe Figure 6 (Textbook p. 7), discuss in groups and complete the worksheet.
2. Answer the questions based on Figure 6.
3. Record the results in the table (Characteristics and English).
4. Use the useful words to write simple sentences about the roles of soil for plants.

Questions	Answers
1. What do roots take from the soil?	
2. Why can the plant stand firm and not fall over?	
3. What does soil contain?	

CONCLUSION:
Write 2–3 simple sentences about the roles of soil for plants.
.....

USEFUL WORDS (TỪ MỜI)

- water (nước)
- minerals (chất khoáng)
- air (không khí)
- organic matter (mùn hữu cơ)
- roots (rễ)
- hold/support (giữ/chống)
- stand firm (vững chắc)

USEFUL SENTENCE FRAMES

- Roots take ... from the soil.
- Soil provides ... for plants.
- Soil contains ...
- Soil helps plants ...
- These help the plant ...

Figure 1. Student worksheet

Finally, at the **Evaluate** stage, students present their findings in Vietnamese combined with English or entirely in English. Through these activities, subject content and language are integrated to support the development of scientific knowledge, scientific competence, and English language ability. Thus, when implemented at an appropriate level and in suitable formats, CLIL extends beyond mere vocabulary instruction. It provides opportunities for students to access, interpret, and apply scientific knowledge while simultaneously developing language competence and scientific thinking through engaging learning activities.

4. Results and Discussion

4.1. Principles and Process for Teaching Primary Science through the CLIL Approach

4.1.1. Principles for Organizing Instruction

Drawing on the 4Cs framework, the primary science curriculum, and research on CLIL and the cognitive characteristics of primary school students, and studies on CLIL, the teaching of primary science through English should follow the following principles:

- Principle 1: Ensuring alignment with the subject curriculum. Teaching content should be consistent with the objectives and learning outcomes of the primary science curriculum while maintaining the accuracy of scientific knowledge (MOET, 2018). English is used as a medium to support learning rather than as a substitute for subject content (Coyle et al., 2010).

- Principle 2: Ensuring language objectives are appropriate to learners' cognitive levels and learning contexts. Teachers need to distinguish between everyday communication and subject-specific language. Depending on the cognitive demands of learning tasks, ranging from remembering and understanding to analyzing and evaluating, appropriate language structures should be selected to support students in accessing and expressing scientific knowledge (Dalton-Puffer, 2011). In addition, language should be presented in meaningful contexts and supported through cognitive scaffolding, including visual materials, audio resources (De Zarobe, 2025).

- Principle 3: Structuring lessons around the 4Cs framework (Content, Communication, Cognition, and Culture). These four components should be integrated within the same teaching process. Their integration enables students to develop scientific knowledge and language competence simultaneously.

- Principle 4: Taking account of the characteristics of primary school students. As primary school students often have limited English vocabulary and shorter attention spans, teachers should differentiate learning tasks and incorporate visual, experiential, game-based, role-play, and collaborative activities to support students' access to both content and language (Zhaokira et al., 2024).

- Principle 5: Adapting implementation to local conditions. CLIL should be implemented flexibly according to school facilities, students' English proficiency, and teachers' professional capacity. In well-resourced schools, technology can be used to design interactive learning activities. In contexts where resources are limited or students have low levels of English proficiency, a soft CLIL approach

may be adopted, using Vietnamese to support the explanation of scientific concepts while introducing English through key vocabulary, sentence patterns, and visual materials (Graham et al., 2018).

4.1.2. Instructional Process

Drawing on the primary science curriculum, studies on CLIL, and previous research on CLIL implementation in educational settings, this study adopts a Soft CLIL approach to propose a process for integrating English into primary science instruction. The five-step procedure synthesizes key CLIL principles and adapts them to the content and language requirements of primary science education, covering planning, preparation, implementation, and assessment. The process comprises: (1) analyzing the curriculum and selecting content; (2) Defining dual content and language objectives; (3) preparing instructional resources and language support; (4) designing and implementing CLIL-based learning activities using the 4Cs framework; and (5) assessing learning outcomes.

- Step 1: Analyzing the curriculum and selecting appropriate content: This initial step ensures that Science learning objectives remain the primary focus, while English serves as a tool to support learning. Teachers review the curriculum and expected learning outcomes to identify content that is suitable for language integration. Priority should be given to content that can be illustrated through visual resources as well as topics involving widely used scientific concepts and terminology that can be readily expressed and applied in English.

- Step 2: Defining dual content and language objectives: A key feature of CLIL is the integration of content and language learning objectives. Content objectives are derived from the learning outcomes specified in the primary science Curriculum (MOET, 2018), whereas language objectives focus on the vocabulary, grammatical structures, and communicative functions needed for learning and discussing scientific concepts (Bentley, 2015, pp. 11-15). The integration of these two sets of objectives is a defining characteristic of the CLIL approach (Coyle et al., 2010).

- Step 3: Preparing instructional resources and language support: Teachers prepare instructional materials and language-support tools. Science teaching resources may include pictures, videos, real objects, laboratory equipment, worksheets, and graphic organizers that enable students to observe, experiment, describe, and explain scientific phenomena. In addition, language support should be provided through key vocabulary, useful expressions, and simple sentence patterns directly related to lesson content, such as “water”, “energy”, “solid”, “liquid”, or sentences like “Water evaporates” and “Plants need water to grow”. The language used should be concise, meaningful, and appropriate to students’ proficiency levels (Dalton-Puffer, 2011). The combination of visual resources and language scaffolding helps students access scientific knowledge while gradually using English as a learning tool (Le & Dang, 2024).

- Step 4: Designing and implementing CLIL-based learning activities using the 4Cs framework: Learning activities are designed around the four components of the 4Cs framework: Content, Communication, Cognition, and Culture (Coyle et al., 2010). These four components are considered interrelated in the design of each activity: Content specifies the scientific knowledge to be learned; Communication supports the use of English to access and express this content; Cognition involves appropriate thinking processes; and Culture connects learning with students’ everyday and social contexts. Activities should engage students in exploring scientific concepts through observation, experimentation, description, and explanation of phenomena (Content), while also providing opportunities to use English at an appropriate level for discussion, presentation, and reporting (Communication). Tasks should encourage cognitive processes such as comparing, classifying, explaining, and drawing conclusions (Cognition). Furthermore, activities should be connected to real-life situations and issues related to the environment, society, and students’ daily lives (Culture). Thus, the four components are integrated within learning activities rather than addressed as separate elements. This approach promotes meaningful integration of scientific content and language learning, supporting the development of knowledge, communication skills, and thinking skills.

- Step 5: Assessing learning outcomes: Assessment should address both science learning outcomes and students' use of English. Teachers may employ various assessment methods, including classroom observation, learning products, questioning, and oral presentations, to evaluate students' understanding and application of scientific knowledge as well as their ability to use English in learning contexts (Graham et al., 2018). Assessment should focus on students' progress and their ability to apply what they have learned in practical situations (Pham, 2017).

4.2. Example of Application

To illustrate the proposed CLIL-based instructional process, the lesson "Some Actions for Protecting the Environment and Natural Resources" (Lesson 29: Human Impacts on the Environment and Environmental Protection Measures, Grade 5 Science, pp. 104–107) can be implemented as follows.

- Step 1: Analyzing the primary science curriculum and selecting content, students are required to: "Identify and practice appropriate actions that contribute to the protection of natural resources and the environment; develop and present messages using suitable formats, such as images or diagrams, to encourage people to live in harmony with nature and protect the local environment and biodiversity." An analysis of these learning outcomes suggests that environmental protection is a topic that lends itself well to the use of internationally recognized terminology. The content is highly visual, closely connected to students' daily experiences such as saving electricity and water or sorting waste. Additionally, teachers can readily create meaningful contexts and design activities that encourage students to express personal opinions using simple sentence patterns such as "We should...", "We shouldn't...", and "I can...".

- Step 2: Defining dual content and language objectives: Identify actions that contribute to environmental protection and the conservation of natural resources; explain the significance of these actions for the environment and daily life; recognize and use basic vocabulary related to environmental protection, such as "environment", "water", "forest", and "energy"; Use simple English expressions to describe and suggest actions for protecting the environment and natural resources, for example: "We should save water" and "We shouldn't throw rubbish".

- Step 3: Preparing instructional resources and language support: Visual materials from Grade 5 Science (p. 104) are used together with a worksheet (Figure 2). These materials include pictures of environmental protection activities, such as saving water, recycling waste, planting trees, protecting forests, and cleaning the environment. Language support includes key vocabulary (e.g., "save water", "recycle", "protect forests"), useful expressions, and simple sentence patterns that help students describe and explain the environmental actions shown in the pictures.

- Step 4: Designing and implementing CLIL-based learning activities using the 4Cs framework.

- Step 5: Assessing learning outcomes: Assessment is conducted throughout the learning process using classroom observation, students' completed worksheets (Figure 1 2), and peer assessment. It focuses on students' understanding and application of scientific knowledge, participation and collaboration, and their ability to use simple English to communicate scientific

WORKSHEET – LESSON 29
ACTIONS TO PROTECT THE ENVIRONMENT AND NATURAL RESOURCES
(Some actions to protect the environment and natural resources)

TASK: Identify the action in each picture (a-e).
 1. Identify the action in each picture (a-e).
 2. Explain the meaning of each action for the environment and natural resources.
 3. Use useful words and sentence frames to present in English.

Picture	Action	Meaning
a)		
b)		
c)		
d)		
e)		

2 What will happen if we do not do these actions?

3 Which actions should we do regularly? Why?

4 What actions are done in your local area to protect the environment?

5 What can you do every day?

USEFUL WORDS
 • save water
 • recycle
 • protect forests
 • save energy
 • treat wastewater

SENTENCE FRAMES
 • We should
 • We shouldn't
 • This helps to
 • This is good for the environment

Figure 2. Student

ideas and relate learning to everyday contexts. The assessment emphasizes students' progress and their ability to apply both Science knowledge and English in meaningful learning situations.

Teacher activities	CLIL	Student activities
Assign the task: Ask students to observe Figures 2a–e and answer the questions: “What action is shown in each picture?” and “How does this action help protect the environment and natural resources?”	Content	Observe the pictures and identify the actions shown (e.g., “composting”, “forest protection”, “wastewater treatment”, “energy conservation”).
Organize group discussion (four students per group) and ask students to complete the worksheet (see Figure 2)	Communication	Discuss ideas, exchange opinions, and complete the worksheet using simple expressions such as <i>We should save water</i> , and <i>This helps protect the forest</i> .
Ask guiding questions such as: “What might happen if these actions are not carried out?” and “Which actions should be practiced regularly? Why?”	Cognition	Analyze situations, explain reasons, predict consequences, and select appropriate behaviors for protecting the environment and natural resources.
Ask students to relate the lesson to their local context: “What activities are carried out in your community to protect the environment?” and “What can you do every day?”	Culture	Make connections with real-life experiences and suggest additional actions such as reducing littering, saving electricity, and planting trees.
Invite each group to present its findings using two or three simple English sentences.	Communication & Cognition	Present ideas using simple sentences such as “We should not throw rubbish”, and “This helps save energy”.

4.3. Questionnaire survey of Primary School Teachers on the Proposed Teaching Procedure

To obtain teachers' feedback on the appropriateness and feasibility of the proposed science teaching procedure, the study consisted of two stages: (1) soliciting feedback from primary school teachers on the proposed teaching procedure; and (2) conducting a preliminary classroom implementation in teaching the topic “Some Activities to Protect the Environment and Natural Resources” (Lesson 29, Grade 5 Science).

The proposed CLIL-based science teaching procedure was evaluated through a questionnaire survey to obtain teachers' judgments on the appropriateness of each step and suggestions for refinement. The survey involved 68 primary school teachers from public primary schools in Hanoi. The demographic characteristics of the participants are presented in Table 1. The participants represented diverse teaching contexts and experience levels, with the majority (57.4%) having more than 10 years of teaching experience.

Table 1. Characteristics of the Participating Teachers

Characteristics	N = 68	%	Characteristics	N = 68	%
School location			Teaching experience		
<i>Urban</i>	47	69.1	<i>1–3 years</i>	14	20.6
<i>Suburban</i>	21	30.9	<i>4–6 years</i>	9	13.2
Current teaching grade			<i>7–10 years</i>	6	8.8
<i>Grade 5</i>	23	33.8	<i>More than 10 years</i>	39	57.4
<i>Grade 4</i>	22	32.4			
<i>Grades 1–3</i>	23	33.8			

A 5-point Likert scale was used, ranging from 1 (not appropriate) to 5 (highly appropriate): 1 = Not appropriate; 2 = Slightly appropriate; 3 = Moderately appropriate; 4 = Quite appropriate; 5 = Highly appropriate. The mean score interpretation ranges were defined as follows: 1.00–1.80: Not

appropriate; 1.81–2.60: Slightly appropriate; 2.61–3.40: Moderately appropriate; 3.41–4.20: Quite appropriate; 4.21–5.00: Highly appropriate (Sullivan et.al., 2013).

Table 2: Presents the results of teachers' evaluation of the appropriateness of each step in the CLIL-based Science teaching procedure

Evaluation content	N	Mean	SD	Level
Step 1. Analyzing the science curriculum and selecting content	68	3.985	0.922	Quite appropriate
Step 2. Identifying dual objectives in both Science content and English language	68	3.897	1.024	Quite appropriate
Step 3. Designing lesson plans based on the CLIL approach	68	3.838	0.924	Quite appropriate
Step 4. Preparing teaching materials and English language support	68	3.912	0.989	Quite appropriate
Step 5. Implementing CLIL-based teaching activities	68	3.868	0.913	Quite appropriate
Step 6. Assessing learning outcomes	68	3.882	0.907	Quite appropriate
Overall mean	68	3.897		Quite appropriate

The results of the validation show that all steps in the procedure were rated “Quite appropriate”, with mean scores ranging from 3.838 to 3.985. Among them, Step 1, “Analyzing the topic and learning objectives to select appropriate content for CLIL teaching,” obtained the highest score ($M = 3.985$; $SD = 0.922$), while Step 3, “Designing lesson plans based on the CLIL approach,” received the lowest mean score ($M = 3.838$; $SD = 0.924$). The overall mean was 3.897, indicating that the procedure was evaluated by teachers as relatively highly appropriate and feasible for application in primary science teaching practice. Some teachers also suggested that the procedure should be more concise. A teacher from Be Van Dan Primary School stated: “It should not be added but rather reduced, simplified as much as possible.” This indicates that it is necessary to refine the procedure by integrating closely related components, thereby making it more concise while still ensuring the essential elements of CLIL-based teaching are maintained. Based on feedback, the procedure was revised into five steps: (1) analyzing the science curriculum and selecting content; (2) identifying dual objectives in both science content and English language; (3) preparing teaching materials and English language support; (4) designing and organizing CLIL-based science learning activities based on the 4Cs framework; and (5) assessing learning outcomes. To further refine the proposed procedure, it was subsequently piloted in an actual classroom through the implementation of a lesson, with the results presented in the next section.

4.4. Pedagogical Experiment

A pedagogical experiment was conducted using Lesson 29: Human impacts on the environment and environmental protection measures in Grade 5 Science. The experiment was carried out from March to May of the 2025–2026 academic year at Be Van Dan Primary School, Nam Dong Ward, Hanoi City, involving two intact Grade 5 classes. The control group comprised 50 students (22 boys and 28 girls) in Class 5C, while the experimental group included 48 students (25 boys and 23 girls) in Class 5G. The two classes had comparable the first-semester Science achievement and similar English proficiency and were therefore considered comparable before the intervention. As intact classes were used, convenience sampling was adopted. Each class was taught by its own teacher for one 40-minute lesson following the same learning objectives, with the experimental group applying the proposed CLIL-based science teaching procedure and the control group receiving conventional instruction.

Students' learning outcomes were assessed using a 10-point worksheet measuring scientific understanding and language competence. Prior to analysis, the assumptions for the independent-samples t -test were checked and satisfied. The null hypothesis (H_0) stated that there was no significant difference between the two groups, whereas the alternative hypothesis (H_1) stated that a significant difference existed. The data were analyzed using IBM SPSS Statistics (Version 20.0).

Table 3. Results of the independent samples t-test comparing the mean test scores of the experimental and control groups

Group	N	M	SD	p
Control	50	7.150	1.28	
Experimental	48	7.958	1.18	0.002

The experimental group obtained a higher mean score ($M = 7.958$, $SD = 1.180$) than the control group ($M = 7.150$, $SD = 1.280$). The independent samples t-test indicated that this difference was statistically significant ($p = 0.002$). Therefore, the null hypothesis was rejected. These findings provide preliminary evidence that the proposed CLIL-based science teaching procedure may enhance students' scientific understanding and language competence. Classroom observations further showed that students in the experimental group were more actively engaged in learning activities, participated more frequently in pair and group discussions, and demonstrated greater confidence in using simple English vocabulary and expressions related to the lesson content. These observations were consistent with the quantitative findings and complemented the worksheet results. They also provided further empirical support for the theoretical framework proposed by Coyle et al. (2010) and were consistent with the findings reported by Le, T.T.H et al. (2024).

5. Conclusion

Teaching science through the CLIL approach aligns with the competency-based orientation and the current requirement of strengthening English use in general education. Based on both theoretical and practical research, this study proposed a five-step CLIL-based science teaching procedure at the primary level, ensuring the integration of science content objectives and language development objectives. The results of the pedagogical experiment showed that students taught using the proposed CLIL-based science teaching procedure achieved higher performance than those taught using conventional methods. The difference in scores between the experimental and control groups was statistically significant ($p=0.002$). The proposed procedure supports Grade 5 students' scientific understanding and language competence. The findings contribute to the theoretical and practical development of CLIL-based science teaching by providing empirical evidence to inform teachers and educational institutions interested in its implementation, while also supporting the ongoing implementation of the policy promoting English as a second language in Vietnamese schools.

Note on contributors: Dr. Pham Viet Quynh is a lecturer at the Faculty of Education, Hanoi Metropolitan University, Vietnam; Dr. Phan Thanh Ha is a lecturer at the Department of Primary Education, Hanoi National University of Education, Vietnam. Author 1: conceptualization, methodology, investigation, design of the instructional process, preparation of illustrative examples, data analysis, and manuscript drafting; Author 2: writing of the introduction and theoretical background, lesson plan development, and implementation of the experimental teaching.

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