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Investigating the Effectiveness of CLIL Strategies on Overcoming Challenges and Shaping Educators' and Learners' Perceptions

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Content and language must be carefully balanced when teaching science and engineering through a foreign language, as in Content and Language Integrated Learning (CLIL). This study examines challenges learners face in CLIL classes, evaluates the effectiveness of strategies used to address these challenges, explores learner and educator perceptions of these strategies, and investigates the role of code-switching in supporting content learning and language development in English-medium instruction. A mixed-method, cross-sectional design was employed with 200 junior and senior students and 15 educators from 10 engineering and science departments at the University of Koya. Quantitative data were collected via a structured Likert-scale questionnaire administered to learners, and qualitative data via unstructured interviews with educators; data were analysed using structural equation modelling (AMOS) and thematic analysis supported by MAXQDA. The findings show that all examined strategies had significant positive effects on learners' perceptions and an inverse relationship with experienced challenges. Limited English proficiency, technical vocabulary demands, and scarce resources emerged as major obstacles, while interaction, group work, feedback, and strong grammar and vocabulary knowledge supported both content and language learning. Code-switching was found to enhance content comprehension and concept clarification while only slightly constraining language development.

Keywords: CLIL, code-switching, content cognition, content communication, language development

INTRODUCTION

Content and language integrated learning (henceforth CLIL) was originally initiated to encourage Europeans to acquire a second language. However, it has now evolved into a teaching and learning system specifically related to English, as English has become a predominant language of instruction and education in academic institutions (Hemmi & Banegas, 2021). However, CLIL typically involves a subject instructor instructing students in a second or foreign language while teaching the subject matter. Nevertheless, CLIL may also involve incorporating topic content into language sessions (Richards & Rodgers, 2014). CLIL is a pedagogical strategy that focuses on learning

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the second language and the subject matter simultaneously. It integrates different principles and methodologies to enhance the effectiveness of language education. In this framework, a foreign language serves as the medium for studying non-language subjects, with equal importance placed on both language development and subject knowledge. CLIL applies to every language, age, and level of education, from early childhood to vocational and professional training, making it a model of lifelong learning (Coyle, 1999).

CLIL refers to learning a language by exposing it to other disciplines. It pursues two central goals: acquiring subject knowledge and developing proficiency in the target language. Unlike conventional language classes, CLIL uses the language as the medium for conveying subject content. It is often associated with content-based instruction, bilingual education, or immersion learning. Ultimately, the purpose of CLIL is to enable students to strengthen their language abilities while simultaneously gaining academic knowledge. Students may use their newly acquired language skills immediately, due to CLIL, rather than of merely studying them for the future. This technique may be especially important in vocational contexts since it provides language exposure without adding more time to the curriculum (Pratap & Alapati, 2022). The integration of foreign language learning with other academic subjects means studying areas like history or science through a language that is not one's native tongue. CLIL offers significant advantages, enhancing both language acquisition and the understanding of the subjects taught in that language (Hidalgo & Ortega-Sánchez, 2023).

There are many strategies that can be adopted in CLIL classes to minimise the challenges faced by the learners in language learning and content comprehension. According to Lyster (2011), comprehension is a fundamental requirement in second language learning. In content-based programmes, teachers aim to ensure that students can effectively understand the curriculum presented in the target language. Therefore, it is essential to use language in a manner that makes the content comprehensible in CLIL classrooms. Moreover, understanding content necessitates a careful negotiation of meaning. This suggests that both teachers and learners work toward a shared understanding of the content. The process of negotiating meaning can take various forms—for instance, it may unfold across multiple turns in a conversation rather than within a single exchange, with one speaker expanding on or adapting the words or expressions of the other; another speaker can ask clarifying questions to help the other understand what they have said. Furthermore, when using CLIL, learners do not just "pick up" language. Through the many forms of corrective feedback the teacher offers, they also improve their language correctness and awareness. Besides feedback, dialogic talk facilitates learning of both language and content. Dialogic talk is considered a hallmark of effective interaction in CLIL classrooms. It involves conversations that build shared understanding through structured dialogue, progressive questioning, and guided discussion. These strategies help narrow choices, lower risks of mistakes, and ease the transfer of concepts and principles. Due to its cognitive impact and the opportunities it provides for engaging with and practising rich language, dialogic teaching is regarded as an essential element of CLIL pedagogy (Llinares et al., 2012).

Scaffolded learning is considered a crucial component of CLIL by Richards and Rodgers (2014). Scaffolding is the temporary support a teacher provides to a student to help them master a skill so they may eventually finish a job on their own. Learners first rely on those who have more expertise than they do, but as time goes on, they eventually assume greater accountability for their learning. Scaffolding, as described by Swain et al. (2010), occurs in classroom activities when two or more participants interact and one, whether the teacher or a peer, possesses greater expertise than the learner. Although scaffolding plays a significant role in all classroom-based learning, it is especially crucial in CLIL environments, as students must comprehend and convey complex concepts in a foreign language (Llinares et al,. 2012).

In CLIL classes, according to Kruawong and Phoocharoensil (2024), integrating language and content is mostly dependent on vocabulary. Learning subject-specific vocabulary is a key component of CLIL courses since various topics or content areas are communicated using distinct vocabulary registers. One unique aspect of learning a second language in CLIL contexts, according to Llinares et al. (2012), is that, unlike in foreign language classes, the vocabulary required to communicate is frequently technical and abstract in order to represent content in the instructional register. Moreover, grammar is a useful tool for content communication. Grammar is learnt in accordance with how content is expressed. Grammar advancement is not determined by grammatical difficulty but rather by the demands of the content. It employs both a linguistic and a pragmatic approach to language development via use. In order to take a more immersed approach, it could be necessary to include the grammar point via various applications in CLIL classes (Richards & Rodgers, 2014). Thus, CLIL integrates language and competence; it is a dual-focused process of learning. It is designed to not only enhance students' proficiency but also to facilitate the learning of the language being taught (Sumartana et al., 2019).

The purpose of this study is to achieve certain goals and address specific research enquiries. The primary aim of this research paper is to unveil the effectiveness and implications of some strategies employed in teaching content disciplines in English, as the target language, to enhance language skills by adopting the CLIL approach. Moreover, the study aims to pinpoint the challenges learners encounter when learning content materials and the target language, while also examining how teachers and learners perceive the implementation of CLIL. This study also aims to investigate the effectiveness of CLIL using code-switching as a facilitator for its success. This research article addresses some research questions to investigate the objectives of this study, including;

1. What challenges do learners face in learning disciplinary content knowledge and English language proficiency, and how do educators and learners in these departments perceive the challenges of implementing CLIL and the strategies to overcome them?
2. How do the effective strategies, employed to overcome CLIL challenges, enhance content and language learning in various adopted science and engineering university classes?

3. To what extent does the use of code-switching, or the learner's first language, contribute to understanding the content materials while disrupting English language learning?

Although the CLIL approach has been widely examined in different educational works, previous studies have typically focused on single subjects or relatively narrow disciplinary areas, such as science vocabulary in secondary schools, scientific translation, business English, or English for specific engineering fields. These works have demonstrated gains in language skills, content knowledge, or student confidence, but they do not systematically investigate CLIL challenges and strategies across a broad range of science, health, and engineering disciplines.

The present study addresses this gap by examining CLIL implementation in ten departments (biology, physics, mathematics, chemistry, clinical psychology, software engineering, architecture, civil engineering, petroleum engineering, and geotechnical engineering) within one university, thereby offering a comprehensive view of CLIL in diverse disciplinary contexts. Unlike earlier research that focuses mainly on learning outcomes, this study specifically investigates the challenges faced by both teachers and students in CLIL classes, the effectiveness of strategies used to overcome these challenges, and their perceptions of these strategies.

Furthermore, while prior empirical work often highlights particular CLIL components (e.g., vocabulary development or speaking skills), this study explicitly draws on the 4Cs framework and analyses all four dimensions, content, communication, cognition, and culture, for both learners and educators. It also considers a wide range of teaching and learning aspects, including vocabulary, grammar, English proficiency, translation, content memorisation, reading, writing, speaking, listening, materials, confidence, participation, group work, motivation, feedback, code-switching, and critical thinking, thus providing a more holistic account of CLIL practice in English-medium science and engineering education.

THEORETICAL FRAMEWORK

The 4CS Framework of CLIL

The 4Cs framework for CLIL takes a holistic approach, emphasising that effective CLIL goes beyond traditional views of either language or subject content in isolation. It highlights the interconnection between content (the subject matter), communication (language use), cognition (thinking and learning), and culture. Integration is addressed on multiple levels: combining content with cognitive development, linking language learning with communication and culture, and fostering intercultural interaction. According to Coyle (1999, 2010), the framework strengthens subject knowledge while enhancing cognitive processing, which in turn deepens content understanding, improves language proficiency, and promotes cultural awareness. The cornerstone of the language of learning is content language, which includes specific vocabulary and terminologies, structures, and grammar. This approach gives students access to fundamental ideas and abilities related to the subject theme or topic. Learners are more likely to develop the

metacognitive abilities necessary for success in a broad range of academic and professional domains if they use language as a learning tool (Iswarya & Singh, 2022).

The 4Cs framework is underpinned by a core set of principles, which constitute its conceptual foundation. The first of these concerns a subject matter that extends beyond knowledge and skills. It highlights learners actively building their own knowledge and developing appropriate, transferable skills. Learning and thinking are required to gain the content knowledge, and cognitive processes need to be analysed in relation to language requirements to enable progress. Another principle highlights that language is to be learnt in context through engagement with topic areas and cognitive processes in a second or target language, both through input and production. Collaboration within the learning environment is also essential because providing avenues for exploratory writing and conversation enables learners to think through material and build ideas independently. Finally, the system highlights the complex interdependence between language and culture. Placing intercultural and cultural awareness before everything else, it takes education further towards transformative pedagogies, global citizenship, learner voice, and identity building (Coyle, 1999, 2006).

Figure 1
The 4Cs Framework for CLIL

In the 4Cs framework, the 'C' for communication is understood in a broad sense, extending beyond grammar to include aspects such as the use of the mother tongue and code-switching. Within CLIL, the target language is not only studied as a subject in its own right but also used as a medium for learning content. This tripartite linguistic approach (see Figure 2) reflects a shift away from traditional language teaching focused on form and grammatical progression toward a "language-using" perspective that integrates cultural and functional dimensions (Coyle, 2007).

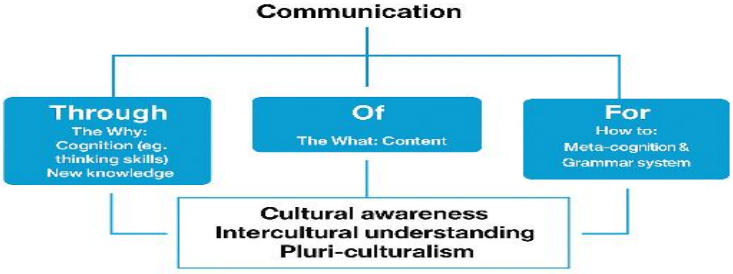

Figure 2
Embedding Language (Communication) in CLIL

Within the 4Cs framework, communication is described through the concepts of the language of, for, and through learning. Language of learning refers to the specific linguistic tools students need in order to grasp essential ideas and skills tied to subject content. The language for learning focuses on how language supports metacognition and the ongoing development of knowledge, which includes both teaching strategies that aid learning and strategies that foster learner independence. Meanwhile, the language through learning highlights the sociocultural principle that meaningful learning cannot take place without active language use—where reasoning and dialogue form the core. In particular, when learners express and articulate their understanding, they achieve deeper levels of learning (Coyle, 2007).

The Roles of Learners and Educators in CLIL Classes

Learners play a central role in the effectiveness of CLIL programmes, as the approach relies heavily on student-centred methods. Many students find CLIL courses demanding, especially at the outset, since mastering cognitively challenging content through another language requires more than simply receiving information from the teacher. For this reason, CLIL emphasises active learner participation, ultimately aiming to foster learner autonomy (Llinares et al., 2012). At the same time, teachers take on roles that differ from—and are often more demanding than—those in traditional content or language instruction. They frequently collaborate with colleagues to design courses and resources, adjust their language use to support comprehension in a second language, and provide scaffolding, dialogic teaching, and targeted feedback to guide both subject and language learning. In short, a core responsibility of CLIL teachers is ensuring that students fully grasp the content being taught (Richards & Rodgers, 2014).

Before any actions are initiated, educators must conduct a thorough needs analysis in order to responsibly implement CLIL programmes. The absence of awareness or knowledge among educators is closely associated with the individuals who are responsible for the implementation of CLIL, i.e., teachers. The majority of second language support in CLIL classes, which are exclusively taught by content teachers, is provided through unnecessary translation. This also resulted in the realisation that teachers perceived themselves as either content or language teachers, a perspective that influenced the integration of components or team teaching. This reticence was evident in the instructors' reluctance to integrate materials from content or language classes (Banegas, 2012).

However, the term CLIL is often used broadly to encompass various educational approaches, such as total or partial immersion programmes and basic foreign language–medium instruction (Aguilar & Muñoz, 2014). Consequently, the main focus for educators in English-medium programmes is to continuously monitor improvements in students' second language skills and to identify any potential negative effects on content learning. Key questions persist regarding whether students achieve meaningful progress in language proficiency and whether they gain the intended benefits of English Medium Instruction in enhancing their English skills (Balta et al., 2022).

To help the teachers to initiate and design CLIL modules and classes, Pratap and Alapati (2022) listed six distinct phases:

Choosing Influential Texts: Many learners learn more effectively from books that include images since they are able to mentally visualise the content in the text.

Textual interpretation: Texts are often shown via the use of diagrams. Students may use these structured frameworks to enhance the organisation of the ideas and information conveyed in a book.

Lexical comprehension: Students should possess the ability to rephrase the key ideas of the book using their language (language recognition). Collocations, semi-fixed expressions, and fixed phrases may be evaluated in conjunction with subject-specific and academic terminology.

Student Assignments: Based on the intended result and the specific preferences of the learners, a diverse range of activities should be provided. To effectively practise both content and language, exercises designed for production should be inherently focused on content.

Material Production: The relationship between language and cognition is intricate and interdependent. Nevertheless, the educational process is most effective when learners are exposed to challenges and provided with constructive feedback about their performance.

The significance of a proficient language instructor: Like English Language Teaching, CLIL seeks to guide language processing and support language development by teaching learners fundamental reading and listening abilities, as well as linguistic structures and vocabulary.

METHOD

Research Design

This study employed a mixed-method design by incorporating qualitative and quantitative data in order to establish the success and setbacks concerning perceptions and strategies of CLIL among students and lecturers within engineering and science disciplines and to enhance the validity and depth of the findings. The data were collected from the students through an electronic survey instrument that is intended to capture learners' perceptions and experiences of CLIL, whereas data collection from educators was done through unstructured interviews to tease out insights and challenges regarding the implementation of the CLIL pedagogies. This study tried to explore the pedagogical effects of CLIL on subject-specific learning outcomes and language learning, using a questionnaire and interview responses for a comprehensive analysis. Moreover, the data in this study were collected at a single point in time; therefore, a cross-sectional approach was employed. The data were gathered from various disciplines within the same semester, with an equal number of male and female participants.

Participants and Setting

The research was carried out at the University of Koya within ten departments from both the Faculty of Engineering and the Faculty of Science and Health. These included

departments like Civil Engineering, Architecture, Software Engineering, Geotechnical Engineering, and Petroleum Engineering within the Faculty of Engineering. On the parallel side, the Faculty of Science and Health embraced such departments as biology, chemistry, physics, mathematics, and clinical psychology. In this study, the participants for both the student and educator cohorts across these disciplines were involved. The participants are non-native English speakers. A total of 200 junior and senior students were included in the participant cohort for this research, with 20 students selected from each of the 10 departments, i.e., ten junior students and ten senior students from each department. One hundred candidates were selected from the Faculty of Engineering, while the remaining 100 were from the Faculty of Science and Health. The criteria for selecting participants were based on their level of education, content knowledge, cognition, and communication skills, as the participants were junior and senior students who possess sufficient knowledge of the content materials and subject-specific vocabularies and who can communicate in English and comprehend the survey at a moderate level. In addition, one to two educators from each department participated in the study, contributing to a total of 15 educators. This comprises 8 educators from the Faculty of Engineering and 7 from the Faculty of Science and Health. In order to facilitate a thorough examination of the challenges and effects of CLIL from the perspectives of both students and educators, the selection of participants was intended to ensure equitable representation across both faculties.

Data Collection

Questionnaire

This study adopted a structured questionnaire, as it included only closed-ended items. The learners from the departments of (Civil Engineering, Architecture, Software Engineering, Geotechnical Engineering, Petroleum Engineering, Biology, Chemistry, Physics, Mathematics, and Clinical Psychology) filled out this questionnaire to investigate their perception toward CLIL and CLIL's effects on enhancing the language skills of the learners. Thus, this questionnaire is structured based on the research questions and it aims to gather insights into the challenges encountered by learners in implementing CLIL in these departments. The researcher developed this questionnaire as a Google Forms survey based on prior literature concerning CLIL in this study. The researcher explained the nature of the CLIL approach to these learners and explained the main ideas about CLIL so that the learners would have enough knowledge to conceptualise the questions. The closed-ended questions are structured using a Likert scale of 1 to 5, where (1 is Strongly Disagree); (2 is Disagree); (3 is Somewhat agree); (4 is Agree), and (5 is Strongly agree). To address the research questions effectively, the items in the questionnaire are adapted from Lundin and Persson (2015), Metlí and Akıs (2022), Dong, Le, and Tuyet (2022), as well as other previous studies cited in this paper, to better investigate the challenges students face in employing CLIL, the strategies that might help them overcome CLIL-related difficulties, and their perceptions of CLIL in general.

Interview

This study adopted unstructured interview for the teachers in the departments of the Faculty of Engineering and the Faculty of Science and Health, including Civil Engineering, Architecture, Software Engineering, Geotechnical Engineering, Petroleum Engineering, Biology, Chemistry, Physics, Mathematics, and Clinical Psychology. The unstructured interview method was adopted to better perceive the teachers' perceptions toward the strategies that are adopted to lessen the challenges in implementing CLIL by engineering, science, and health learners. The questions were designed to capture the teachers' perceptions toward the implementation of CLIL in these disciplines. The challenges faced by the teachers and the strategies adopted to overcome these challenges were addressed in the content of the interview questions. The researcher conducted the interviews in person with those teachers from April and June 2025. The interviews were recorded and then transcribed for thematic analysis. The items in the unstructured interview were developed to address all the research questions and suit the study's context or setting based on two methods. The rationale of part of the interview questions is adapted from Cauli (2021), Dong, Le, and Tuyet (2022), and Metlí and Akıs (2022). The other part is deduced from the items in the structured questionnaire to make a sort of correlation between both scales, i.e., the structured questionnaire and the unstructured interview items.

Ethical Approval and Informed Consent Statement

Ethical approval for this study was obtained from Koya University through the Deanship of Research and Development Centres, in accordance with the institutional Research/Project Ethics Form. Formal permission was granted by the Dean of the Faculty of Engineering and the Dean of the Faculty of Science and Health, as well as by the heads of the relevant departments, to conduct interviews with teachers and to distribute the survey to students. All participants were informed about the aims of the study, the voluntary nature of their participation, their right to withdraw at any time, and the confidentiality of their responses, and informed consent was obtained prior to data collection.

Validity and Reliability

To determine the validity, we made a pilot study among 20 students from 10 departments, calculating the Pearson correlation between each item and the total of the scale, as indicated in Table (1). We found that all the items showed a statistically significant correlation with the overall scale. The result indicates that the items in these dimensions have been statistically validated. However, in the Challenge Scale, item 6 did not show a statistically significant correlation. Therefore, this item is not considered validated and has been removed.

Table 1
Validity of the Scale

Variables	Item	Correlation	Item	Correlation	Item	Correlation	Item	
Challenges	Item1	0.711**	Item4	0.519**	Item7	0.795**	Item10	0.630**
	Item2	0.795**	Item5	0.624**	Item8	0.663**	Item11	0.494*
	Item3	0.781**	Item6	0.180	Item9	0.833**		
Strategies	Item1	0.638**	Item4	0.561*	Item7	0.582**	Item10	0.540*
	Item2	0.669**	Item5	0.735**	Item8	0.785**	Item11	0.486*
	Item3	0.839**	Item6	0.822**	Item9	0.655**	Item12	0.733**
Perceptions	Item1	0.591**	Item3	0.897**	Item5	0.880**		
	Item2	0.782**	Item4	0.868**				

** P-Value<0.01 * P-Value<0.05

To assess the reliability of the structured questionnaire and the unstructured interview scales, we utilized Cronbach's Alpha. Table (2) displays the Cronbach's alpha values for each variable in the structured questionnaire scale: Challenges (0.876), Strategies (0.889), and Perception (0.846). These values indicate a high level of reliability. Table (3) illustrates Cronbach's alpha values for the overall scale of the unstructured interview data. The mean of all the coded themes and sub-themes is (36.33) and the maximum is 43. Thus, the Cronbach's alpha of the qualitative data is 0.254, and its valid cases are 15, and its missing cases: are 0 (0.0%).

Table 2
Reliability of the Questionnaire Scale

Variables	Cronbach's Alpha	N. Items	Items Deleted
Challenges	0.876	10	1
Strategies	0.889	12	0
Perception	0.846	5	0

Table 3
Reliability of the Interview Scale

	N	Mean	SD (samp.)	SD (pop.)	Minimum	Median	Maximum
TOTAL SCALE (summation)	15	36.33	4.061	4.203	29	37	43
TOTAL SCALE (mean)	15	0.6	0.067	0.069	0.48	0.61	0.7

The Quantitative Results

The descriptive statistics show the minimum, maximum, means, and standard deviations for the students' challenges, strategies, and perceptions in table 4. The mean for challenges was 2.83 and the standard deviation was 0.747; for strategies it was 3.73 and the standard deviation was 0.587; and for perception it was 2.96 and the standard deviation was 0.480. The results indicate that challenges have a significant impact on students, although the effects differ depending on the specific challenge. The strategies can be acted upon and implemented for the students to a significant extent and close to the agree option. The results gained from the perception scale can align with the challenges and the presented strategies. Moreover, the mean and standard deviation for each item in the questionnaire scale is recorded in table 5.

Table 4
Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Sd. Deviation
Challenges	200	1.11	4.78	2.83	0.747
Strategies	200	1.67	4.89	3.73	0.585
Perception	200	1.00	4.00	2.96	0.480

Table 5
Mean and Standard Deviation of the Items

Variables	Minimum	Maximum	Mean	Sd. Deviation
Challenge	1	5	2.88	1.020
	1	5	2.71	1.125
	1	5	3.01	1.244
	1	5	2.73	1.018
	1	5	2.91	1.032
	1	5	3.23	1.036
	1	5	2.68	1.178
	1	5	2.59	1.014
	1	5	2.73	1.093
	1	5	3.95	0.994
	1	5	3.93	1.044
Strategies	1	5	3.92	0.936
	1	5	3.18	1.026
	1	5	3.82	1.081
	1	5	3.83	0.972
	1	5	3.96	0.945
	1	5	2.99	1.246
	1	5	4.01	0.912
Perception	1	5	3.40	0.914
	1	5	3.65	0.960
	1	5	3.92	0.931
	1	5	3.84	0.930

To investigate the key differences between males and females in perceiving CLIL and implementing the strategies to overcome the challenges, this study surveys 200 students from 10 departments, 94 female and 106 male. To extract the difference between male and female, we use an independent samples t-test as shown in the table (6). There is no significant difference between males and females (P-value>0.05). This test suggests that students of both sexes face such challenges, understand them, and try to use strategies to overcome these challenges.

Table 6
Gender-Based Differences in Key Study Variables

Variables	Gender	N	Mean	Standard Divion	T	P-Value
Challenges	Male	106	2.87	0.770	0.900	0.369
	Female	94	2.78	0.721		
Strategies	Male	106	3.74	0.593	0.164	0.870
	Female	94	3.73	0.579		
Perception	Male	106	2.98	0.454	0.646	0.519
	Female	94	2.94	0.509		

In this study, structural equation modelling was performed using AMOS to analyze the direct effects of strategies on challenges and perceptions. As shown in table (8), the

strategies have a statistically significant effect of 0.411 in promoting perception, and the -0.372 amount also has the opposite effect on the challenge. Accordingly**,** strategies have a direct impact on perception: that is, with each standard deviation increase in the use of strategies, there is an increase in perception by 0.411. Conversely, with each standard deviation decrease in the use of strategies, there is a decrease of 0.411 standard deviations in perception. On the contrary, strategies have an inverse impact on challenges: that is, with each standard deviation increase in the use of strategies, there is a decrease in challenges by -0.372. Conversely, with each standard deviation decrease in strategies, there is an increase in challenges by 0.411 standard deviations.

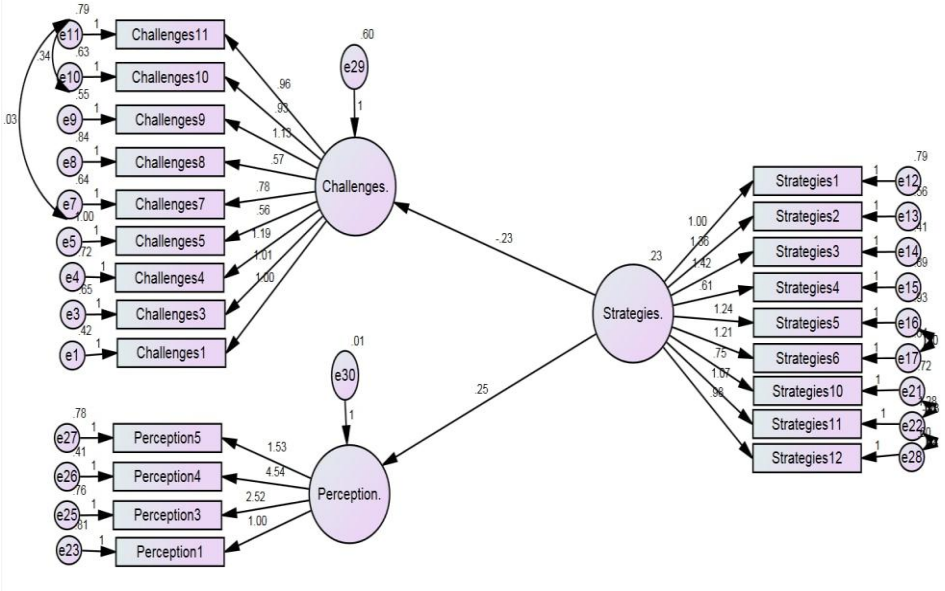

Figure 3
Effects of Strategies on Challenges and Perceptions

Table 7
Model Fit Indices

Fitting indexes	RMSEA	CMIN/DF	PNFI	AGFI	PCFI	IFI	CFI
Cut value	≤ 0.08	≤ 3	≥ 0.60	≥ 0.80	≥ 0.60	≥ 0.90	≥ 0.9
The model	0.054	1.639	0.686	0.852	0.786	0.905	0.903

Table 8
Effects of Strategies on Challenges and Perceptions

Variables			Effect	P-Value
Strategies	⟶	Challenges	-0.372	0.015
Strategies	⟶	Perception	0.411	0.003

Based on the analysis of the collected data, there is no significant difference between males and females, as the z-score has not reached the level of statistical significance.

Table 9
The Direct Effects Strategies on Challenges and Perception Based on Gender

Variables	Male		Female		z-score
	Effect	P-Value	Effect	P-Value	
Strategies → Challenges	-0.230	0.222	-0.499	0.051	-0.850
Strategies → Perception	0.250	0.146	0.640	0.012	1.269

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

The Qualitative Results

The qualitative data were collected after conducting semi-structured interviews with 15 teachers from two faculties, the Faculty of Engineering and the Faculty of Science and Health, in the departments of Civil Engineering, Architecture, Software Engineering, Geotechnical Engineering, Petroleum Engineering, Biology, Chemistry, Physics, Mathematics, and Clinical Psychology at Koya University. The interviews included 10 questions. The participants' responses were transcribed verbatim from the audio recordings. The data was analysed adopting thematic analysis (Braun & Clarke, 2006). To categorise the themes (parent codes) and the sub-themes (codes), the collected data or the responses of the interviews were coded for the thematic analysis employing the qualitative analytical software MAXQDA Analytics Pro (24.10.00).

The interviews were coded into 10 main themes, and each theme represents an item of the interview. The main themes coded in this study are mentioned respectively according to the order of the items in the interview: Content and Language Challenges, Class Participation Challenges, Language Skill Prioritization, Active Learning Strategies, Feedback and Motivation, Mother Tongue and Code Switching, Teacher's Language Proficiency, CLIL Effectiveness, Importance of Interaction, and Cultural Context Integration in CLIL. These themes were designed based on the dimensions of the study; challenges of CLIL, Strategies of CLIL, and perceptions of CLIL.

A thorough analysis of the data is conducted in this study. Thus, many sub-themes are coded under each theme. In table 10, the overall themes and sub-themes in this study is 61, including 51 sub-themes and 10 themes. The segments coded in these 15 interviews is 545. As the coded themes and sub-themes are too many, they are referred to by C1, C2, and C3 codes. Thus, each theme or sub-theme is assigned a code number, and the corresponding number of coded segments is also identified along with its percentage.

Table 10
Themes and Sub-themes Identified from Interviews

Code No.	THEMES sub-themes	Code segment No.	Code segment percent
C1	CONTENT AND LANGUAGE CHALLENGES	15	2.75
C2	unlike senior students, junior students find disciplinary content and vocabulary difficult	7	1.28
C3	lack of equivalence in the target language	7	1.28
C4	disciplinary content & vocabulary are difficult in English	11	2.02
C5	disciplinary content & vocabulary are NOT difficult in English	5	0.92
C6	English proficiency gaps	11	2.02
C7	vocabulary limitations	10	1.83
C8	CLASS PARTICIPATION CHALLENGES	15	2.75
C9	students with good English are active participants	3	0.55
C10	language proficiency is NOT tied to student participation	2	0.37
C11	low language proficiency hinders student participation	16	2.94
C12	gradual language improvement	7	1.28
C13	feel shy	5	0.92
C14	low confidence	5	0.92
C15	fear of mistakes	5	0.92
C16	LANGUAGE SKILL PRIORITIZATION	15	2.75
C17	Writing	8	1.47
C18	Reading	7	1.28
C19	Speaking	12	2.20
C20	Listening	6	1.10
C21	ACTIVE LEARNING STRATEGIES	15	2.75
C22	reading & group work enhances CLIL success	13	2.39
C23	passive attendance	2	0.37
C24	reading materials	6	1.10
C25	class discussions	8	1.47
C26	group work	16	2.94
C27	students use mother tongue language in group works	2	0.37
C28	group work fosters confidence	2	0.37
C29	FEEDBACK AND MOTIVATION	15	2.75
C30	feedback and motivation build confidence	7	1.28
C31	lack of feedback or motivation leaves students directionless	2	0.37
C32	feedback enhances learning content & improving language	10	1.83
C33	motivation enhances learning content & improving language	12	2.20
C34	personalized feedback	9	1.65
C35	MOTHER TONGUE AND CODE SWITCHING	15	2.75
C36	using mother tongue hinders language learning	3	0.55
C37	code switching fosters English language learning	3	0.55
C38	using mother tongue to learn subject matter	14	2.57
C39	using mother tongue for concept clarification	8	1.47
C40	using mother tongue based on student level (especially junior students)	10	1.83
C41	TEACHER'S LANGUAGE PROFICIENCY	15	2.75
C42	dual impact of proficiency (may help or hinder)	3	0.55
C43	teaching effectiveness isn't tied to proficiency	3	0.55
C44	proficient teachers offer effective teaching	12	2.20
C45	content Delivery Quality	9	1.65
C46	CLIL EFFECTIVENESS	15	2.75
C47	CLIL improves grammar	10	1.83

C48	CLIL enhances vocabulary	15	2.75
C49	CLIL builds confidence	6	1.10
C50	CLIL improves language skills	16	2.94
C51	IMPORTANCE OF INTERACTION	15	2.75
C52	interaction improves language skills	12	2.20
C53	interaction fosters creativity	7	1.28
C54	interaction builds confidence	4	0.73
C55	interaction encourages critical thinking	5	0.92
C56	interaction enhances content understanding	12	2.20
C57	CULTURAL CONTEXT INTEGRATION IN CLIL	15	2.75
C58	cultural integration enhances language and content learning	10	1.83
C59	cultural context is tied to language level	4	0.73
C60	cultural integration is not experienced	2	0.37
C61	cultural integration is experienced	11	2.02
SUM		545	100%

In table 11, the demographic information and the coding summary of the participants are generated in the analysis that includes: faculty, department, degree, and gender of the participants. The number of the coded segments of each teacher's interview is recorded. Teachers from ten different departments, including both PhD and MSc holders of both male and female genders, were interviewed. The names of the interviewed teachers are kept confidential, and they are referred to by T1, T2, T3, etc.

Table 11
Demographic and coding summary of teacher participants

Teacher's Name	Coded Segments	Faculty	Department	Degree	Gender
T1	41	Engineering	Architectural Engineering	PhD	Female
T2	39	Engineering	Software Engineering	PhD	Male
T3	38	Engineering	Geotechnical Engineering	MSc	Female
T4	37	Engineering	Petroleum Engineering	MSc	Male
T5	36	Engineering	Software Engineering	MSc	Male
T6	34	Engineering	Geotechnical Engineering	MSc	Male
T7	34	Engineering	Civil Engineering	MSc	Male
T8	33	Engineering	Architectural Engineering	PhD	Female
T9	29	Science & Health	Physics	PhD	Male
T10	43	Science & Health	Physics	PhD	Male
T11	43	Science & Health	Biology	PhD	Female
T12	38	Science & Health	Mathematics	MSc	Male
T13	37	Science & Health	Clinical Psychology	PhD	Male
T14	32	Science & Health	Chemistry	PhD	Male
T15	31	Science & Health	Mathematics	PhD	Male

DISCUSSIONS

The results of the questionnaire and interview data are discussed and analysed in this section. For the quantitative results, 32 items were prepared based on three variables: challenges, strategies, and perceptions. For the qualitative results, 10 themes and 51 sub-themes were identified, each with varying coding segment values and effects. These themes are examined in relation to the study's variables: challenges, strategies, and perceptions.

Regarding the challenges dimension, the data from the questionnaire revealed that students moderately underwent these challenges, so the mean of the survey data based

on 9 validated items in this dimension is 2.83%, which was very close to the response category 'somewhat agree.' In other words, the students somewhat agreed that they were facing these challenges. In contrast, the responses of the educators regarding the dimension of challenges in CLIL classes was coded by two main themes. The first theme, *content and language challenges*, had a value of 12.10%, including its sub-themes. The sub-theme *disciplinary content and vocabulary are difficult in English* received the highest number of coding segments with a value of 2.02%, while the fewest lecturers believed in the sub-theme *disciplinary content and vocabulary are NOT difficult in English* and got the least value of 0.92%. Moreover, the second challenge theme, *class participation challenges,* was coded with a value of 10.65%, including its sub-themes as well. The sub-theme *low language proficiency hinders student participation* was recorded as the most effective challenge with the highest value of 2.94% and was coded 16 times in the interview data. In contrast, the sub-themes *feel shy, low confidence, and fear of mistakes* were recorded as the least influential class participation challenges, each with a value of 0.92%.

Another dimension of the collected data included the perceptions of learners and educators about the effectiveness of CLIL and its strategies to overcome the challenges faced by students in engineering and science classes. Both participants, learners and educators, fairly had positive perceptions about the effectiveness of CLIL and its strategies to overcome the challenges. Regarding the data of the perception dimension from the survey, the mean of 9 validated items was 2.96, which was very close to the category 'somewhat agree' on the Likert Scale. The results indicated that students somewhat agreed on the items of the survey, and they had positive perceptions of this approach.

Concerning the perception dimension in the data collected from educators' interviews, four main themes were identified that represent educators' perceptions regarding this method of teaching. The first was the *teacher's language proficiency*, with an overall value of 7.70%, including its sub-themes. Four sub-themes were identified, each with a different value and coded segments. Almost 80% of the interviewed teachers believe that *proficient teachers offer effective teaching*, with a value of 2.20%. However, very few educators responded to these two sub-themes: *dual impact of proficiency (may help or hinder) and teaching effectiveness isn't tied to proficiency*, and each received 3 references and a value of 0.55%. Thus, a teacher's language proficiency is considered an important factor in the success of CLIL, according to the collected data.

CLIL effectiveness is identified in the thematic analysis of the collected data as another theme for the educators' perceptions in regard to CLIL mechanisms and strategies in engineering and science classes. In the thematic analysis, four items were categorised as the sub-themes of the *CLIL effectiveness,* and the overall value of this theme, including its sub-themes, is 11.37%. Different mechanisms in the CLIL programme were raised to reflect the educators' perceptions. Thus, the sub-theme *CLIL improves language skills* received the highest number of references, totalling 16, as 90% of the interviewed teachers indicated that CLIL enhances language skills, which corresponds to a value of 2.94%. Similarly, another item with high coded segments was *CLIL enhances vocabulary*. All the interviewed teachers expressed positive perceptions of this item,

which had a value of 2.75%. The interviewed teachers stated that a significant aspect of the learners' content learning relies on their understanding of disciplinary vocabulary, and any method to enhance their vocabulary will contribute to improved content comprehension as well. Another two sub-themes of the perceptions on CLIL's programme were *CLIL improves grammar* and *CLIL builds confidence*, as nearly 67% of the interviewed teachers believe that the CLIL programme improves the knowledge of the grammar of the second or target language, whereas only 40% of the interviewed teachers think that this programme builds confidence, with a value of 1.83% and 1.10% respectively for each.

Interaction is considered an important aspect of CLIL's methodology, and its practice enhances its success. Thus, another theme that received educators' perceptions was coded as *the importance of interaction*, which included five other sub-themes with values of 10.08%. Two sub-themes, *interaction improves language skills and interaction enhances content understanding*, were perceived by the interviewed educators with high and similar values and coded segments, 12 references and 2.20% for each. Two main parts of CLIL are language and content, so these two sub-themes both had positive responses from the teachers, as they both enhance the success of CLIL and its components. Another sub-theme that is related to interaction is creativity. This sub-theme is labelled *interaction fosters creativity*, as creativity is a counterpart of interaction and it has a positive influence on the interlocutors, but it received only 7 references with a value of 1.28%. This theme is ended by two other sub-themes, but they received very few responses in the collected data. However, only 4 out of 15 educators responded to the other two sub-themes: *interaction encourages critical thinking and interaction builds confidence,* which had values of 0.73% and 0.92%, respectively. Although critical thinking and building confidence are outstanding components of interaction, very few teachers had positive perceptions of these two aspects.

The last theme in the perception dimension is *cultural context integration in CLIL*. As discussed earlier in the theoretical background, CLIL comprises four main components: content, communication, cognition, and culture. Accordingly, this study focused on analysing content, communication, cognitive aspects, and culture within the collected data. Culture is an indispensable part of CLIL, so this main theme investigates the perceptions of educators on integrating culture in their CLIL classes. This theme consists of four sub-themes, each with a different value and effectiveness, and the overall weight of this theme, including its sub-themes, is 7.70%. In this theme, two sub-themes received a high number of coded segments: *cultural integration enhances language and content learning* and *cultural integration is experienced*. Based on the collected data from the educators' perceptions, these two sub-themes were identified as particularly effective and decisive items for the success of CLIL, with values of 1.83% and 2.02%, respectively. In contrast, only a small number of educators reported negative perceptions of culture's role in CLIL classes. This is reflected in the sub-theme *cultural integration is not experienced***,** which highlights the limited presence of cultural aspects in engineering and science classes, with a value of 0.37%.

Strategies of CLIL as an independent variable played a pivotal role in resolving and investigating the challenges in CLIL classes that were identified by the learners in the survey data and the educators in the interview data. According to the results of the data, the learners agreed with the strategies proposed in the questionnaire, and they found them to be effective and logical in overcoming the challenges faced by the learners in the engineering and science departments. The mean of the strategies proposed to learners as a means of solution of the challenges in engineering and science departments was 3.73. This number proved that the suggested strategies were applicable and effective for overcoming the difficulties in CLIL classes.

The study examines the impact of strategies on the challenges encountered by learners and how they perceive the effectiveness of CLIL. According to the structural equation modelling that was performed using AMOS to analyse the direct effects of strategies on challenges, the effect was −0.372, and the p-value was 0.015, which was statistically significant. This result means that implementing strategies to address challenges was associated with a reduction in the negative outcome (or difficulty). In other words, these strategies effectively help in reducing challenges. Similarly, based on the direct effect of strategies on perceptions, the effect was 0.411, and the p-value was 0.003, which is also statistically significant. The result indicates that strategies aimed at influencing perception are associated with a positive increase in the desired outcome. In simpler terms, these strategies help in improving perception or positive responses among participants.

Concerning the interview data, the strategies dimension was coded into four main themes. The first strategic theme for studying CLIL and overcoming the challenges was *language skill prioritisation,* with a value of 8.80%. The most effective skill based on interview data was the sub-theme *speaking,* with a value of 2.20% and it was coded 12 times. The next most effective skills, after the *speaking* sub-theme, were *writing*, *reading*, and *listening*, with values of 1.47, 1.28, and 1.10, respectively. The second identified theme for CLIL strategies was *active learning strategies*, with a value of 11.76%, including its sub-themes. Seven sub-themes were coded under this main theme, each with a varying coding segment and percentage. According to the collected data, *group work* proved to be the most effective strategic method for enhancing CLIL success and fostering confidence, with a value of 3.31%. Other strategic methods, or sub-themes, were coded but with less influence on CLIL success, such as *class discussions and reading materials*, which received 8 and 6 references, with values of 1.47% and 1.10%, respectively.

Another strategic theme that leads to the success of CLIL by learning content and improving language was *feedback and motivation,* with the same value as the previous themes. Five strategies related to *feedback and motivation* were coded as their sub-themes with different values and effectiveness, including *feedback and motivation build confidence, lack of feedback or motivation leaves students directionless, feedback enhances learning content & improving language, motivation enhances learning content & improving language, and personalised feedback.* Two sub-themes, *motivation and feedback as strategies to enhance learning content and improving language,* tend to be the most referenced codes or sub-themes by the interviewed educators, with values

of 2.20% and 1.83%. However, very few lecturers referenced the sub-theme *lack of feedback or motivation leaves students directionless,* with a value of 0.37% by 2 references. This indicates that nearly 90% of the interviewed educators believe in feedback and motivation as two tools for enhancing CLIL success through learning content and improving language.

The qualitative and quantitative results indicated that code-switching has an active role in the success of the CLIL approach. The learners agreed that code-switching enhances the comprehension of content knowledge as a strategic tool. However, its use may hinder English language learning moderately. Thus, the tenth and final theme in the thematic analysis of the interview data was *Mother tongue and code switching.* It was identified as the fourth strategic method for teaching non-language subjects in a second or foreign language, with a value of 9.72%, including its sub-themes. *Using the mother tongue to learn subject matter* was coded as the most effective strategy of using the Kurdish language in classes to clarify the content materials, receiving 14 references and a value of 2.57%. Another sub-theme, or reason, for using the mother tongue, the Kurdish language, in science and engineering classes was coded as *using the mother tongue based on student level (especially junior students)*, with a value of 1.83% and 10 coded segments. The sub-themes *using mother tongue hinders language learning and code-switching fosters English language learning* received the fewest coded segments or references, as very few educators believe that *code-switching or using the mother tongue either fosters or hinders language learning*, each with a value of 0.55%.

CONCLUSIONS

This study explored the challenges faced by the learners in CLIL classes, as well as the learners' and educators' perceptions toward the effectiveness of some strategies to overcome these challenges. The findings revealed the following concluding remarks. The learner's limited knowledge of the English technical terms hinders their content comprehension, so they memorise content materials because their English proficiency is low, which limits their ability to engage in content discussions, and their insufficient knowledge of the content, which makes it difficult for them to understand it in English. The lack of resources in both Kurdish and English posed a significant challenge for most learners, impacting their understanding. Moreover, the learners' lack of confidence in the target language, English, influences their communication and comprehension about the content.

Educators reported that content and vocabulary are difficult in English due to the learner's English proficiency gaps, vocabulary limitations, and lack of equivalence in the Kurdish language. Another concluding point is class participation which is identified as another challenge based on educators' perception. They responded that the learner's low proficiency hinders student participation with other minor reasons: feeling shy, low confidence, and fear of making mistakes. Furthermore, there is a correlation between language and content learning, so learners can adapt to the academic culture of English while studying course materials. However, in CLIL classes, understanding any module and learning the second language are interdependent, as each complements the other. Thus, the relationship between learners and educators is further strengthened

when they make progress in learning disciplinary content and improving the target language.

Learner's knowledge of the target language, English, encourages and motivates them to think critically about the content knowledge. Besides, educators' language proficiency is a key factor in content teaching, and proficient teachers can deliver effective and engaging teaching, ensuring that content knowledge is conveyed to learners with quality. Thus, it's concluded that CLIL approach is an effective strategy that improves language skills and grammar among engineering and science learners, enhances disciplinary content vocabulary, and builds learners' confidence. The key success of the CLIL approach is interaction, as it improves learners' language skills, enhances their content comprehension, fosters creativity among them, and builds their confidence. Also, CLIL programme integrates learners' cultural context, Kurdish, with the English-speaking academic environment, so cultural integration is engaged and experienced in the adopted CLIL classes.

It's also concluded that learners' comprehension of the content in any discipline is bound by enhancing language skills and subject-specific vocabulary, which is a key component in comprehending the content. Thus, forming group work activities enhances learners' ability to communicate effectively in CLIL classes. Also, integrating reading scientific materials and group work activities are effective methods to enhance content comprehension, language development, and foster confidence as well. However, learners' strong knowledge of grammar and vocabulary was identified as another strategy for overcoming CLIL challenges and would help them communicate more effectively about both the content and its underlying cognition.

Another crucial concluding point is the teachers' feedback and motivation which are key strategies to address challenges in CLIL classes. These develop learners' language skills and reinforce content comprehension through meaningful interaction and build learners' confidence and a lack of these strategies will leave students feeling directionless. In this study, code-switching was found as an essential CLIL strategy that enhances learners' comprehension of the content knowledge and concept clarification, whereas it slightly hinders learners' language development. Finally, in this study, there were no significant differences between males and females in facing the challenges and overcoming them using the adopted strategies, and their perceptions were moderately alike according to the results of the data.

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DECLARATION OF CONFLICTING INTERESTS

The author declares no conflicts of interest pertaining to this study.

REFERENCES

Aguilar, M., & Muñoz, C. (2014). The effect of proficiency on CLIL benefits in engineering students in Spain. *International Journal of Applied Linguistics*, *24*(1), 1–18. https://doi.org/10.1111/ijal.12006

Balta, N., Satayev, M., Barrios, E., Fernandez-Costales, A., Agaidarova, S., & Izbassarova, R. (2022). The effect of CLIL combined with language instruction on language learning and the role of individual and institutional factors in students' perspectives: Empirical evidence from Kazakhstan. *Eurasia Journal of Mathematics, Science and Technology Education*, *18*(10), em2160. https://doi.org/10.29333/ejmste/12425

Banegas, D. L. (2012). CLIL teacher development: Challenges and experiences. *Latin American Journal of Content and Language Integrated Learning*, *5*(1), 46–56. https://doi.org/10.5294/laclil.2012.5.1.4

Cauli, E. (2021). Implementing CLIL approach to teaching ESP in academic contexts in Albania. *SSRN Electronic Journal*, 5(25).

Coyle, D. (1999). Supporting students in content and language integrated learning contexts: Planning for effective classrooms. In *Learning through a foreign language* (pp. 46–62). CILT (Centre for Information on Language Teaching and Research).

Coyle, D. (2006). Developing CLIL: Towards a theory of practice. *Monograph 6*. APAC, Barcelona, Spain.

Coyle, D. (2007). Content and language integrated learning: Towards a connected research agenda for CLIL pedagogies. *International Journal of Bilingual Education and Bilingualism*, *10*(5), 543–562. https://doi.org/10.2167/beb459.0

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

Dong, L. Q., Le, P. T. N., & Tuyet, N. T. (2022). EMI for engineering-technology students in Vietnam: Challenges and suggestions. *VNU Journal of Foreign Studies*, *38*(5). https://doi.org/10.25073/2525-2445/vnufs.4869

Hemmi, C., & Banegas, D. L. (2021). *International perspectives on CLIL.* Palgrave Macmillan.

Hidalgo, D. R., & Ortega-Sánchez, D. (2023). CLIL (content and language integrated learning) methodological approach in the bilingual classroom: A systematic review. *International Journal of Instruction,* *16*(3), 915–934. https://doi.org/10.29333/iji.2023.16349a

Kruawong, T., & Phoocharoensil, S. (2024). Enhancing science vocabulary and content knowledge of Thai EFL students through content and language integrated learning

(CLIL) and English science textbooks word lists (ESTWL). *rEFLections, 31*(1), 275–294. https://doi.org/10.61508/refl.v31i1.272797

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

Lundin, Ch., & Persson, L. (2015). *Advantages and challenges with CLIL: A study examining teachers' thoughts on learner engagement and confidence within content and language integrated learning* [Thesis manuscript]. Retrieved from https://cutt.ly/tdUA5Ov

Lyster, R. (2011). Content-based second language teaching. In E. Hinkley (Ed.), *Handbook of research in second language teaching and learning* (Vol. II, pp. 611–630). Routledge.

Metlí, A., & Akıs, D. (2022). Challenges and strategies on the content and language integrated learning approach (CLIL): A case study from the Turkish context. *Latin American Journal of Content & Language Integrated Learning, 15*(1), 1–27. https://doi.org/10.5294/laclil.2022.15.1.4

Pratap, C., & Alapati, R. N. (2022). CLIL: A new trend of teaching English to engineering students. *Journal of Namibian Studies: History, Politics, Culture, 32*, 269–280.

Richards, J. C., & Rodgers, T. S. (2014). *Approaches and methods in language teaching* (3rd ed.). Cambridge University Press.

Iswarya, D. S. A., & Singh, J. S. (2022). CLIL for the undergraduate students of engineering in teaching business English. *International Journal of Health Sciences, 6*(2), 11171–11177. https://doi.org/10.53730/ijhs.v6ns2.8014

Sumartana, M., Sadiyani, W., Widanta, R. J., Ardika, D., Sitawati, R., & Suciani, K. (2019). Effectiveness of content-language integrated learning (CLIL) toward students' English competence. *Atlantis Press, 354*, 19–22. https://doi.org/10.2991/icastss-19.2019.81

Swain, M., Kinnear, P., & Steinman, L. (2010). *Sociocultural theory in second language acquisition: An introduction through narratives*. Multilingual Matters.

Tan, Y., & Lan, M. (2023). CLIL-based smart education in the teaching of scientific and technological translation. *Frontiers in Educational Research, 6*(26). https://doi.org/10.25236/fer.2023.062630